APC220 ISM Transparent Transceiver Module V4.0

Overview:

APC220 is highly integrated semi-duplex low power transceiver module with high speed MCU and high performance RF IC. Utilizing high efficiency forward error correction with interleaving encoding (FEC) technology, it makes anti-interference ability and reception sensitivity greatly improved. It also can ensure good performance in the harsh environment such as in the industrial application. The FEC technique is advanced and unique in radio data communication field.

APC220 is a cost-effective and easy-usable module that not only can transmit transparent data with large data buffer, but also can provide over 100 channels. Users just need feed data to the module through serial port. The simply-configuration function and compact size make it an ideal option for radio data communication application.

Application:

- Automated Meter Reading (AMR)
- Wireless sensor
- Industrial Automation
- The control of traffic signal
- Wireless handheld terminal
- Remote control and monitoring
- The management of cars
- Wire Replacement
- Oil and Gas Detection.
- The control of robot

Features:

- 800 meters of RF line-in-sight distance（9600bps）
- Max output power is 20mW (13dBm)
- Frequency from 418MHz to 455MHz
- Dimension: 37.5mm * 18.3mm * 7.0mm
- More than 100 channels
- GFSK modulation
- UART/TTL
- Exceed 256 bytes data buffer
- Simply tool for configuration

Pin Out

APC220 has 9 pins. Refers to the Table 1：

APC220		
Pin NO.	Pin Name	Description
1	GND	Grounding of Power Supply
2	VCC	Power supply DC 3.5V-5.5V
3	EN	Power enable, ≧1.6V or empty, ≦0.5Vsleep.
4	RXD	UART input, TTL
5	TXD	UART output, TTL
6	AUX	Data in/out indication
7	SET	Parameter setting in circuit pin; Low: available
8	NC	Not connected
9	NC	Not connected

Table 1 Pin definition

Dimension

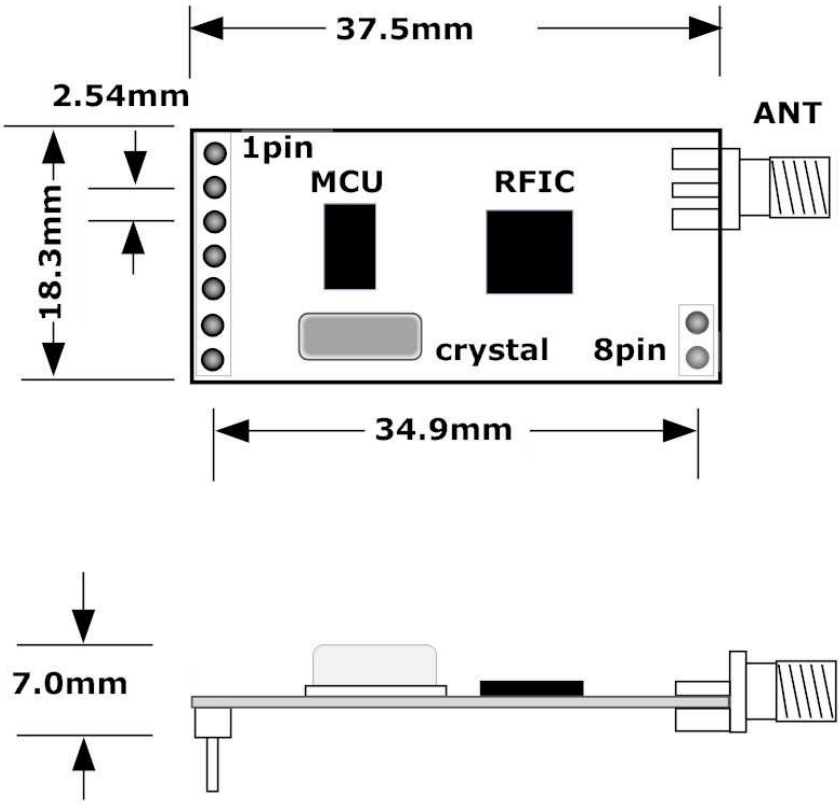


Figure 1: Size of Module

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 to operate the setting. Based on different requirement, all options can be selected visually. It is shown in Table 2 and Figure 2.

Instruction of APC220 parameters		
Parameter	options	default
UART baud rate	1200,2400,4800,9600,19200,38400, 57600bps	9600bps
Serial Parity Check	Disable, Even Parity, Odd Parity	Disable
Frequency	418MHz-455MHz(1K step,accuracy±100Hz)	434 MHz
GFSK data rate	1200,2400,4800,9600,19200bps	9600bps
Output Power	0-9levels(level 9 is 20mW)	9(20mW)

Table 2: Parameter Specification

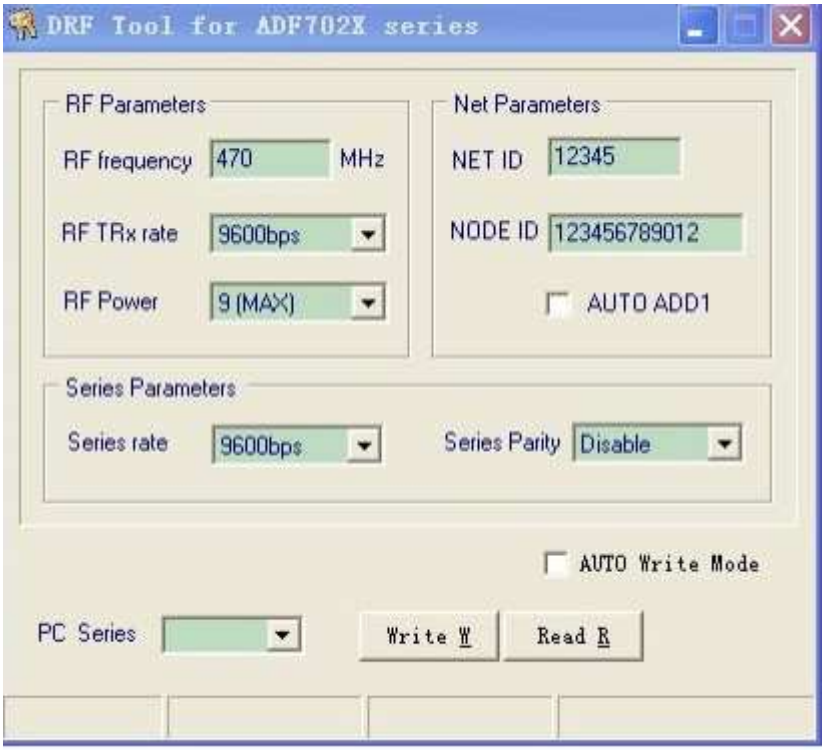


Figure 2: Interface of RF Tool

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

♦ Setting through PC. APC220 port is UART/TTL. When APC220 connecting with PC, users need to use a TTL-to-RS232 level converter or USB adapter. AppconWireless provides both converter boards 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.

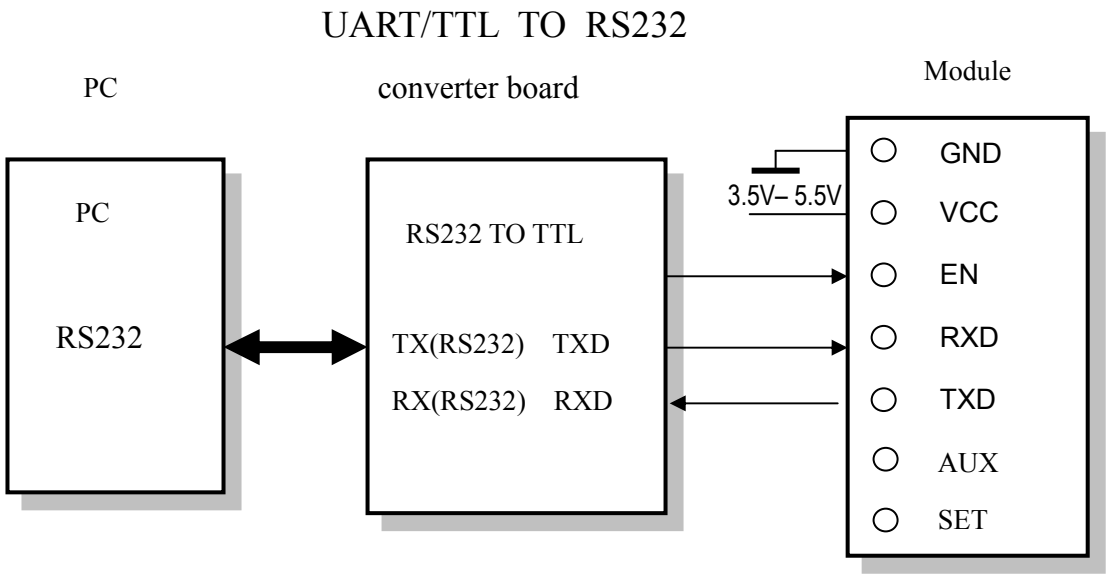


Figure 3: The connection diagram

♦ Setting in circuit. The module can work normally 50ms (T1) after powering on. When configuring the module, users need switch the SET pin to low and the module then enters into setting mode after 1mS or more (T2). It will use 9600 bps (data rate) and no parity check as default format to communicate.

When a command is sent to the module through the RXD pin, the module will send back response information by TXD pin in 200mS after users verify the command is correct. When

users check out the parameters are successfully set from the response information, the SET pin can be set to high and the module will work with the new parameters in 10mS (T4).

Caution: Users can only send setting command once when the SET pin is setting to low. If users want to revise the parameters after one successful setting, users must configure SET pin to high and then set it into low in order to reconfigure again. After 100ms (T4), the module will work with the new parameters.

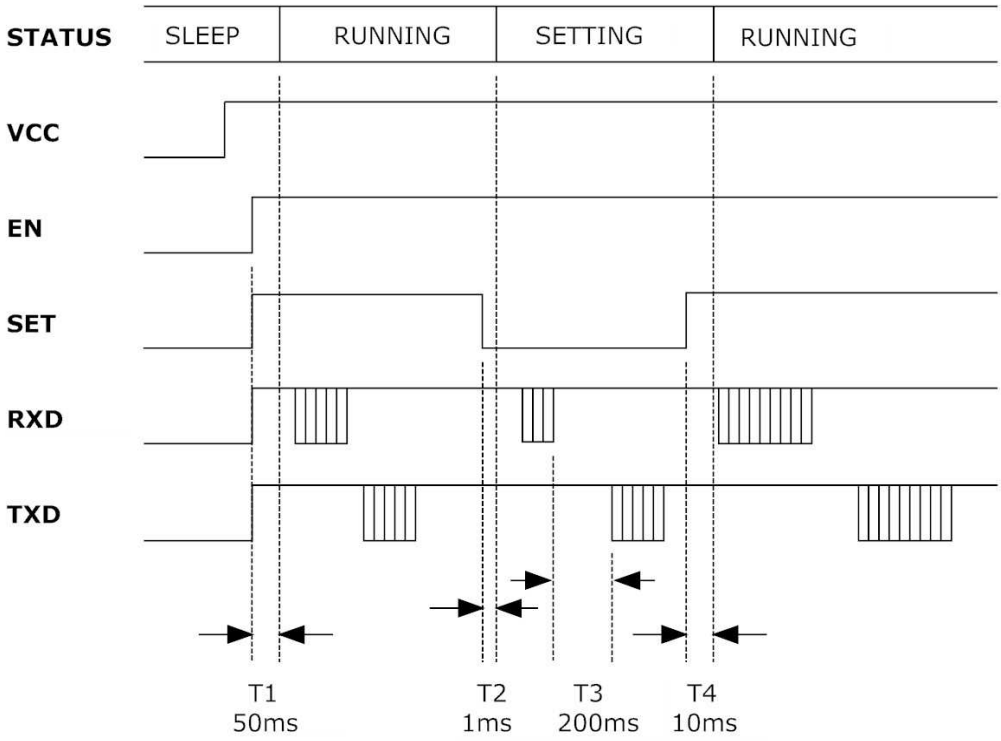


Figure 4: Timing diagram for Setting Parameter in circuit

The setting commands of APC220 are in ASCII format. The default data rate is 9600bps and no parity check is adopted. The setting commands only have two sentences: Read and Write.

♦ Read command: RD ↙

Acknowledge (from module): PARA_Freq_DR FSK _POUT_DR IN_Parity ↙

♦ Write command: WR_ Freq_DRFSK _POUT_DR IN_Parity ↙

Acknowledge (from module): PARA_Freq_DR$_{FSK}$ _P$_{OUT}$_DR $_{IN}$_Parity ↙

('_' means one blank space)

Parameter	Unit	Length(Byte)	Decription
Freq.	KHz	6	434MHz = 434000
DR$_{FSK}$	K bps	1	2400,4800,9600,19200 bps equal to 1,2,3,4
Pout	dB	1	0~9; 0 refers to 0dBm and 9 for 13dBm
DR$_{IN}$	Kbps	1	1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6 equals to 0,1,2,3,4,5,6
Parity		1	0: No parity; 1: Even parity; 2: Odd parity

Table 3: APC220 Parameter Coding

E.g. If the user wants to set the module work at Freq (434MHz), DR$_{IN}$ (1.2K bps), P$_{OUT}$ (13dBm), DR$_{FSK}$ (9.6k bps) and Parity (no parity), the command could be written as below:

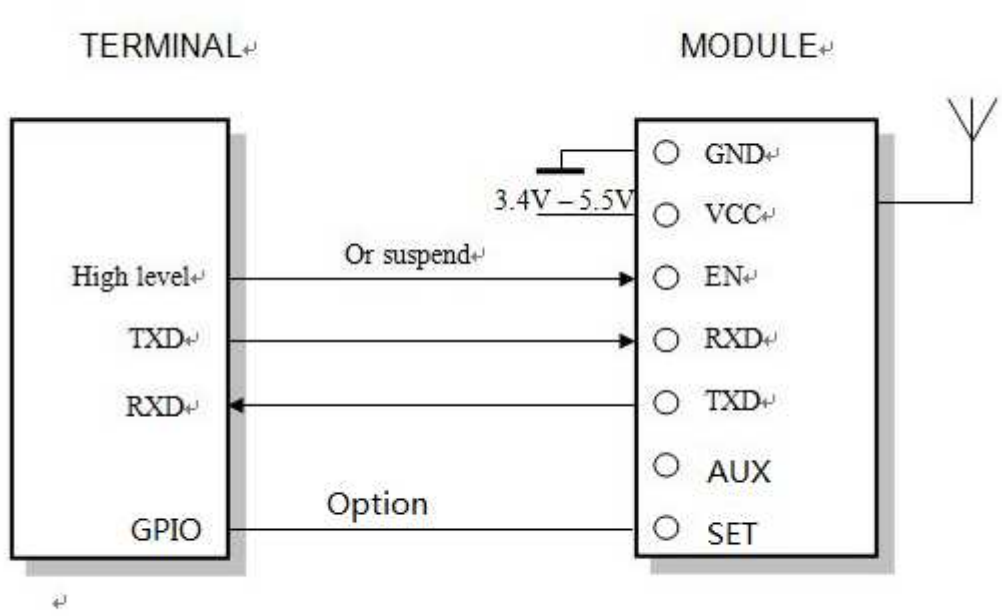
Write Command: WR_434000_3_9_0_0

Corresponding HEX code: 0x57,0x52,0x20,0x34,0x33,0x34,0x30,0x30,0x30,0x20,0x33, 0x20,0x39,0x20,0x30,0x20,0x30,0x0D,0x0A

Acknowledge: PAPA_434000_3_9_0_0

Corresponding HEX code: 0x50,0x41,0x52,0x410x20,0x34,0x33,0x34,0x30,0x30,0x30, 0x20,0x33,0x20,0x39,0x20,0x30,0x20,0x30,0x0D,0x0A

Application Schematic:



Caution: When APC220 connect the UART/TTL interface，SET pin is optional.

Figure 5: The Connection between Module and Terminal

Electrical Specifications

The technical specifications of APC220:	
Work frequency	418MHz to 455MHz (1KHz step)
Modulation	GFSK
Frequency interval	200KHz
Transmitted power	20mW (10 levels adjustable)
Received sensitivity	-114dBm@9600bps
Air data rate	2400 - 19200bps
UART rate	1200 - 57600bps
The parity of series COM	8E1/8N1/8O1
The buffer of COM	256bytes
Humidity	10%～90%
Temperature	-30℃ - 85℃
Supply voltage	3.4 – 5.5V (the ripple is ±50mV)
Transmit current	≦100mA@500mW
Receiving current	≦32mA
Sleeping current	≦5uA
RF line-in-sight range	800m (@9600bps)
Dimension	37.5mm x 18.3mm x 7.0mm

Constructing Network (one point to multi-point):

APC220 is a semi-duplex module, which can be communicated by point to point or one point to multi-point. In the second mode, user needs to set one master module, while the others are slave modules. Every module must only have one unique ID. The coordination of

communication is controlled by the master module, which sends data or commands including ID information. All slave modules can receive the data packets, and compare the ID with itself. If they are matched, the module will deal with the data packets. Otherwise, it will discard them. In order to avoid interfering each other, only one module can be in transmitting state when the network is working. APC220 can set many different frequencies so that many networks can work in the same place and at the same time.

User should pay attention to the following questions based on the complex transfers in the air and some inherency characteristics of wireless communication:

1）Latency of wireless communication

The wireless terminal keeps receiving data packets after waiting for a while to ensure no data any more. There should be tens to hundreds mil-seconds latency from transfer to receiver (the exact latency depended on UART rate, air rate and the size of data package). In addition, it also need consume some time to transmit from module to terminal, but the delay time is permanent in the same condition.

2）Data flux control

Although there is a buffer zone with 256 bytes in the wireless module, when the UART rate is higher than the air rate, there must be a problem about the data flux. It may cause to lose some data because the data overflow from the buffer. Under this condition, it must be ensured that the average UART rate should NOT higher than 60 percent of the air rate. For instance, the UART rate is 9600bps, the air rate is 4800bps. If UART rate is the same as the air rate, the only way is to interval the transmitting time. If terminal transmits 100bytes to UART every time, it will take 104ms every time. (104ms/0.6)*(9600/4800) =347ms. So if the interval time that terminal transmit 100bytes to UART should NOT less than 347ms every time, those mentioned problems can be avoided.

3）Error control

The wireless network module has strong capability of anti-interference because of the high efficiency checking error correction with interleaving encoding technology. However, when it is

in a bad circumstance that has strong electric interference, the data may be lost or receive some error data. User can increase the development of the system link layer protocol. For instance, if user can increase TCP/IP slip window and repeat transmitting functions, it will improve the reliability and ability of wireless network communication.

4) Selection of antenna

Antenna is a very important factor of the communication system. The quality of antenna impacts the capability of communication system. So user should strictly choose the quality of antenna. Generally speaking, it mainly contains two points: the type of antenna (size) and its electric capability. The antenna must be matched with the frequency of communication system.

Q&A:

Q&A	
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	1．The supply voltage exceeds range
	2．The ripple of power is too big.

distance	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.

Partner:

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ADI Third Party Designer

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