HAC-LN96 Low Power Radio Data Module

I. Features of HAC-LN96 Low Power Radio Data Module

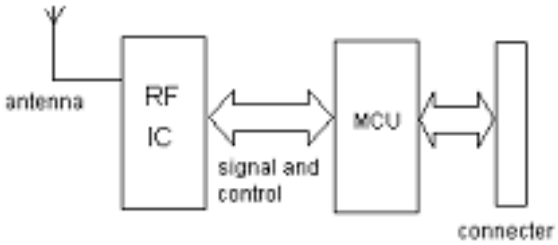
1. Low power transmission with the transmission power of 800mW
2. ISM frequency band, requiring no application of frequency point.
   Carrier frequency of 902~910MHz.
3. High anti-interference and low BER(Bit error Rate)
   Based on the FSK modulation mode, the high-efficiency forward error correction channel encoding technology is used to enhance data's resistance to both burst interference and random interference 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 range of visibility, the reliable transmission distance is >1500m when the height is greater than 2m (BER=10^{-3}/9600bps).
   Within the range of visibility, the reliable transmission distance is >2500m when the height is greater than 2m (BER=10^{-3}/1200bps).
5. Transparent data transmission
   Transparent data interface is offered to suit any standard or nonstandard user protocol. Any false data generated in the air can be filtrated automatically (What has been received is exactly what has been transmitted).
6. Channel allocation and frequency:
   This module has 64 channels which are tagged through 0 to 63, channel alternation is 115.2KHz, initial channel 0 has the frequency of 902.3324MHz and the ending channel is working at 909.5900MHz.
7. Dual serial port, 3 interface modes
   HAC-LN96 provides 2 serial ports and 3 interfaces, with COM1 as the TTL level UART interface and COM2 as user defined standard RS-232/RS-485 interface (user only needs to plug/pull 1 bit short circuiter and energize it to make the definition).
8. Large data buffer zone
   Interface baud rate is 9600bps with format of 8N1/8E1 and user self-definition, allowing the transmission of long data frames at one time for more flexible programming by users. (If the user needs, it can also transmit the data in unlimited length at one time).
9. Intelligent data control and the user doesn'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-LN96 will automatically complete the other operations, such as transmission/receiving conversion in the air, control, etc.
10. Low power consumption and sleeping function
    Power Supply: 7.2VDC,
    Maximum Current: 500mA.
    Maximum Transmission Power: 800mW.
    Receiving Current: 50mA.
11. High reliability, small and light
    Single chip radio-frequency integrated circuit and single chip MCU are used for lessened peripheral circuits, high reliability, and low failure rate.

II. Application of HAC-LN96 Series low power Radio data module

HAC-LN96 series low power radio data module is suitable for:
Wireless meter reading
Industrial remote control and remote test
Automatic data collecting system
Building automation, safety and security, powerhouse equipment wireless monitor, entrance control system
POS system, wireless keyboard, mouse

III. How to use HAC-LN96 series low power radio data module

HAC-LN96 series low power radio data module provides three interface modes including standard RS-232, RS-485 and UART/TTL levels allowing direct connection with computer, user's RS-485 device, monolithic processor and other UART components for application. The schematic circuit of HAC-LN96 is shown below:



HAC-LN series principle map

1. Power supply

   HAC-LN96 uses DC power supply with voltage of 7.2V.

   Under working condition, transmission current is ⩽500mA, receiving current is ⩽ 50mA .

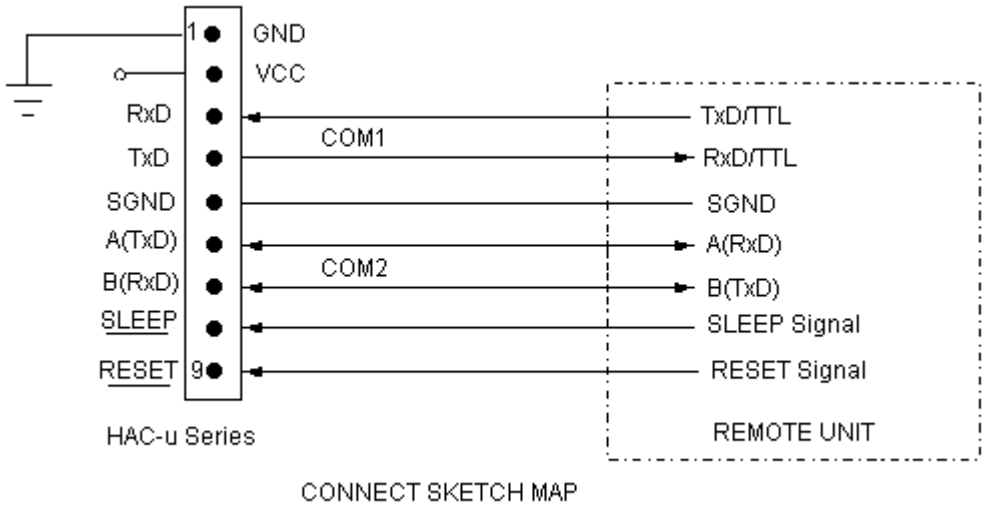
2. Definition of HAC-LN96 connecting terminal

   HAC-LN96 can supply one 9-pin connector (JP1), and its definitions as well as connection method for terminals are shown in Table 1.

Table 1: Definition of connecting pins and connection method

Pin No	Pin Name	Description	Level	Connected to the terminal	Remarks
1	GND	Grounding of power supply		Grounding of power supply	JP1/Pin1
2	Vcc	Power supply DC	7.2V		JP1/Pin2
3	RxD/TTL	Serial data receiving end	TTL	TxD	COM1
4	TxD/TTL	Serial data transmitting end	TTL	Rxd	
5	SGND	Grounding of the signal			
6	A(TxD)	A of RS-485 or TxD of RS-232		A(RxD)	COM2 See Page 3,4
7	B(RxD)	B of RS-485 or RxD of RS-232		B(TxD)	
8	SLEEP	Sleep control (input)	TTL	Sleep signal	Low efficiency t>15ms
9	RESET	Reset (input)	TTL	Reset signal	Negative impulse reset

3. Sketch map of connection between HAC-LN96 and terminal equipment (see below)
4. Setting of channel, interface and data format:



CONNECT SKETCH MAP

Before using HAC-LN96, the user needs to make simple configuration based on its own needs to determine the channel, interface mode and data format.

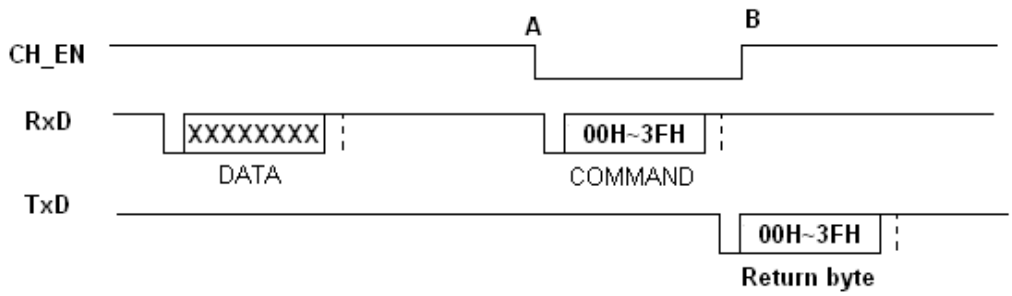
There is one group of 5-bit short-circuit jumper wire (JP2) on the upper right corner of HAC-LN96, defined as ABCDE respectively. Assuming the open circuit of jumper wire (without short circuiter) is mode 1 and short circuit of jumper wire (with short circuiter) is mode 0, then the configuration is as follows:

a. Channel configuration:

Channel configuration is done through single byte command plus swap enabling signal. Detail is as following:

Pin8 of JP1 is defined as CH_EN for swap enabling, it is used as an input signal to the wireless module and it usually is connected to one of the output ports on customer's MCU. When this pin is set to 1, the wireless module will be transmitting data normally. On the other hand, when this pin is set to 0, then the module is waiting to be configured by the 1 byte channel command – which is the channel ID. As a confirmation, the wireless module will return the configured 1 byte channel ID within 2ms after it received the channel command.

By resetting CH_EN to 1 the wireless module will exit from the configuration mode. The configuration timing sequence is as following:



In Which：CH_EN is an input signal to the wireless module。

RxD is an input signal to the wireless module。

TxDis an output signal to the wireless module。

b. Selection of interface mode:

HAC-LN96 provides 2 serial ports. COM1 (Pin3 and Pin4 of JP1) is fixed as UART serial port of TTL level; COM2 (Pin6 and Pin7 of JP1) can choose interface mode through D of JP2:

D=1 (without short circuiter) COM2 = RS-485

D=2 (with short circuiter) COM2 = RS-232

The following attention should be paid for the two serial ports provided by HAC-LN96:

i. For the data received from the air, when HAC-LN96 transmits it to the terminal equipment through serial port, COM1 and COM2 output simultaneously, i.e. if the user connects one device at COM1 and COM2 respectively, they can receive the data simultaneously.

ii. For the data transmitted from the terminal equipment and ready to transmit to the air, HAC-LN96 can only receive the data sent from either COM1 or COM2 but not simultaneously.

Suggestion: The user only connects to use one serial port of COM1 or COM2.

c. Parity mode selection:

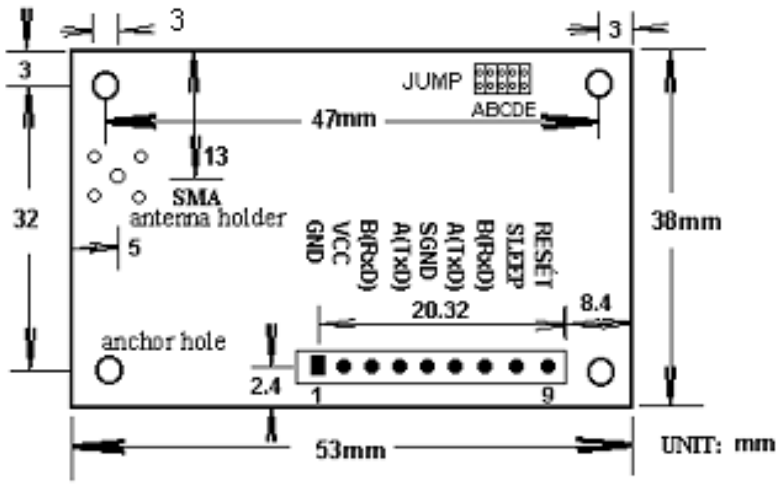
HAC-LN96 can support no-parity or even parity modes of the serial communication UART, i.e. 8N1/8E1. It can choose parity mode through E of JP2:

E=1 (without short circuiter) Parity: 8E1 (even parity)

E=0 (with short circuiter) Parity: 8N1 (no parity)

Note: The user can't set the communication rate of HAC-LN96 itself. The user chooses when placing the order and it is already set when delivered from the factory.

5. Sketch map of structural size (see below):



Sketch map of structural size of series HAC-LN wireless data-transceiver module

IV. Application of series HAC-LN96 networking

The communication channel of HAC-LN96 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 each 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-LN96 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.

V. Technical specification of HAC-LN96

Modulation mode: GFSK
Working frequency: 902~910MHz
Transmission power: 800mW
Receiving sensitivity -112dBm
Interface data format: 8E1/8N1
Working temperature: -20℃~65℃
Power supply: 7.2 VDC
Dimension:53×38×10mm
Transmitting current: ≤500mA
Receiving current: ≤50mA
Working humidity: 10%~90% relative humidity without condensation
Interface velocity: 9600bps

VI. Description of type

For product type, HAC- indicates the name of manufacturer Spatial Net, Inc. LN96 indicates low power, i.e. transmission power is 800mw , and 96 indicates that interface baud rate is 9600bps.

FCC PART 15 REGULATIONS

Mounting the RF Module in Your Assembly
The RF Module must be mounted horizontally on your printed circuit board to maintain proper orientation of the transceiver. Standoffs should also be used on the side opposite the pin row to maintain clearance between the RF Module and you printed circuit board. The RF module may not be co-located with any other antenna or transmitter.

RF Module Antenna
The RF Module is certified for compliance to FCC Part 15 rules only using the TLB-915-2.5J and TLB-915-1200 dipole antenna. Use of any other antenna violates FCC Part 15 rules.

FCC Part 15 Certification
The RF Module has been certified per FCC Part 15 rules for integration into OEM products without further testing or certification. This certification is your assurance that the RF module will not cause harmful interference.

Labeling Requirements
FCC rules require the Original Equipment Manufacturer using the RF Module to place an appropriate label on the outside of the finished equipment. The label must be clearly visible and include the information shown below.

Contains Transmitter Module
FCC ID: S58-HACLN96K02G
WARNING:
This device complies with Part 15 of the FCC Rules. Its operation is subject to the following conditions:
(1) This device may not cause harmful interference.
(2) This device must accept any received interference including interference that may cause undesired operation.

Limitations
The RF Module is registered under FCC Part 15 Rules. To utilize this registration on your OEM System you must follow the applications circuit provided in this data sheet and use one of the listed antennas. Any changes or modifications to the recommended circuit must be approved by Spatial Net, Inc. Failure to seek Spatial Net, Inc.'s approval for modifications could void certification of
the end product.

Warning: RF Exposure
The RF Module is approved for mobile, base station and mobile applications. A minimum separation of 20 centimeters should be maintained between the antenna and the equipment operator. For mobile applications check the minimum separation distances defined below To ensure compliance, operation at distances closer than those defined is not recommended.

The Warning message below must be included in the user Manual for the end product.

To comply with FCC RF exposure requirements for mobile transmitting devices, this transmitter should only be used or installed at locations where there is at least 20 cm separation distance between the antenna and all persons.

FCC Notifications

The RF Module generates radio frequency energy. It must be installed according to the manufacturer's guidelines stated in the data sheet or it has the potential to cause interference with other radio devices. Testing has been performed to assure that it conforms with the FCC Part 15 rules for intentional and unintentional radiators.

No further EMI compliance testing of the *transmitter* is required as long as the 20 cm separation and co-location requirements are observed. Each new use of the module will, however, need to be scanned for unintentional radiation from digital clocks, etc.

All necessary calibration has been performed at the time of manufacture. Any modification of the device after it leaves the factory is a violation of FCC rules.