1. General

RF6610T series is a low cost, ultra-low power, high performance two way semi-duplex LoRa modulation transceiver with operation at 433Mhz, 868Mhz and 915Mhz. It integrates with 32 bit high speed low-powered MCU and high performance ASR6601. ASR6601 is a combo consisted of RF chip SX1262 and Arm Cortex M4 core MCU. Adopting high efficiency forward error correction with interleaving encoding (FEC) technology, it makes anti-interference ability and reception sensitivity greatly improved. That guarantees good performance in the harsh environment such as some industrial application. The FEC technology is advanced and unique in radio data communication field.

RF6610T has the UART interface, that make it is easy to implement wireless data transmission. It is flexible for users to set the baud rate, frequency, output power, air data rate etc parameters. The compact size makes it an ideal option for radio data communication application.

2. Features

- 5000 meters of communication distance（300bps）
- Output power: Max150mW (22dBm) (7 levels adjustable)
- Air data rate: 300 - 62500bps, can be configured through RF tool
- UART data rate: 1200 - 115200bps, can be configured through RF tool
- Frequency: 430MHz-510MHz, 868MHz, 902MHz-928MHz
- Working Current: 120mA(TX), 12mA(RX),2.0uA(Sleeping)
- parity of series COM: 8E1/8N1/8O1
- LoRa modulation
- Receive sensitivity: -135dBm(@600bps)
- UART/TTL
- AES128 encryption
- Exceed 1000 bytes data buffer
- Supply Voltage: 3.0V – 5.5V
- 125KHz,250KHz, 500KHz Channel spacing
- Dimension: 34.2mm *18.4mm *10.00mm

3. Application

- Automated Meter Reading (AMR)
- Remote control, remote measurement system
- Access control
- Data collection
- Identification system
- IT household appliance
- Wireless alarm system

4. Maximum specification

Symbol	Parameter	Min	Max	Units
VCC	Supply Voltage	3.0	5.5	V
TOT	Operation Temperature	-30	85	℃
HOH	Operation Humidity	10%	90%	
TST	Storage Temperature	-55	125	℃

5. Pin-Out description:

RF6610T module has 38 pins. Refers to the Table 1：

NO.	Name	Type	Pin function description
1	GND	Input	Power ground, connected to peripheral power ground
2	VCC	Input	Power supply VCC, 3.0-5.5V
3	EN	Input	Module sleep state wake-up, active low
4	RX	Input	3.3V TTL serial port data input, connected to user TTL-TXD
5	TX	output	3.3V TTL serial port data output, connected to user TTL-RXD
6	AUX	Output/Input	Wake up peripherals, active low (when the module is in node and SPF mode)
7	SET	Input	The center and nodes enter the fast channel mode: the center end does not send long preambles, the node end receives continuously without sleeping, and the low level is active.

Table 1: Pin definition

6. Dimensions

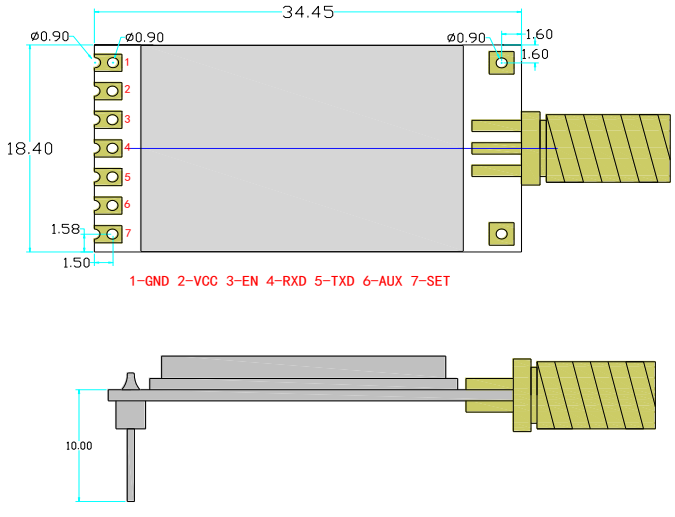


Figure 1: Dimension and Structure Diagram

7. Working mode

a. Normal mode

Normal mode is a straight forward communication in which the module receives from source and sends data to the destination through serial port (UART/TTL) at raw data format. The communication is transparent. User set the module as the standard mode in the RF tool that make the module in the transparent mode. RF6610T has built in the encryption, data packaging and unpacking. Users don't need to consider the data processing during implement. The PA15 pin of RF6610T will give indication about the data IN/OUT of serial port 2ms in advance in order to wake up the external MCU.

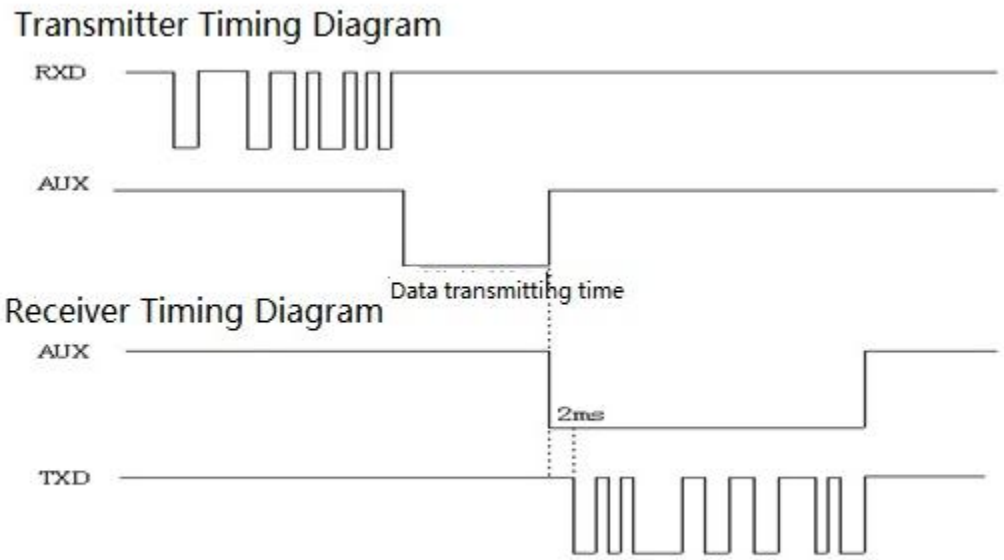


Figure 2: Timing Sequence in Transparent Mode

b. Central-Node mode

In this mode, one RF6610T module needs to set as the central mode and other modules should be node mode. In central mode, RF6610T works at the full performance with its full power consumption. In the node mode, some functions are closed to lower the power with 5% or less full power consumption. When the PA14 pin is connected to logic high, the node module only keeps CAD wireless monitor to detect if there is any preamble to wake up and doesn't handle the data from the external MCU through UART. If the node module sends data to the central module, user needs to set PA14 pin to low to activate the node module and the node modules handle the data from the external MCU through UART.

In the configuration tool, there is an option for Node ID which is used to set the ID of node module. If the ID of the node modules is 0x00 0x00, the node module will not make address detection. In other words all

nodes will receive the data including address from central module. The data package of the first two bytes should be the node ID. It is a broadcast in the network

E.g. The Central module sends data‘0x00 0x01 0x22 0x33 0x44 0x55’, all of the node modules with ID ‘0x00 0x00’ will receive the data ‘0x00 0x01 0x22 0x33 0x44 0x55’. If the ID of node module is not 0x00 0x00, the node module with ID the same as the one in the first two bytes of data package can receive this data packet.

E.g. The Central module sends data ‘0x00 0x01 0x22 0x33 0x44 0x55’, the module with ID ‘0x00 0x01’ can get the data ‘0x22 0x33 0x44 0x55’and the first two byte ID will be filtered.
In order to guarantee the reliability of communication, the length of data package should not exceed 64 bytes.

8. Parameter Configuration

Through serial port or using setting tool ‘Rf-Tool’, users can configure relative parameters such as frequency, UART rate, air rate, checkout mode and so on.

It is very simply for configuration. Based on different requirement, all options can be selected visually. It is shown in Table 2 and Figure 3.

Parameter	Description
Serial parameter	The values are fixed at 9.6k bps & no parity check.
Frequency	It indicates the center frequency of RF carrier
Work mode	Normal mode, Central mode, Node mode, SPF mode
RF-Factor	Lora spreading factor. Larger value means higher sensitivity but longer air transmission time
RF-BW	Lora bandwidth. Larger value means lower sensitivity. Recommended value: 125K.
Code Rate	LoRa coding rate. The values are 4/5，4/6, 4/7, 4/8. The default setting is 4/6.
Node ID	It is available in the Central/Node mode.
Net ID	Only the modules with the same network ID can communicate with each other. It can avoid interferences from irrelative modules
TX Power	It is used to set the output power of RF6610T. There are 7 power levels. The 7 means the max. output power---20dBm and 0 means the lowest output power.

Serial baud-rate	It defines the data rate between RF6610T and the host
Serial parity	It defines the parity check between RF6610T and the host
Sleep Period	It is available in the Central/Node mode. It defines the sleep period of Node module.
Wake Period	It is available for the Node module only. It defines the time of module waking up to receive the preamble from Central module.
Extension Node address	It defines 8 bytes Node ID compared to 2 bytes Node ID. It is available in the Central/Node mode. It also support the address display on the message or not and which position the Node ID show in the message.
SPF mode	SPF mode is a mode with transparent transmission. The module runs at low power status with certain wake timer and CAD monitoring. It can support fixed data bytes transmission.
Heartbeat period	It is available in the Central/Node mode. It defines the heartbeat period from Node module to Central module.
TX-CAD	It is a function to detect the air environment before transmitting. It will avoid the signal collision in the radio communication.

Table 2: Parameter Specification

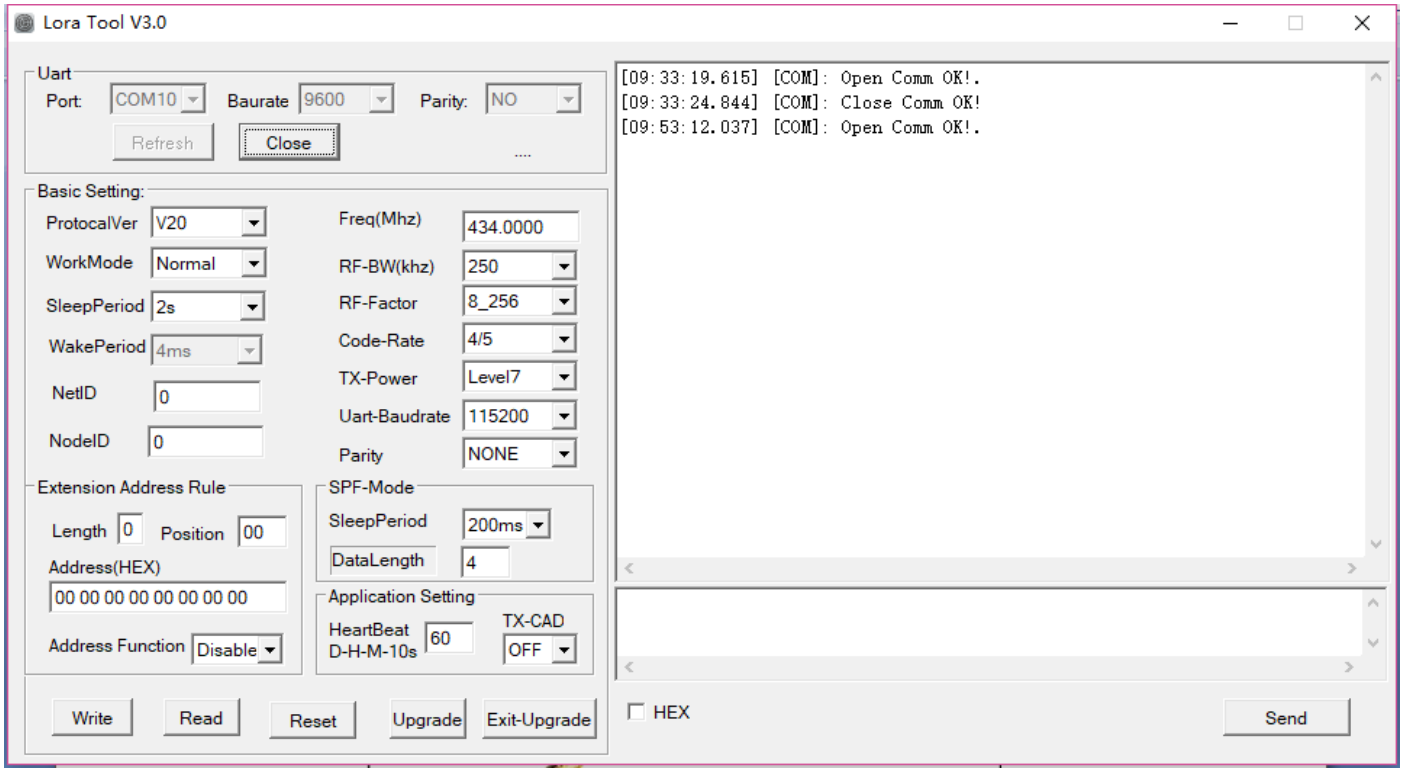


Figure 3: Interface of RF Tool

Users can configure the parameters (frequency, data rate, output power, RF Factor, RF Bandwidth etc.) through PC or in circuit.

♦ Setting through laptop. RF6610T port is UART/TTL. When RF6610T connecting with PC, users need to use USB adapter. AppconWireless provides USB adapter as accessory. The schematic is shown in Figure 3

Firstly users connect converter board to PC through DB9 cable and open ‘RF Tool’, then insert module into converter board. After that, the status column of ‘RF tool’ will give a indication ‘Found Device’. Users then can read/write the module.

If users connect USB converter, USB driver needs be installed firstly. The driver has different version for different OS. USB converter has five wires with five different colors: Black, Red, Blue, Yellow, Green, Black wire is GND pin. Red wire is VCC pin. Blue wire is TXD pin. PE1 pin should be connected to GROUND.

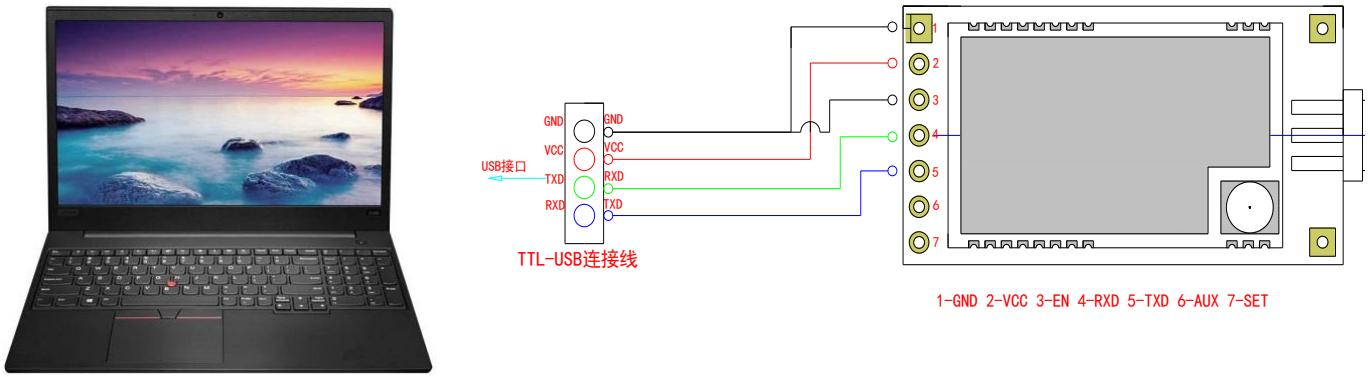


Figure 4: The connection diagram

♦ Setting in circuit . Users also can use microcontroller to change the default parameters. The work mechanism is the same as the laptop.

Sync word		ID code		Header	Command		Length	Data	CRC	End code	
0xAF	0xAF	0x00	0x00	0XAF	XX	YY	LEN	XXXX	CS	0X0D	0X0A

RF6610T Command Structure

Notes: 1. The ID code is 0x00 0x00 in command.

2. In command code, XX in sending command is 0x80 and in response command is 0x00. YY is the command type. The work mode of

YY	TYPE	YY	TYPE	YY	TYPE	YY	TYPE	YY	TYPE
0x01	write	0x02	read	0x03	standard	0x04	Central	0x05	Node

Command Type and Value

3. Length refers to the data bytes between Length byte and CRC byte which the two bytes are not calculated in the length.

4. Data refers to the detailed parameters which need to be changed.

Baudrate	Parity	Frequency	RF_Factor	Mode	RF_BW	ID	Net ID	Power

Parameter Sequence in Data Section

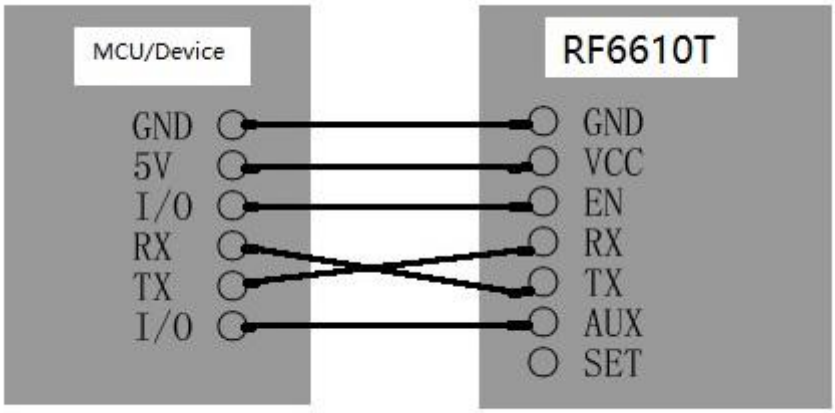
The air data rate and sensitivity of RF6610 defines by the RF-Factor, RF-BW and Code rate. The following chart is a relationship between air data rate, sensitivity and RF-Factor, RF-BW, Code rate.

RF-BW / Air / RF-Factor	125KHz		250KHz		500KHz	
	Air data rate (bps)	Sensitivity (dbm)	Air data rate (bps)	Sensitivity (dbm)	Air data rate (bps)	Sensitivity (dbm)
5-32	15625	-117	31250	-114	62500	-111
6-64	9375	-120	18750	-117	37500	-114
7-128	5470	-123	10940	-120	21880	-117
8-256	3125	-126	6250	-123	12500	-120
9-512	1758	-129	3516	-126	7032	-123
10-1024	977	-132	1953	-129	3906	-126
11-2048	537	-135	1074	-132	2148	-129
12-4096	293	-138	586	-135	1172	-132

9. Application Schematic:

The connection schematic between RF6610T and MCU or terminal is shown as below.

The parameter of RF6610T'serial port must match with MCU or terminal's (RF6610T has the same serial port baud rate and parity style with MCU or terminal). Two or more RF6610Ts in a system should have the same parameters such as TX/RX frequency, air date rate and RF channel.



Caution: 1. When RF6610T is installed, make sure the antenna is far away from device to enhance the performance.

2. RF6610T should have the same common ground with MCU or terminal. Otherwise it may cause the module abnormal performance.

3. When RF6610T works normal, DO NOT touch the module and antenna.

Figure 6: Connection between Module and Device (TTL/UART port)

10. Order information

a) RF6610T- 433

b) RF6610T- 868

c) RF6610T-915

11. Q&A:

Questions and Answers	
Can not communicate between two devices	1．The communication protocol is different between two modules, for instance: data rate and checkout.
	2．The frequency or RF data rate is different between two communicated modules.
	3．They are not the same kind products.
	4．The connection between module and terminal is wrong.
	5、The module is wrong.
	6．The setting of EN is wrong.
	7．The communication distance exceeds the range, or the connection of antenna is bad.
Short communication distance	1．The supply voltage exceeds range
	2．The ripple of power is too big.
	3．The connection of antenna is bad or it is a wrong kind of antenna
	4．Antenna is too close to the surface of metal or the ground
	5．Receiving circumstance is very bad, for instance buildings and strong interference.
	6．There is interference of the same frequency
Receive wrong data	1．Wrong setting of COM, for example, Baud rate is wrong
	2．The connection of UART is wrong.
	3．The cable to the UART is too long.

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