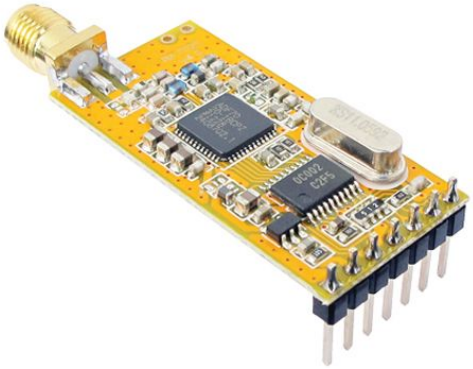
APC220

13dBm ISM RF Transceiver Module V1.03



Features

- 1000m distance cover(2400bps)
- GFSK modulation
- Frequency on 433MHz or 470MHz
- More than 100 channels
- 13dBm Max.output power
- -118dBm sensitivity @1200bps
- UART/TTL interface
- Dual 256bytes data buffer

Application

- Short range communication
- Automatic meter reading
- Industrial control and automation
- Security alarm and surveillance
- Wireless data transmission
- Wire replacement
- Remote control and monitoring
- Wireless sensor network

DESCRIPTION

APC220 is an sub-1 GHz transceiver module designed for operations in the unlicensed ISM (Industrial Scientific Medical) and LPRD bands. The GFSK (Frequency Shift Keying) modulation/demodulation, multi-channel selection, high bandwidth efficiency and anti-blocking performance make APC220 modules easy to realize the robust and reliable wireless link.

PIN FUNCTIONS

PIN	Name	Description
1	GND	Ground (0V)
2	VCC	Power supply. DC 3.3V-5.5V

3	EN	Power enable, ≧ 1.6V or empty, ≦ 0.5Vsleep
4	RXD	UART input, TTL level
5	TXD	UART output, TTL level
6	AUX	The pin is expanded for other functions
7	SET	Setting parameters, setting online supported
8	NC	Not connected
9	NC	Not connected

Table 1: APC220 Pin Functions

ELECTRICAL SPECIFICATIONS

Symbol	Parameter (condition)	Min.	Typ.	Max.	Units
VCC	Supply Voltage	3.5		5.5	V
Temp	Operating temperature range	-30	25	85	°C
RH	Operating relative humidity	10		90	%
Freq	Frequency range	418		455	MHz
FDEV	Modulation deviation		28.8		KHz
Mod	Modulation type		GFSK		
IDD	Receive mode Transmit mode @ 20mW Sleep mode			28 40 5	mA mA uA
Pout	Output power			13	dBm
Sen	Receiving sensitivity @1200bps		-118		dBm
DRFSK	Air data rate	2.4	9.6	19.2	Kbps
DRIN	UART data rate	1.2		57.6	Kbps
TS	Switching time		5		us
CHBW	Channel spacing		200		kHz
ZANT	Antenna Impedance		50		Ohm

Table 2: APC220 Electrical Specifications

SETTING PARAMETERS

1. DEFAULT VALUES

Parameter	Option	Default Value	Units
UART data rate	1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6	9.6	Kbps
Parity Check	No check, Even parity, Odd parity	No check	Disable
Frequency	418MHz ~ 455MHz (1KHz per step)	433.92	MHz
Air data rate	2.4, 4.8, 9.6, 19.2	9.6	Kbps
Output Power	0 ~ 9 levels	9 (20mW)	mW

Table 3: APC220 Default Settings

2. PARAMETER SETTING

The APC230 parameters (frequency, data rate, output power, etc.) can be setting by PC or MCU(Figure 2).

BY PC . The APC220 interface is UART/TTL. If connect it to an PC, one converter is needed to transform the different module pin level. APPCON provides two types converter boards (TTL-to-RS232 and TTL-to-USB) for configuration.

Firstly, connect an module to PC by an converter, running APPCON RF-Magic software(Figure 1). After that the status column of RF-Magic should display “Found Device”. Then the module can be read and write.

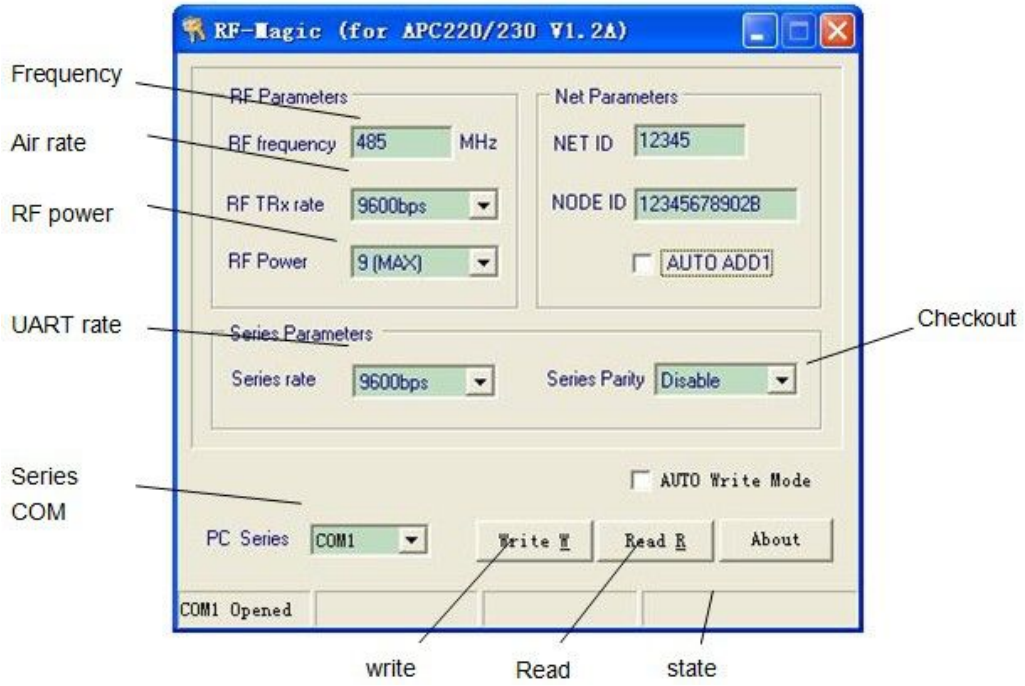


Figure 1: APPCON RF-Magic

BY MCU . The parameters are set by UART (4 pin and 5pin) and SET pin(Figure 4), The module will be working normally 50ms (T1) later after power on. To setting the module, set the SET pin level to low, the module is changed to 9600bps (UART data rate) and no parity automatically as default. About 1ms later, the module enters into setting mode (T2) for setting.

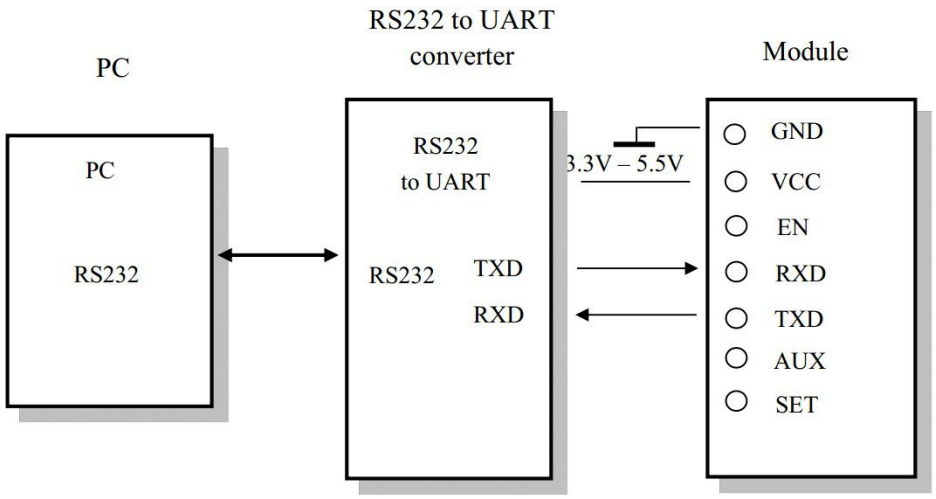


Figure 2: Connecting Diagram

When an setting command is sent to the module by RXD pin, the module will send back response from TXD pin within 200ms(T3) after setting command is verified. When Setting parameter is confirmed, set SET pin to high, the module will be working with new setting within 10ms(T4).
Please note: When the SET pin level is low(setting mode), there is one chance to sent setting command, If the parameter have to revised after an successful setting or wrong setting, the SET pin level need to set to high and do the setting again to enter setting mode.

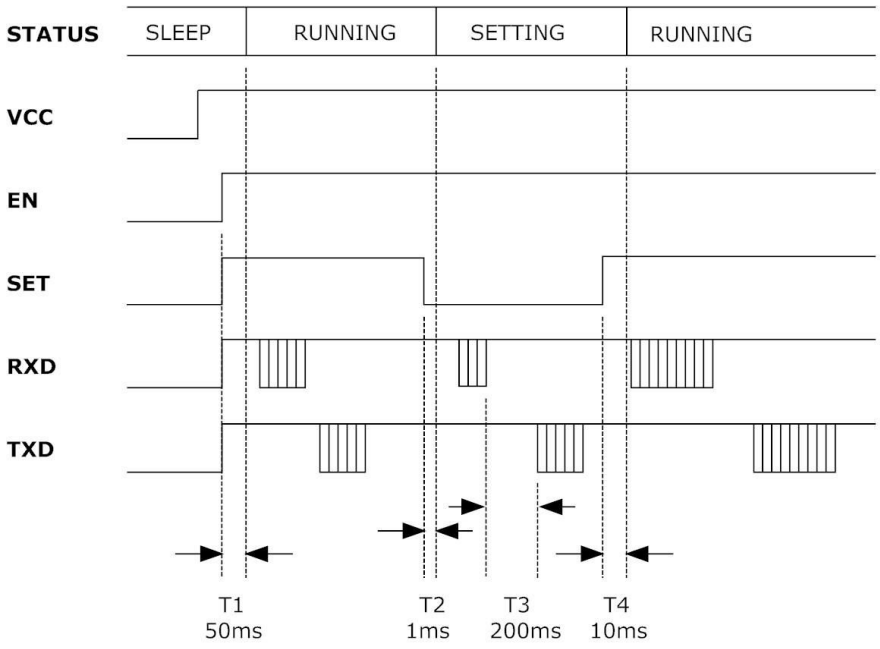


Figure 3: Timing Sequence for Setting Parameters

The commands of APC220 are ASCII code. The default setting data rate is 9600bps and no parity check included. The setting include two commands: Read command and Write command, they are must be the capital letters. The parameters are parted by blank. And the ‘enter’ means end.

***Read command**: RD↙*

Response (from module): PARA_Freq._DRFSK_POUT_DRIN_Parity↙

***Write command**: WR_Freq._DRFSK_POUT_DRIN_Parity↙*

Response (from module): PARA_Freq._DRFSK_POUT_DRIN_Parity↙

The Parameters Table

Parameter	Unit	Length(Bytes)	Explanation
Freq.	KHz	6	433.92MHz = 433920
DRFSK	Kbps	1	2400, 4800, 9600, 19200 bps equal to 1, 2,3, 4
POUT	dBm	1	0~9; 0 refers to -1dBm and 9 for 13dBm
DRIN	Kbps	1	1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6 equal to 0,1, 2, 3, 4, 5, 6
Parity	---	1	0: No parity; 1: Even parity; 2: Odd parity

Table 4: APC220 Parameter Coding

E.g. If the user wants to set the module work at Freq (434MHz), DR FSK (9.6k bps), POUT (20mW), DRIN (1.2K 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↙

Response: *PARA_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 ↙

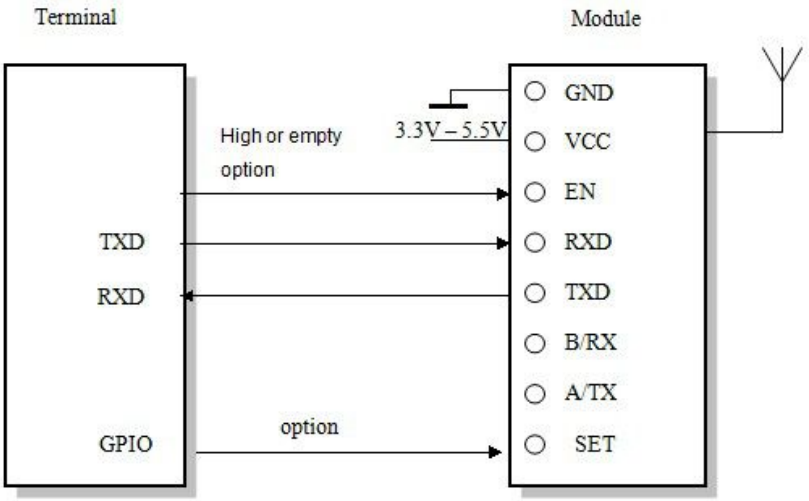


Figure 4: The Connection between Module and Terminal

APPLICATION NOTES(point to multi-point)

APC220 series are half-duplex wireless modules which can be used in point-to-point or point-to-multi-point applications. In the latter application, users need to set one module as the host and others as client modules. Each module must have an unique ID and the coordination of communication is controlled by the host which send data and command including ID. If the client module finds that the ID contained in the received message is the same as its own, it will continue to receive the remaining data; otherwise it will discard the coming message. In order to avoid any interference, only one module is allowed to work in transmit mode at any time. 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）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 data rate, Air data rate and the flow of data package). In addition, it also will cost some time to transmit from module to terminal but the delay time is the same with the same condition.

2）The data flow control

Although there is a buffer zone with 256 bytes in the wireless module, when the UART data rate is higher than the Air data rate, there must be a problem about the data flow. 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 data rate is lower than 60 percent of the Air data rate . For instance, the UART data rate is 9600bps, the Air data rate is 4800bps. If UART data rate is the same as the Air data 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)*(9600/9600)=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) The antenna selection

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.

The APC802, APC220, APC230 could communicate each other for more complicated application and different combinations.

MECHANICAL DATA

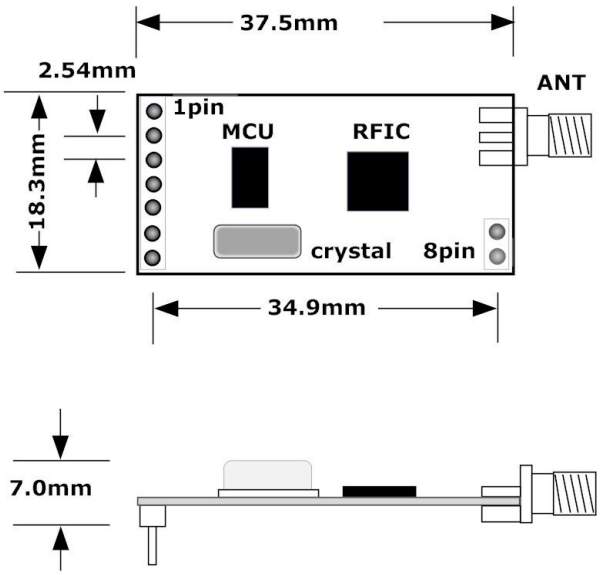


Figure 5: Mechanical Dimension

APPCON TECHNOLOGIES

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