## APC250
### 20dBm ISM RF Transceiver Module                                    V1.21

### Features

- GFSK transceiver Module
- ISM frequency bands
- 19.2K bps data rate
- Multiple channels
- 20dBm Max. output power
- Baud rate configurable
- 256 bytes data buffer
- Standby current < 3uA
- Supply voltage 3.4~5.5V

### Application

- Home automation
- Security alarm
- Telemetry
- Automatic meter reading
- Contactless access
- Wireless data logger
- Remote motor control
- Wireless sensor network

## DESCRIPTION

APC250 is a low-cost sub-1 GHz transceiver module designed for operations in the unlicensed ISM (Industrial Scientific Medical) and LPRD bands. GFSK (Frequency Shift Keying) modulation/demodulation, multi-channel operation, high bandwidth efficiency and anti-blocking performance make APC250 modules easy to realize the robust and reliable wireless link.

The module can be configured to work in different channels with 200k Hz space. It adopts high efficient looped interleaving EDAC (Error Detection and correction) coding with coding gain up to 3dB which keeps in advance in EDAC and coding efficiency over normal FEC (Forward Error Correction). Because of its high reliability in correction, modules can filter error and fake information automatically and realize truly transparent wireless link, which makes APC250 very suitable in the rigid communication environment.

APC250 integrates 256 bytes buffer. When the buffer is empty, users can transfer 256 bytes data per time and even limitless data transfer can be achieved as long as RF data rate (RF module to RF module) is configured to be faster than UART data rate (MCU to RF module). The module provides standard UART/TTL interface for selection. Users can choose seven data rates and three parity checks which makeAPC250 possibly tailor-made for different applications. APC250 operates at 3.4~5.5V with extra low standby current which makes it suitable for battery powered-up applica -tions.

## PIN FUNCTIONS

| PIN | Name | Function | Description |
|---|---|---|---|
| 1 | GND | Ground | Ground (0V) |
| 2 | VCC | Power | Power supply |
| 3 | / EN | Input | Enable pin ($\cong 0.5$): work mode; ($\cong 2.0V$): sleep mode |
| 4 | RXD | Input | UART input, TTL level |
| 5 | TXD | Output | UART output, TTL level |
| 6 | AUX | Output | Data In/Out indication |
| 7 | SET | Input | Data / Field strength pin |
| 8 | NC | --- | No connection |
| 9 | NC | --- | No connection |

**Table 1 APC250 Pin Functions**

## ELECTRICAL SPECIFICATIONS

| Symbol | Parameter (condition) | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| VCC | Supply Voltage | | 3.4 | | 5.5 | V |
| Temp | Operating temperature range | | -30 | 25 | 85 | °C |
| RH | Operating relative humidity | | 10 | | 90 | % |
| Freq | Frequency range | | 410 | | 440 | MHz |
| | | | 860 | | 875 | |
| | | | 905 | | 925 | |
| $F_{DEV}$ | Modulation deviation | | | 36 | | KHz |
| Mod | Modulation type | | | GFSK | | |
| $I_{DD\_R}$ | Current in receive mode | @ 433Mhz | | 20 | | mA |
| | | @ 868Mhz | | 20 | | |
| | | @ 915Mhz | | 20 | | |
| $I_{DD\_T}$ [1] | Current in transmit mode | @ 433Mhz | | | 100 | mA |
| | | @ 868Mhz | | | 100 | |
| | | @ 915Mhz | | | 100 | |
| $I_{DD\_S}$ | Current in sleep mode. | @ 433Mhz | | 3 | | uA |
| | | @ 868Mhz | | 3 | | |
| | | @ 915Mhz | | 3 | | |
| Pout | Output power | @ 433Mhz | | | 20 | dBm |
| | | @ 868Mhz | | | 20 | |
| | | @ 915Mhz | | | 20 | |

| | | @ 433Mhz | | -121 | | dBm |
|---|---|---|---|---|---|---|
| Sen. [2] | Receive sensitivity | @ 868Mhz | | -115 | | |
| | | @ 915Mhz | | -115 | | |
| $DR_{FSK}$ | GFSK data rate | | 1.2 | | 19.2 | Kbps |
| $DR_{IN}$ | Interface data rate | | 1.2 | | 57.6 | Kbps |
| $T_E$ | Evoking time from Sleep to Normal | | | | 20 | uS |
| $CH_{BW}$ | Channel spacing | | | 200 | | kHz |
| $Z_{ANT}$ | Antenna Impedance | | | 50 | | Ohm |

**Table 2 APC250 Electrical Specifications**

**Notes:**

(1) Transmit current is tested at the Max. output power.

(2) Sensitivity is measured at 1.2k bps data rate.

## ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Min. | Max. | Units |
|---|---|---|---|---|
| VCC | Supply Voltage | -0.3 | 5.5 | V |
| VI | Input voltage | -0.3 | VCC+0.3 | V |
| VO | Output voltage | -0.3 | VCC+0.3 | V |
| TST | Storage temperature | -55 | 125 | °C |

**Table 3 APC250 Maximum Ratings**

## SETTING PARAMETERS

### 1. Default Values

| Parameter | Option | Default Value | Unit |
|---|---|---|---|
| MCU 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 | |
| Frequency | 418 ~ 455MHz | 433.92 | MHz |
| | 860 ~ 875MHz | 869 | |
| | 905 ~ 925MHz | 915 | |
| GFSK data rate | 1.2,2.4, 4.8, 9.6, 19.2 | 9.6 | Kbps |
| Output Power | 0 ~ 7 levels | 7 (20dBm) | |

**Table 4 APC250 Default Settings**

## 2. Parameter Setting

Users can configure the parameters (frequency, data rate, output power, etc.) of RF modules by PC or MCU.

- **BY PC.** The interface of APC250 is UART/TTL. If connecting it to PC, users need to use a TTL-to-RS232 level converter to transform the different levels. APPCON Technologies also provides converter board for configuration.

  Firstly users need to connect converter board to PC by cable and openAPPCON RF software; then insert module into converter board. After that the status column of tool should display "Found Device". Users then can read/write the module.
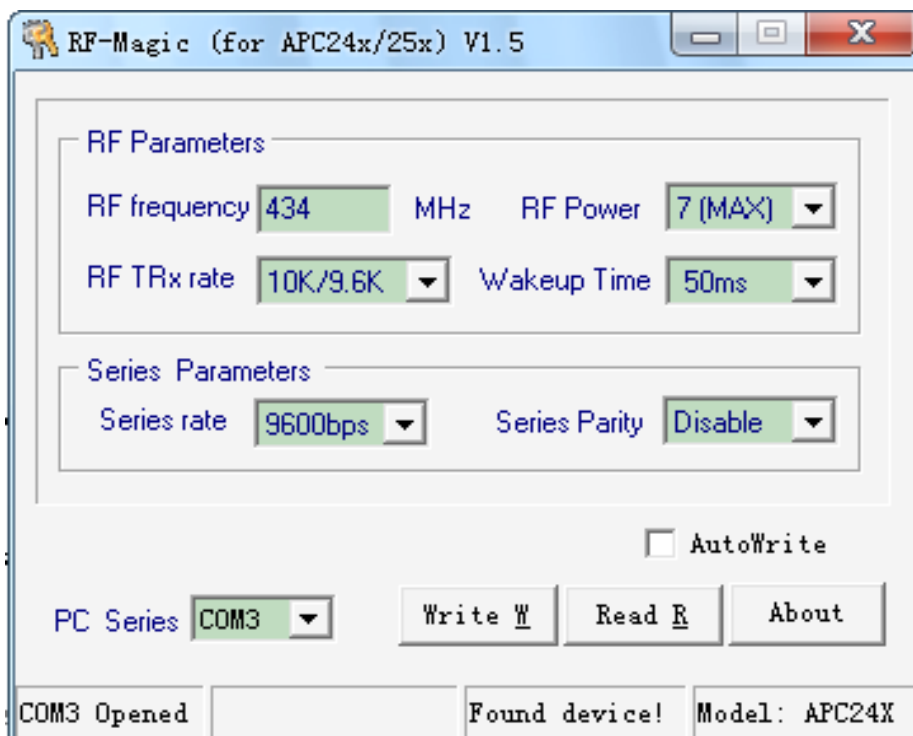


**APPCON RF Tool**

- **BY MCU**. The module can work normally after powering on for 50ms (T1) or more. When configuring the module, users need to switch the module to sleep mode (EN pin is high or floating) and monitor AUX pin. When AUX pin is high (no Receive or Transmit), the module will enter sleep mode in which the module can be configured after 20us (T2). When command is input to RXD pin, the module will be evoked. No matter what status of UART interface, the module will use 9600 bps (data rate) and no parity check as default format to communicate.
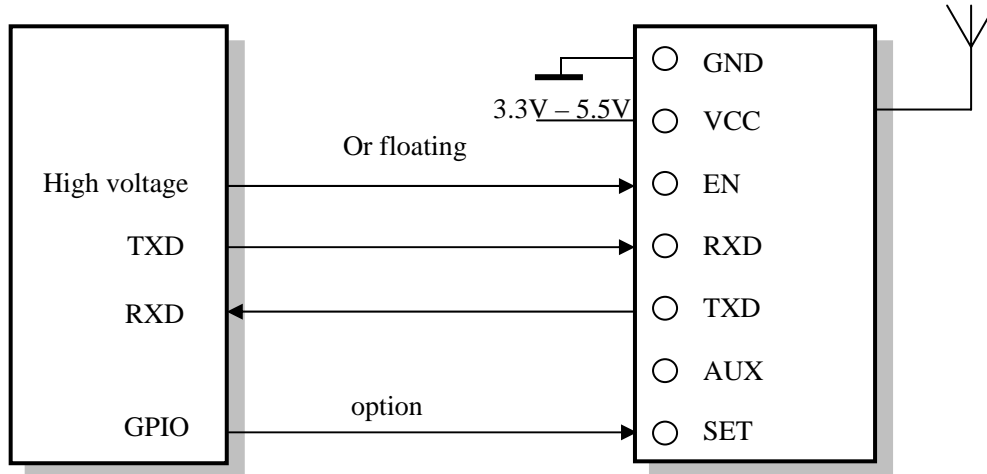
**Figure 2: Connecting Diagram**

When a command is sent to the module through the RXD pin, the module will send back response information by TXD pin in 50ms or less (T3) after it verifies the command is correct. The module then will be reset and initialized automatically and work with new settings after 100ms (T4). If the input command is incorrect, the module will make no response but it will still be reset and initialized. Users can take this advantage to wake up modules in long-term sleep or reset the modules.
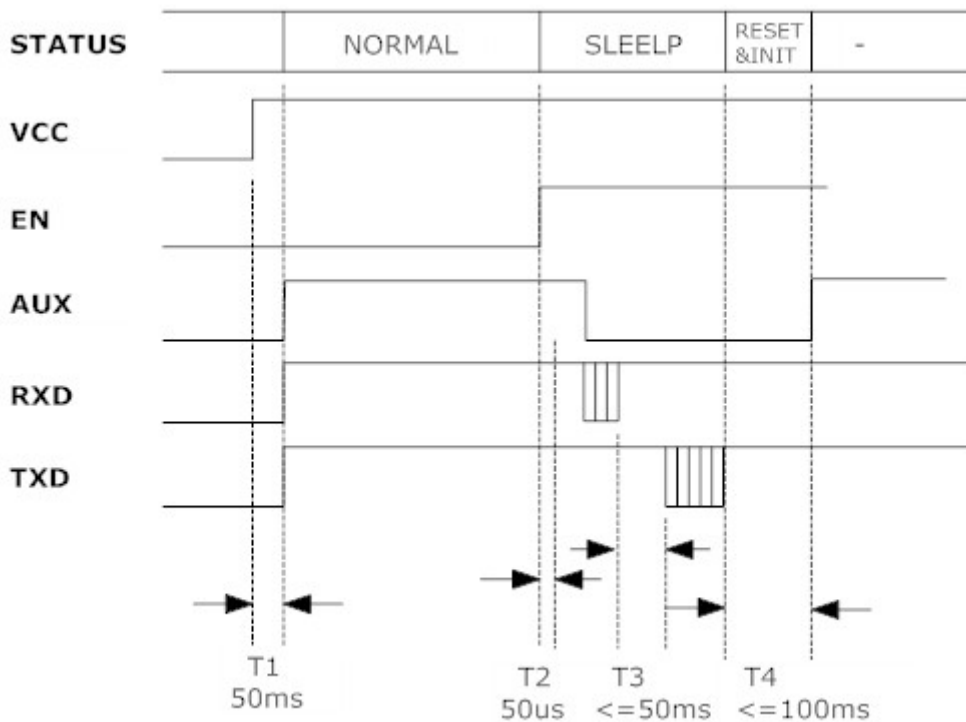


**Figure 3: Timing Sequence for Setting Parameters**

The commands of APC250 are HEX coding. The default configuring data rate is

9600 bps and no parity check included. The command set include two commands: Read command and Write command.

**Read command:**   0xFF,0x56,0xAE, 0x35,0xA9,0x55,0xF0
*Response:*         0x24,0x24,0x24+Freq+DR$_{FSK}$+P$_{OUT}$+DR$_{IN}$+Parity

**Write command:**  0xFF,0x56,0xAE,0x35,0xA9,0x55,0x90+Freq+DR$_{IN}$+P$_{OUT}$+DR$_{FSK}$+ Parity
*Response:*         0x24,0x24,0x24+Freq+DR$_{FSK}$+P$_{OUT}$+DR$_{IN}$+Parity

| Parameter | Unit | Length (Byte) | Explanation |
|---|---|---|---|
| Freq. | KHz | 3 | 433920KHz = 0x06, 0x9F, 0x00 |
| DR$_{FSK}$ | Kbps | 1 | 1, 2, 5,10, 20, 40 equals to 0x00,0x01,0x02,0x03,0x04,0x05 |
| P$_{OUT}$ | dB | 1 | From 0 to 7 represents 0x00 to 0x07. One increment increases 3dBm. "0x07" equals to the Max. output power (10dBm). |
| DR$_{IN}$ | Kbps | 1 | 1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6 equals to 0x00,0x01,0x02,0x03,0x04,0x05,0x06 |
| Parity | | 1 | 0x00: No parity; 0x01: Even parity; 0x02: Odd parity |

**Table 5 APC250 Parameter Coding**

E.g. If the user wants to set the module work at Freq (433.92MHz), DR$_{FSK}$ (10K bps), P$_{OUT}$ (10 dBm), DR$_{IN}$ (9.6k bps), Parity (no parity), the command could be written as below:

**Write Command:** 0xFF,0x56,0xAE,0x35,0xA9,0x55,0x90,0x06,0x9F,0x00,0x03,

0x07,0x03, 0x00

*Response:*        0x24,0x24,0x24,0x06,0x9F,0x00,0x03,0x07,0x03,0x00

When the SET pin is in logic high, the module will work in normal mode. If it is set to logic low, the module will not output data but present field strength. The format is fixed 0xff+0xff+0xff+field strength value (one byte).
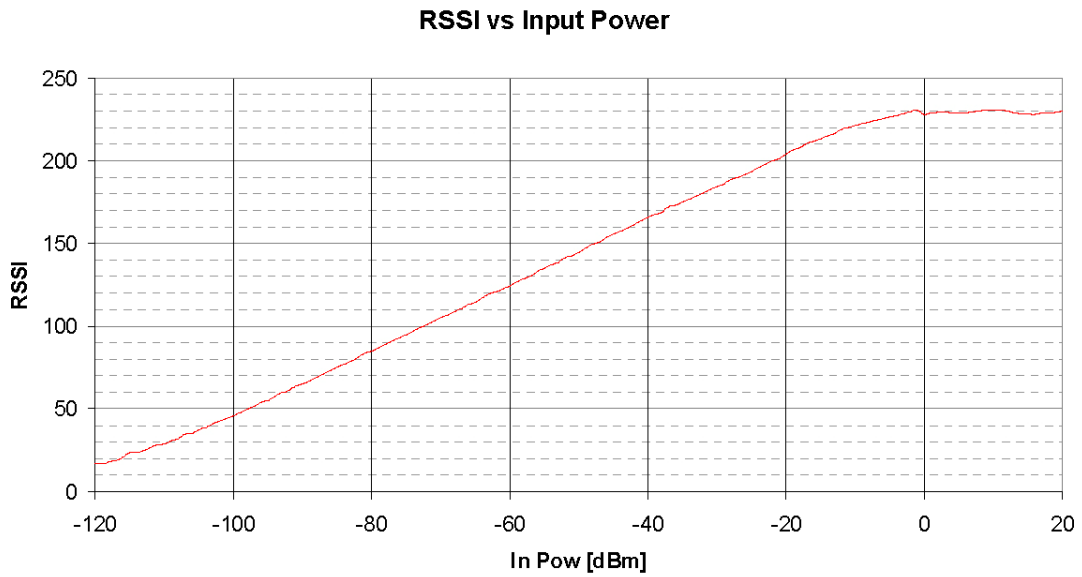
## RSSI vs Input Power



**Figure 4: RSSI Value vs Input Power**

The sleep mode of APC250 is switched through software. In Receive or Transmit mode, the module only can enter into sleep mode after one Receive or Transmit is finished. Users can take full use of this character. In other word sleep mode can be set in advance by setting EN pin to logic high before one Receive or Transmit finishes because the module will detect EN pin automatically after one Receive or Transmit process ends. Users can inquiry the status of AUX pin to judge if data is received or sent successfully.
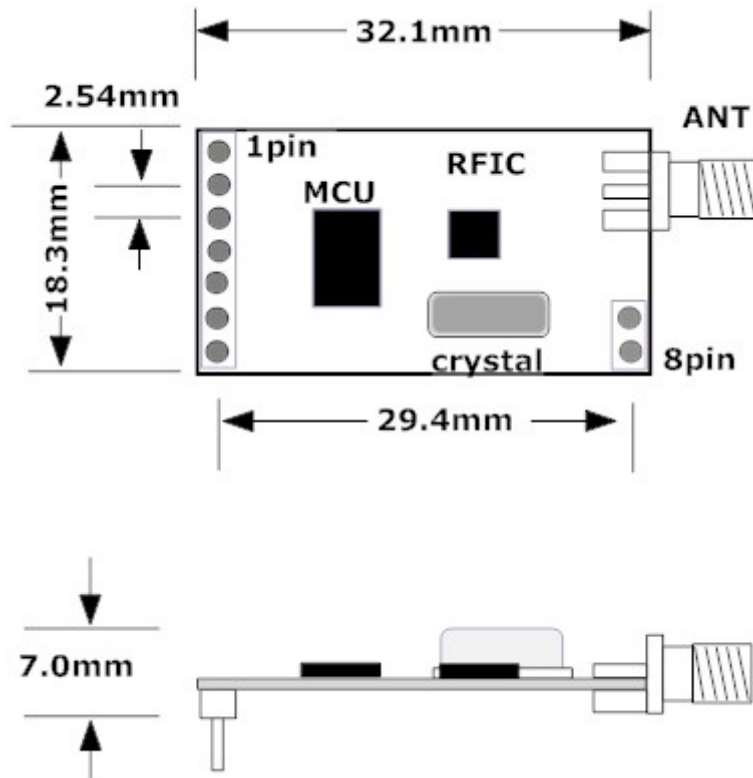
## MECHANICAL DATA



**Figure 5: Mechanical Dimension**

| | |
|---|---|
| **APPCON Technologies**<br><br>Add.: Room 1005,Zhongyangxigu Building, Xinzhou,Futian district, Shenzhen, China 518000<br>Tel:     0086-755-33370185<br>Fax.:   0086-755-33370186<br>Email:  sz0755@yahoo.cn<br>Web:   www.appcon.com.cn | APPCON Technologies Co., Ltd reserves the right to make corrections, modifications, improvements and other changes to its products and services at any time and to discontinue any product or service without notice. Customers are expected to visit websites for getting newest product information before placing orders.<br><br>These products are not designed for use in life support appliances, devices or other products where malfunction of these products might result in personal injury. Customers using these products in such applications do so at their own risk and agree to fully indemnify APPCON Technologies for any damages resulting from improper use. |

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