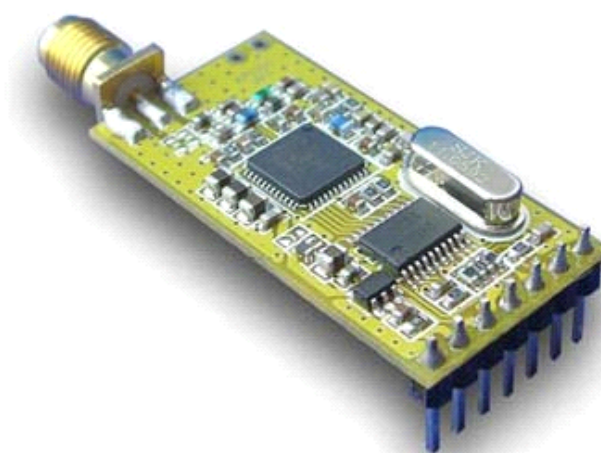# APC Series Transparent Transceiver Module
APC220-43

Product Overview:

APC220-43 is highly integrated semi-duplex low power transceiver module with high speed MCU and high capability RF IC。Using high efficiency forward error correction with Interleaving encoding technology , it can make anti-interference and sensitivity improved highly. It can have a good performance in strong interference circumstance as well, for example the industry field。The technique is advanced in data transfers area。

APC220-43 is a cost-effective and easy applied module that not only can transmit transparent data with large data buffer zone, but also can provide more than 100   channels . It 's parameters easily setting and small size make the module an ideal for wireless data transfer 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

Characters:

● 1000 meters of communication distance（2400bps）

● Output power is 20 mW

● Frequency is from 418MHz to 455MHz

● Size of Module 37.5mm x 18.3mm x 7.0mm

● More than 100 channels

● GFSK modulation

● UART/TTL interface

● Exceed 256 bytes data buffer

● fit to large data transfers

● The convenient software for setting

Installation and Use

APC220-43 module has 9 pins. Refers to the Table 1：

APC220-43		
Pin NO.	Pin Name	Description
1	GND	Grounding of Power Supply
2	VCC	Power supply DC 3.5V-5.5V
3	EN	Power enable,$\geqq$1.6V or empty,$\leqq$0.5Vsleep.
4	RXD	URAT input, TTL
5	TXD	URAT output, TTL
6	MUX	The pin is expanded for other functions
7	SET	Setting parameters, setting online supported
8	NC	Not connected
9	NC	Not connected

Table 1 Interface definition

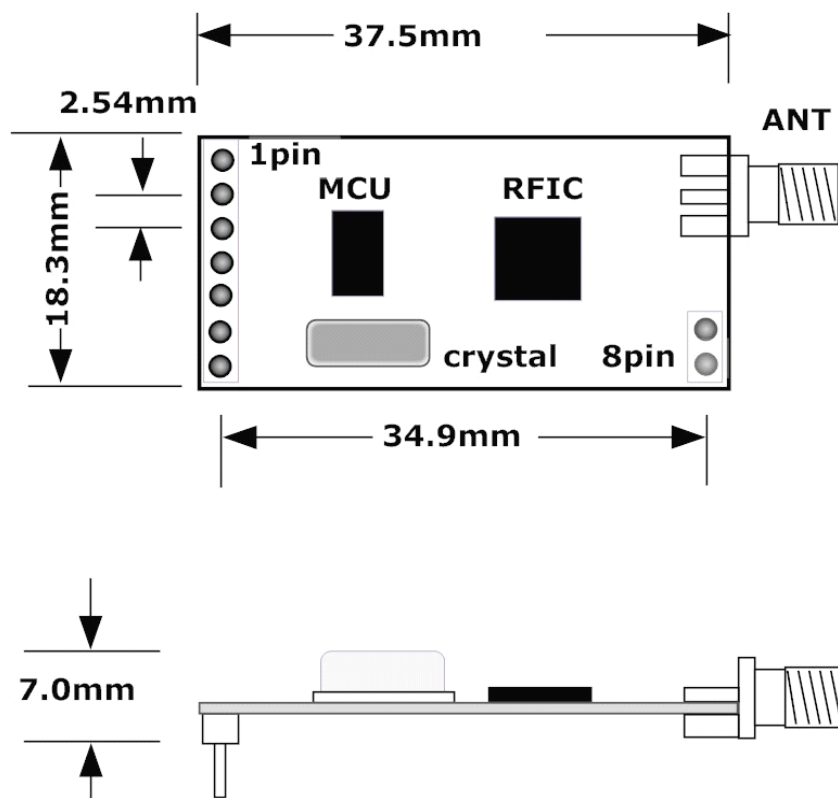## Dimensions – PIN Assignments

Figure 1: Size of Module

Setup parameters

With series COM or through the software Rf-Magic ,user can set up all parameters which include work frequency, UART rate, air rate,checkout mode and so on.

It is very convenient to set APC220-43 . Different options can be selected based on user needs . Please refer to Table 2 and Figure 2.

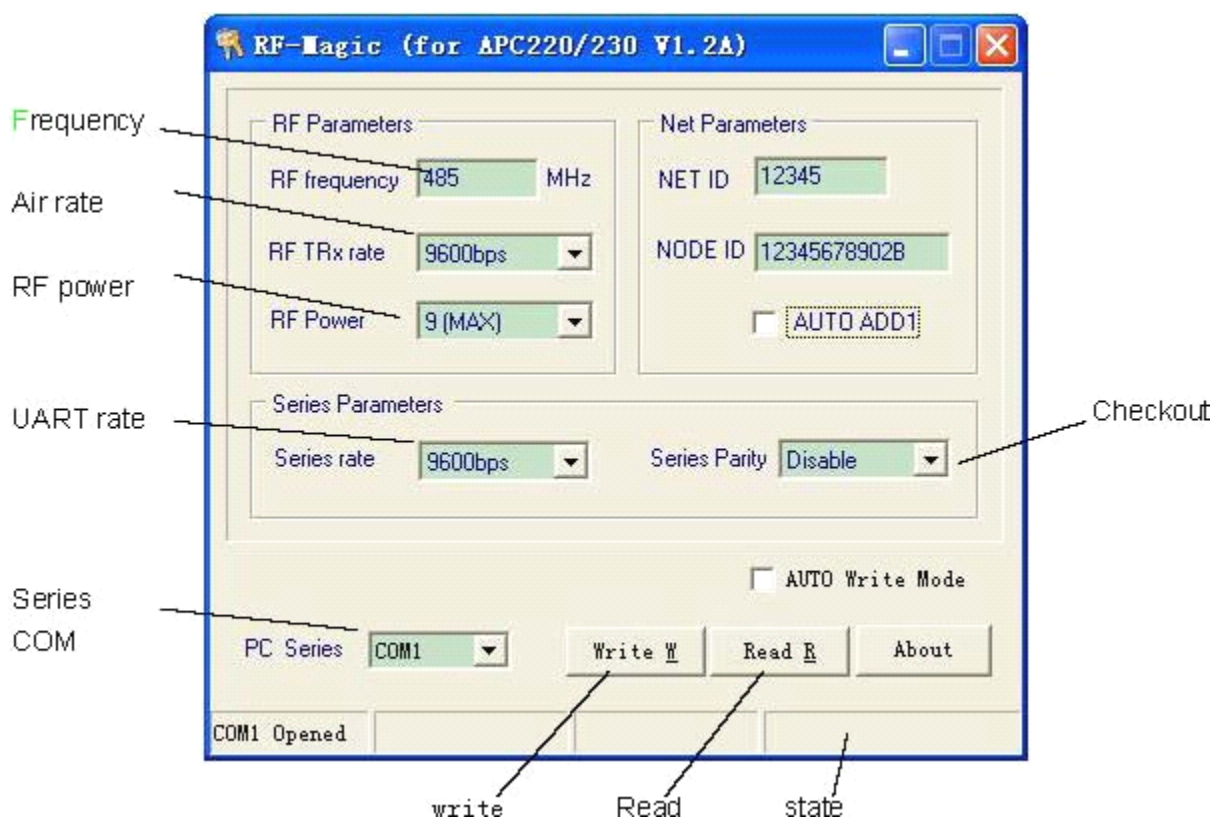| The instruction of setting parameters of module APC220-43		
Setting	options	default
UART rate	1200,2400,4800,9600b,19200,38400,57600	9600bps
Series Parity	Disable,Even Parity,Odd Parity	Disable
Frequency	418MHz-455MHz	434 MHz
Air Rate	2400bps,4800bps,9600bps,19200bps	9600bps
RF Power	0-9(9 for 20mw)	9(20mw)

Table 2 Setting Parameters of Modules

Figure 2 the software of Rf-Magic

There are two ways of setting the parameters of APC220-43. One way is to use the Rf-Magic by PC. Please look at the Figure 3
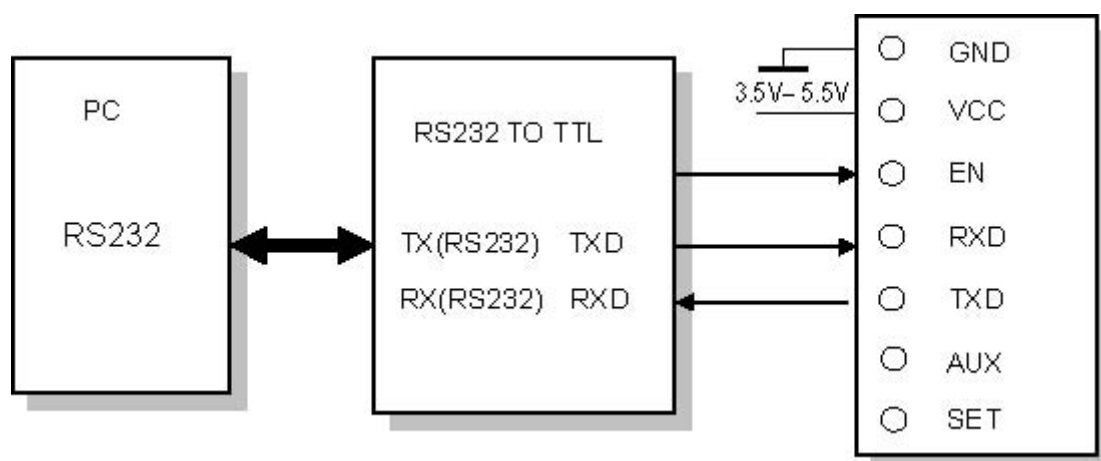
UART/TTL TO RS232PC translation circuit module

Figure 3 the connection of setting parameters

To set the parameters,It needs a UART/TTL to RS232 interface board to connect APC220-43 with PC.At first, connect the APC220-43 and PC by interface board . Then run the software Rf-Magic and plug APC220-43 into the interface board with power supply +5V .After that ,User will see "Found Device" underside of Rf-Magic, and user can write the parameters which user selected.
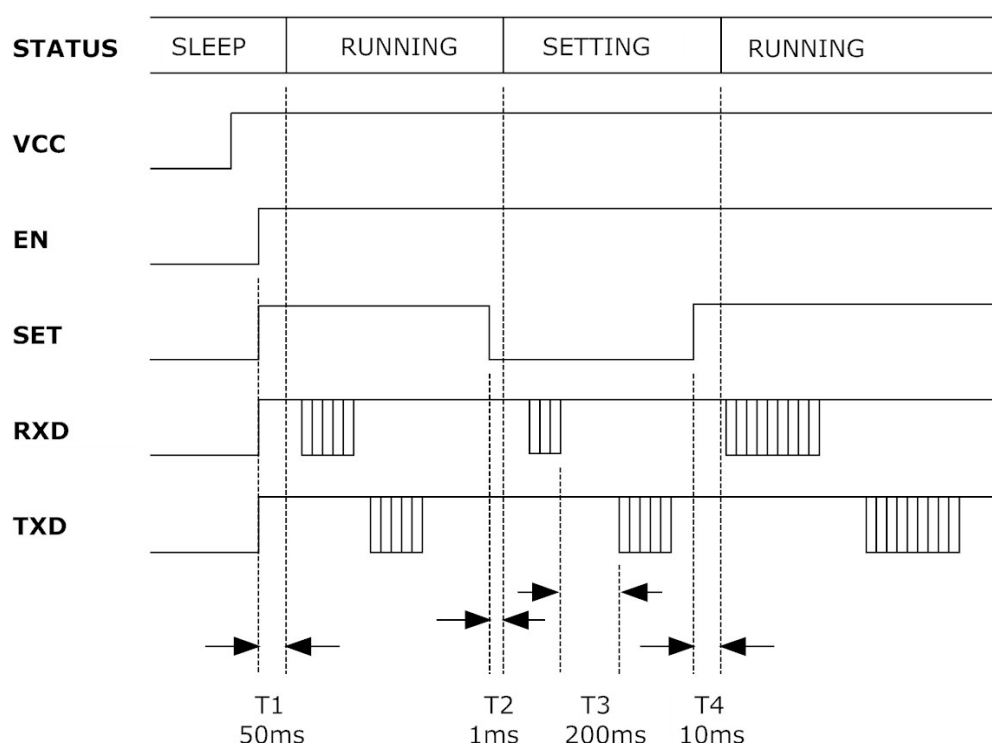

Figure 4 the figure of Setting Parameters Online

The other way of setting parameters is to use terminal on line. The parameters are setted by TTL/UART (4,5PIN) and the control pin of SET (see the Figure 5). APC220-43 will enter normal working (T1, see the Figure 4) mode after the voltage of SET 50ms later. If user wants to set parameters online, you can lower the voltage of SET firstly .Then APC220-43 will set the UART data rate at 9600bps automatically and enter setting mode (T2) with no checkout 1ms later. User should send the parameters command by RXD.After parameters checkout,the pin TXD will return the parameters information(T3) in 200ms. User may set up the voltage of SET after checking out the information that has been written.Finally, APC220-43 will work based on the new parameters in 10ms(T4). It must be noticed that user sent the command to APC220-43 for

only one time when APC220-43 at the setting mode. If the command is wrong or the setting parameters are not completed, user should set them again. However,one more important thing that user must do firstly is to set up the voltage of the pin SET and enter the setting mode . It is the same as the way of the last setting.

APC220-43 is set by ACSII. UART rate is 9600bps and no checkout. There are two setting commands. They are reading and writing. It must use the capital letters. The parameters are parted by blank. And the enter means end.

The command of reading parameters:

RD↙

ANSWER: PARA_frequency_rf data rate_output power_UART data rate_series checkout

The command of writing parameters:

WR_frequency_ RF data rate_output power_UART rate_series_check↙

ANSWER: PARA_frequency_rf data rate_output power_UART data rate_series checkout

The Parameters Table:

The parameters table		
Parameters	Bytes	Instruction
Frequency	6	Unit is KHz,for example 434MHz is 434000.
Rf data rate	1	1,2,3 and 4 refer to 2400,4800,9600,19200bps separetely.
Output power	1	0 to 9, 9 means 13dBm(20mW).
UART rate	1	0,1,2,3,4,5 and 6 refers to 1200,2400,4800,9600, 19200,38400,57600bps separately.
Series checkout	1	Series checkout：0 means no check,1 means even parity,2 means odd parity.

For example , one APC220-43 is set to 434MHZ; rf data rate is 9600bps; Output power is 20mW; UART data rate is 1200bps; No checkout.

WR_434000_3_9_0_0↙ (HEX code:

0x57,0x52,0x20,0x34,0x33,0x34,0x30,0x30,0x30,0x20,0x33,0x20,0x39,

0x20,0x30,0x20,0x30,0x0D,0x0A) ANSWER: PARA_434000_3_9_0_0✓ (HEX

code:0x50,0x41,0x52,0x410x20,0x34,0x33,0x34,0x30,0x30,0x30,0x20,0x33,

0x20,0x39,0x20,0x30,0x20,0x30,0x0D,0x0A)

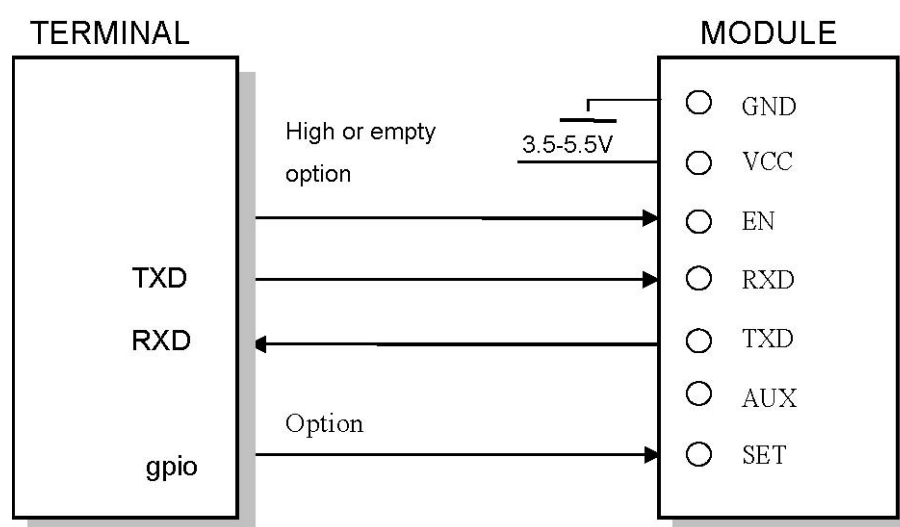## The Connection between Module and Terminal(UART/TTL):

Figure 5:The Connection between Module and Terminal

Application of Constructing Networking (one point to multi-point):

APC220-43 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 host module, while the others are client modules. Every module must only have one unique ID. The coordination of communication is controled by the host module, which sends datas or commands including ID. All the client modules can receive the data packets, and compare the ID with the own's. If they are the same, the module will deal with the data packets. Otherwise, it will discard them. In order to avoid interfereing each other,all client modules must be at transmitting mode when the network is working. APC220-43 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）The data delay of wireless communication

The wireless terminal receives some data ,or after waiting for a while to ensure no data any more, then there will be tens to hundreds milli-seconds delay from transfer to receiver (the exact delay based on the UART rate, air rate and the flow of data package). In addition, it also will cost some time to tranmsmit from module to terminal but the delay time is the same with the same condition.

2）The control of data flux

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 is lower 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 take104ms every time. (104ms/0.6)*(9600/9600)=174ms. So when the interval time that terminal transmit 100bytes to the UART is higher than 174ms every time, those mentioned problems will be avoided.

3）The control of errors

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) Choice of antenna

Antenna is an very important element of the communication system. The quality of antenna impacts the capability of communication system. So user should think more about the quality of antenna.Generally speaking, it mainly contains two points : the kind of antenna (size) and its electric capability. The antenna must be matched with the frequency of communication system.

Specifications

The technical specifications of APC220-43:	
Work frequency	418MHz to 455MHz
Modulation	GFSK
Frequency interval	200KHz
Transmitted power	20mw (10 levels)
Received sensitivity	-113dBm@9600bps
Air 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	3.5 – 5.5V (the ripple is ±50mV)
Transmit current	≦42mA@20mW
Receiving current	≦28mA
Sleeping current	≦5uA
Transfers distance	1000m (open space)
Dimension	37.5mm x 18.3mm x 7.0mm

Questions and Answers：

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.