vc1sx-1276b-g4 wireless module

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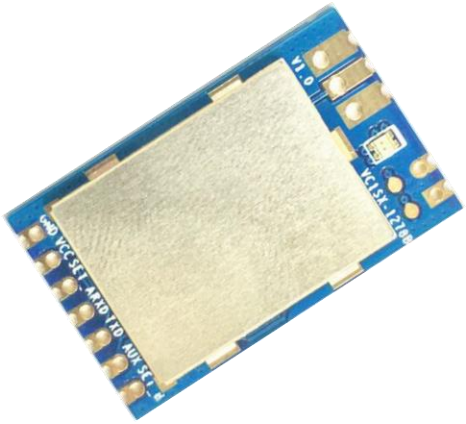

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Version v1.1

version number	editor	time	instruction manual
V1.0	Li Teng	**2016-08-02**	Initial version, all functions are implemented
V1.1	Pei Liqun	**2017-03-25**	Add test bit error rate

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1.Description

VC1SX-1276B type wireless communication module is highly integrated with ultra-low-power half-duplex micro-power wireless data transmission module, using LORA chip SX1276, embedded with high-speed single-chip microcomputer and high-performance radio frequency chip. LoRa ™ spread spectrum modulation frequency hopping technology, communication The distance and receiving sensitivity are far beyond the current FSK and GFSK modulation. Multiple transmission signals occupy the same channel and are not affected. It has strong anti-interference. VC1SX-1276B wireless communication series modules provide flexible channels. Various parameters such as settings, transmit power, frequency, etc. At the same time, the module has a low-power sleep function, and the sleep current is less than 2.5uA; the module supports the low-power carrier sensing protocol, and the module can automatically exit from sleep at regular intervals to listen to air data, It automatically sleeps after data transmission, which is convenient for various battery-powered systems, especially gas meters and water meters.

The VC1SX-1276B-G4 module has a built-in LoraMesh protocol independently developed by entropy weight, which supports routing networking of up to three hops. The user does not need to intervene, and the networking is autonomous, automatic, and self-healing. When using LoraMesh, it can not be configured into sleep mode.

Application field

- ❖ Environmental monitoring, road dust monitoring
- ❖ Automatic meter reading and charging system for water, electricity and gas
- ❖ Industrial remote control for cranes and cranes
- ❖ Production line data acquisition and data communication
- ❖ Automatic control of medical electronic appliances
- ❖ Wireless wireless intelligent control
- ❖ Security alarm and attendance and positioning of underground personnel
- ❖ Car anti-theft, tire pressure monitoring and four-wheel alignment
- ❖ Wireless pos system
- ❖ Channel buoy and LED display in field
- ❖ Highway toll collection system
- ❖ Wireless hanging scale, electronic scale with wireless transmission
- ❖ Bank queue management system

3.Technical

Serial data is directly transparently transmitted, and a single frame of data is up to 242 bytes;

Uses and spread spectrum modulation technology, ultra-low sensitivity, extremely long distance transmission; the maximum transmission distance is greater than 7000 meters / 300kbps, the height is greater than 5 meters, non-urban open distance; the product supports frequencies of 915.8 MHz - 918.5MHz;

100mW transmit power;

Very low receiving sensitivity -112dBm / 9.6kbps @GFSK; using TTL interface;

Multi-channel can be set, send and receive 200Bytes data buffer;

External epson 32.768k RTC crystal to ensure product consistency in meter reading applications; built-in watchdog, external rf industrial grade crystal to ensure product stability.

4. Technical

parameter	Smallest	typical	maximum	unit	condition
Operating conditions					
Working voltage	1.8	3.3	3.6	V	
range of working	-40		85	℃	
Current consumption					
Receive		17		mA	
Emission		115		mA	@20dBm
Sleep current		<3		uA	
RF parameters					
Modulation	0.018		37.5	kbps	Lora™
Transmit power	1		20	dBm	
Receiving sensitivity		-110		dBm	@GFSK 4.8kbps BER<1%
Initial crystal		10		ppm	-20--75 degrees
Frequency		15		ppm	-40--85 degrees
Frequency		<5		khz	915M
Frequency		15		ppm	-40--85 degrees
ESD					
contact		10		kv	Antenna
air		20		kv	Antenna

5. Interface definition

vc1sx-1276b provides a 7-pin connector (con1), the definition of which is based on the terminal connection method as shown in the following table:

Pin	definition	Level direction	Description
1	GND		Power ground
2	VCC		Current is greater than 150MA, ripple is
3	SET_A	I	Reserved io
4	RXD	I	Serial data receiver
5	TXD	O	(Serial data transmitter)
6	AUX	O	Reserve
7	SET_B	I	Reserve

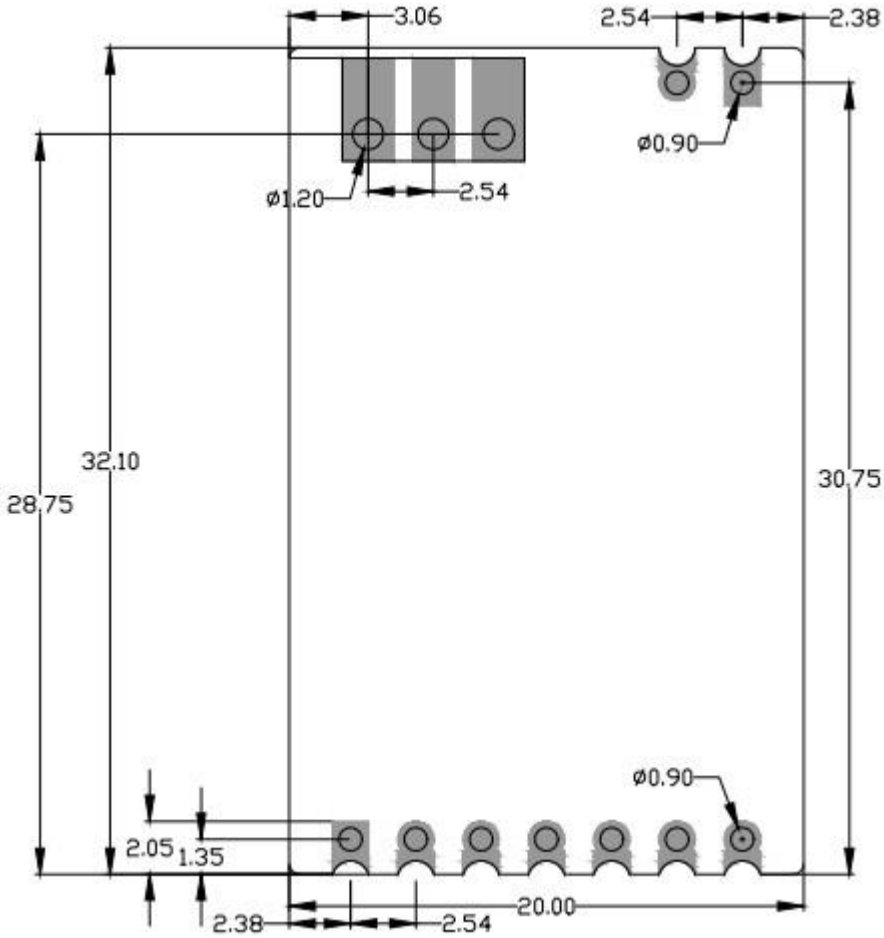

Figure 1.
Product
Dimensions

6. Serial communication protocol

The factory default setting of the serial port is 4800 baud, 8E1

type of data	protocol	Answer	Description
Command frame	55 AA LEN CMD SUB_CMD 01 DATA CRC16 16	55 AA LEN CMD SUB_CMD 02 DATA CRC16 16	len: total package length (length from 55 to 16 Degree) cmd: set command sub_cmd: subcommand data: set value

			crc16: 55 to data crc16 value, low byte first, high byte last See 6.2 for the definition of each command frame
Data Frame		08	This data does not require crc verification
Abnormal response Error		AA	

6.1. Data Frame

6.1.1. Delivery (module serial port receiving)

Format: destination address (4 bytes) + payload (maximum 242 bytes) Once the module serial port receives a data frame, it will reply immediately

1) 0x08 means confirm the serial port reception, and it will start wireless transmission

2) 0xAA means there is an error in the frame format or it is not suitable for sending

a) When the destination address is a local address, the transmission is refused, and the serial port returns 0xAA. b) When the destination address is 0xAA 0xAA 0xAA 0xAA, it means broadcast transmission.

3) When the data frame is received, the wireless is in the process of sending, the new data frame is rejected, and the serial port returns 0xAA.

6.1.2. Data frame upload (wireless data reception completion triggers module serial port transmission)

Format: source address (4 bytes) + destination address (4 bytes) + payload

1) Source address: The source node address of the wireless data corresponding to this serial transmission

2) Destination address: The destination node address of the corresponding wireless data transmitted by the serial port, that is, the local address or broadcast address

6.1.3. About address

The byte order of the address is not configured in the frame (see the command frame). The byte order given by the sample module is factory configured. The address gives an 8-bit bcd code for the label.

For example, if the label is "06130273", the preset address is 0x06 0x13 0x02 0x73

6.1.4. Recommended minimum interval for serial port transmission

For modules that actively initiate data, in order to prevent information collision, according to the minimum transmission interval of the last transmission or reception, it is not recommended to initiate data. Among them, the transmission interval can be considered as the source serial information arrives through three hops (two-level routing) and arrives. The time required by the target serial port.

↘Transmission interval / sec.		↓ Payload / Byte					
		10	20	30	100	200	242
→ SF	7	0.6	0.6	0.7	1.3	1.9	2.3
	8	0.7	0.8	0.9	1.8	2.8	3.4
	9	1	1.2	1.4	2.5	4.5	5.3
	10	1.6	2	2.2	4.6	7.8	9
	11	2.6	3.4	3.9	7.7	13.3	15.6
	12	4.9	5.9	6.9	13.9	23.7	27.7

6.2. Command frame

	protocol	55 AA LEN CMD SUB_CMD 01 DATA CRC16 16

Features	Description	len: total package length (length from 55 to 16) cmd: set command sub_cmd: subcommand, 00 without subcommand: set value

		crc16: 55 to the crc16 value of data, low byte first, high byte last
Setting parameters	Serial input	55 AA LEN 05 01 01 FAD_L FAD_H N DATA CRC16 16
	Serial port	55 AA LEN 05 01 02 FAD_L FAD_H N DATA CRC16 16
	Description	CMD:05 SUB_CMD: 01 fad_l, fad_h: the first address of the parameter storage n: the number of parameter bytes data: n bytes of parameter data
Reading parameters	Serial input	55 AA LEN 05 00 01 FAD_L FAD_H N CRC16 16
	Serial port	55 AA LEN 05 00 02 N DATA CRC16 16
	Description	CMD:05 SUB_CMD: 00 fad_l, fad_h: the first address of the parameter storage n: the number of parameter bytes data: n bytes of parameter data
Wake frame	Serial input	55 AA 0F 00 00 01 XX A0 A1 A2 A3 A4 CRC16 16
	Serial port	55 AA 0F00 00 02 XX A0 A1 A2 A3 A4 CRC16 16
	Description	CMD:00 SUB_CMD: 00 xx: network id, ff time distinguishes network id a0-a4: rf module address that needs to wake up, broadcast call when a0-a4 is aa

		Wake rf module
Sleep frame	Serial input	55 AA 0E 01 00 01 A0 A1 A2 A3 A4 CRC16 16
	Serial port	55 AA 0E 01 00 02 A0 A1 A2 A3 A4 CRC16 16
	Description	CMD:01 SUB_CMD: 00 The module receives this command frame, and the module enters the sleep state after responding
Signal strength indicator	Serial input	55 AA 0A0200 0100 CRC16 16
	Serial port	55 AA 0A0200 02 X CRC16 16
	Description	CMD:01 SUB_CMD: 00 X: the signal strength value of the last communication, this value is the absolute value of the signal strength, for example 36, it means that the signal strength is -
Send power test command	Serial input	55 AA 09 0B 00 01 49 C4 16
	Serial port	55 AA 09 0B 00 02 D2 F6 16
	Description	
Receive sensitivity test	Serial	55 AA 09 07 00 01 EA 61 16
	Serial	55 AA 09 07 00 02 71 53 16
	Descripti	The module starts the reception test.At this time, if the
Read bit error rate	Serial	55 AA 09 08 00 01 2D 2B 16
	Serial	55 AA 11 08 00 02 XX XX XX XX YY YY YY YY CRC16 16
	Description	Where xxxxxxx is the number of error bits, yyyyyyyy is the total number of bits, the bit error rate,

6.3. Parameter setting and reading

Note: After the wireless module sets the parameters, the new wireless parameters are enabled after the wireless module is powered off and then powered on.

parameter	Store first address	long degree	Frame format		Description
Interaction Interface communication parameter	0x1000	3	Assume Set	55 AA 0F05 01 01 00 10 03 BR_L BR_H FCRC16 16	BR_L、BR_H: Low and high byte of serial baud rate Baudrate / 100 f: Serial data format 1: 8n1 2 : 8E1 3 : 8O1 Serial port default parameters: Baud rate 4800bps, 8E1
			read take	55 AA 0C 05 00 01 00 10 03 CRC16 16	
wireless Frequency	0x1003	3	Assume Set	55 AA 0F05 01 01 03 10 03 F_L F_M F_H CRC16 16	F_L, F_M, F_H: Frequency (kHz) BCD code low middle high byte, if you need to set the frequency to 472.125MHz, then F_L, F_M, F_H are 25 21 47, Frequency setting range:
			read take	55 AA 0C 05 00 01 03 10 03 CRC16 16	
Module serial	0x1006	6	Assume Set	55 AA 1205 01 01 06 10 06MID A0~A4 CRC16 16	mid: network id number a0 ~ a3: module's 5-digit serial number, which is the address
			read	55 AA 0C 05 00 01 06 10	

			take	06 CRC16 16	Among them, a4 should be guaranteed to always be 0
Output power	0x100C	1	Assume Set	55 AA 0D05 01 01 0C 10 01 X CRC16 16	x is the power to be set, Values are hexadecimal numbers 01, 02, 05, 08, 0b, 0e, 11, 14 Set the module power to 1, 2, 5, 8, 11, 11, 14, respectively. 17 20dBm
			read take	55 AA 0C 05 00 01 0C 10 01 CRC16 16	
start up / Forbidden Carrier wake-up	0x100D	1	Assume Set	55 AA 0D05 01 01 0D 10 01 X CRC16 16	x = 1, disable the carrier wake function (丌 can sleep) x = 2, enable carrier wake function (Can sleep)
			read take	55 AA 0C 05 00 01 0D 10 01 CRC16 16	
Carrier Detection interval	0x100E	1	Assume Set	55 AA 0D05 01 01 0E 10 01 X CRC16 16	x is the time interval for detecting the carrier (Unit s), the values are 0, 1, 5, 10, 15, 20, 25 Note: The interval time is 0, which means that the wireless module can
			read take	55 AA 0C 05 00 01 0E 10 01 CRC16 16	
Spread spectrum factor	0x100F	1	Assume Set	55 AA 0D05 01 01 0F 10 01 X CRC16 16	x: Set the spreading factor, the range is 7 ~ 12 The bandwidth is 125KHz, and the baud rate corresponding to the spreading factor is as follows
			read take	55 AA 0C 05 00 01 0F 10 01 CRC16 16	

					10: 0.9kbps 11: 0.5kbps 12: 0.27kbps
AUX Status interval	0x1010	1	Assume Set	55 AA 0D05 01 01 10 10 01 STime CRC16 16	When STime is in AUX state Unit: min
			read take	55 AA 0C 05 00 01 10 10 01 CRC16 16	
Power-on the message stat	0x1011	1	Assume Set	55 AA 0D05 01 01 11 10 01 X CRC16 16	When x is a0, power on and output version information Information, for other values, output version information when power on
			read take	55 AA 0C 05 00 01 11 10 01 CRC16 16	

6.4. set_a, aux, set_b foot definition

In the vc1sx-1276b-g4 module, these three pins are meaningless.

6.5. Configuration Tool

For convenience, the configuration tool wraps the above serial interface interactive commands, and the interface is as follows:

7. Precautions for RF frequency point selection

1. The frequency setting range is 915.8 MHz - 918.5MHz, the frequency selection should avoid the integer multiple frequency of the crystal (its accessories ± 1MHz frequency can not be set).

8. Transmit power and receiving sensitivity test

After the module outputs the version information, you can test the transmit power, receive sensitivity, and sleep current through the serial port setting commands. The test process and commands are as follows

Power on and wait for the module to output version information

Send power test command: 55 aa 09 0b 00 01 49 c4 16 Serial port response: 55 aa 09 0b 00 02 d2 f6 16, the module enters the transmitting state

Receive sensitivity test command: 55 aa 09 07 00 01 ea 61 16 Serial port response: 55 aa 09 07 00 02 71 53 16,

The module starts the reception test. At this time, if the bit error rate is less than 1%, the module's red light flashes uniformly. After sending the receive sensitivity test command, it can be delayed for a period of time.

16 Module response 55 aa 11 08 00 02 xx xx xx xx yy yy yy yy crc16 16

Hibernation test: Send the hibernation command, the module enters the hibernation state, and the hibernation state requires the module to be powered on before entering other states. The module needs to be powered on again after the test

9, attached:

9.1, version information

The power-on version information displays 36 bytes, such as "VCWF-2E80-DE-XXD20-20160302-Vsp1.00", where "20160302 is the compilation date and" Vsp1.00 "is the version information

9.2. Command frame crc16 algorithm

```
 #define CRC_POLY 0x8408
unsigned int comCalCRC16(const unsigned char *pucBuf, unsigned int uwLength)
{
   unsigned int uiCRCValue=0xFFFF;
   unsigned char  ucLoop;
   unsigned char * pu8Buf = (unsigned char *)pucBuf;
   while(uwLength--)
   {
uiCRCValue ^= *pu8Buf++;
      for(ucLoop=0; ucLoop<8; ucLoop++)
```

```
    {
      if(uiCRCValue & 0x0001)
      {
          uiCRCValue >>= 1;
          uiCRCValue ^= CRC_POLY;
      }
     else
     {
          uiCRCValue >>= 1;
      }
     }
   }
  uiCRCValue ^= 0xFFFF;
  return uiCRCValue;
}
```

9.3. Examples

Configuration frame: 55 aa 1e 05 01 01 00 10 12 30 00 02 25 01 47 05 20 15 03 26 01 11 02 05 0a 01 00 50

2D 16

Wake frame: 55 aa 0f 00 00 01 05 20 15 03 26 01 bb a7 16

Sleep frame: 55 aa 0e 01 00 01 a0 a1 a2 a3 a4 a1 51 16

Data frame: 68 a0 a1 a2 a3 a4 a5 a6 a7 a8 a9 11 22 33 44 55 4b d1 16

68 A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 11 22 33 44 55 11 22 33 44 55 11 22 33 44 55 11 22 33 44 55 11 22 33 44 55 11 22 33 44 55 11 22 33 44 55 11 22 33 44 55 11 22 33 44 55 11 22 33 44 55 11 22 33 44 55

11 22 33 44 55 11 22 33 44 23 A1 16

Configure carrier detection time and spreading factor: 55 AA 0e 05 01 01 0E 10 02 05 0b

9.4 、 Parameter setting packing instruction

55 aa len 05 01 01 fad_l fad_h n data crc16 16, n> = 1, n <= 18, such as

55 aa 1e 05 01 01 00 10 12 30 00 02 25 21 47 05 20 15 03 26 01 11 02 05 0a 01 00 ef 88 16

in Line configuration, read parameters are the same.

9.5、 Use distance in FCC Radiation exposure

When using a product integrated with the module, the user should be more than 50 cm away from the product.

10. Technical support and after-sales service

Our company provides good technical support for users' use and secondary development free of charge; 开 provides one year warranty, after-sales service for life-long maintenance. To meet the different structural needs of customers, our company can also design smaller sizes or Products of the same shape.

熵权物联 SIOT

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FCC Statement

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.

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.

The distance between user and device should be no less than 20cm.

FCC Caution:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

Co-location warning:

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Limited Channels fixed for use in the US:

This device is pre-set to only transmit in FCC approved channels from 915.8-918.5MHz. This cannot be changed.

OEM integration instructions:

This device is intended only for OEM integrators under the following conditions:

The antenna must be installed such that 20 cm is maintained between the antenna and users, and the transmitter module may not be co-located with any other transmitter or antenna.

The module shall be only used with the external antenna(s) that has been originally tested and certified with this module.

As long as 3 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements,etc.).

Validity of using the module certification:
In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.
Custom design antennas may be used, however the OEM installer must following the FCC 15.21 requirements and verify if new FCC approval will be necessary.

End product labeling:
This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains FCC ID: 2AVBL-VC1SX”.

Information that must be placed in the end user manual:
The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.