

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

Radio Modem AT Command

The RCQ5-XXX module is a module with multiple features:

- Radio Modem with AT Command

(Transparent Transmission Protocol)

The RF modem is very simple to use and provides a wireless RS232 link with a RF data rate of up to 200kbps (2-GFSK modulation). The module can work also in Long Range Mode (LRM) with a RF data rate equal to 2.5kbps.

The transceivers has the functions of a complete radio modem and simply require CMOS/TTL data at the transmit input and the corresponding transceiver(s) output the same data. Preamble and CRC are automatically generated and added to the RF transmission.

- Over The Air Command (OTA Command)

The module has the ability to manage No. 4 digital outputs and No. 4 digital inputs both locally and remotely (OTA Command) by sending simple AT commands.

- Alarm Function

With this function, when a digital input change status a message will be transmitted via UART to the remote device : "Alarm_0_1 "

- Remote I/O Functionality

Remote I/O functionality, this is a type of transmission bidirectional used in the field of automatic controls. When you enable this, every time the digital input changes state on station A, also the digital output of remote station B it will reflect these states simultaneously and vice versa.



Working into European bandwidth : 433/868MHz
Available also the version at 915MHz.

The hardware is based on the module RC-CC1312R-XXX designed by RadioControlli (CC1312R based from Texas Instruments).

For more information and details, please refer to :

- RC-CC1312R-434 datasheet (www.radiocontrolli.com)
- RC-CC1312R-868 datasheet (www.radiocontrolli.com)
- RC-CC1312R-915 datasheet (www.radiocontrolli.com)
- CC1312R datasheet (www.ti.com)

Applications:

- Smart meters
- Wireless security systems
- Home and Building automation
- 6LoWPAN systems
- Automatic Measure Reading
- Low-Power Wireless Systems
- Wireless Sensor Networks
- Remote Control
- Street Lights System
- Parking Sensors
- Environmental Sensors
- Smart Grid and Automatic Meter Reading

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

MODULE INFORMATION

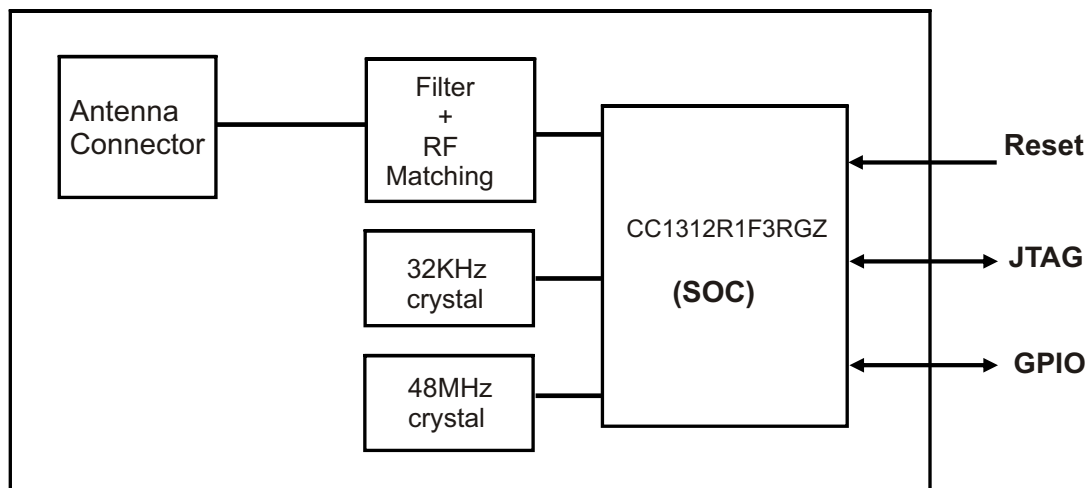
- RC-RCQ5-433** → 433MHz standard Version (UFL Connector)
- RC-RCQ5-433-H** → 433MHz pad version
- RC-RCQ5-868** → 868MHz standard Version (UFL Connector)
- RC-RCQ5-868-H** → 868MHz pad version
- RC-RCQ5-915** → 915MHz standard Version (UFL Connector)

TECHNICAL CHARACTERISTICS

| RC-RCQ5-XXX | | | | | |
|--|------------|-------|-------------|-------|--------------|
| Parameter | Symbol | Min. | Typ. | Max. | Units |
| Operating Voltage | V_{CC} | 1.8 | 3.00 | 3.8 | VDC |
| Supply Current RX Mode | I_{CRX} | | 5.80 | | mA |
| Supply Current TX Mode +10dBm | I_{CTX1} | | 13.40 | | mA |
| Supply Current TX Mode +14dBm | I_{CTX2} | | 24.90 | | mA |
| Supply Current Standby Mode | I_{CSTB} | | 2.0 | | μ A |
| Supply Current Sleep Mode | I_{CSHU} | | 2.0 | | μ A |
| Operative Frequency | F_{of} | | 433/868/915 | | MHz |
| Frequency Error | F_{pp} | | ± 10 | | ppm |
| RF Power Output 50ohm (*) | P_{oo} | -10.0 | | +14.0 | dBm |
| RF Sensitivity 50kbps | S_d | | -110.0 | | dBm |
| RF Sensitivity Long Range Mode 2.5kbps | S_{LR} | | -118.0 | | dBm |
| Data Rate (*) | D_{CC} | 0,01 | | 4.0 | Mbit/s |
| Operative Temperature | T_{LR} | -20 | | +75 | $^{\circ}$ C |

(*) Programmable parameter.

BLOCK DIAGRAM



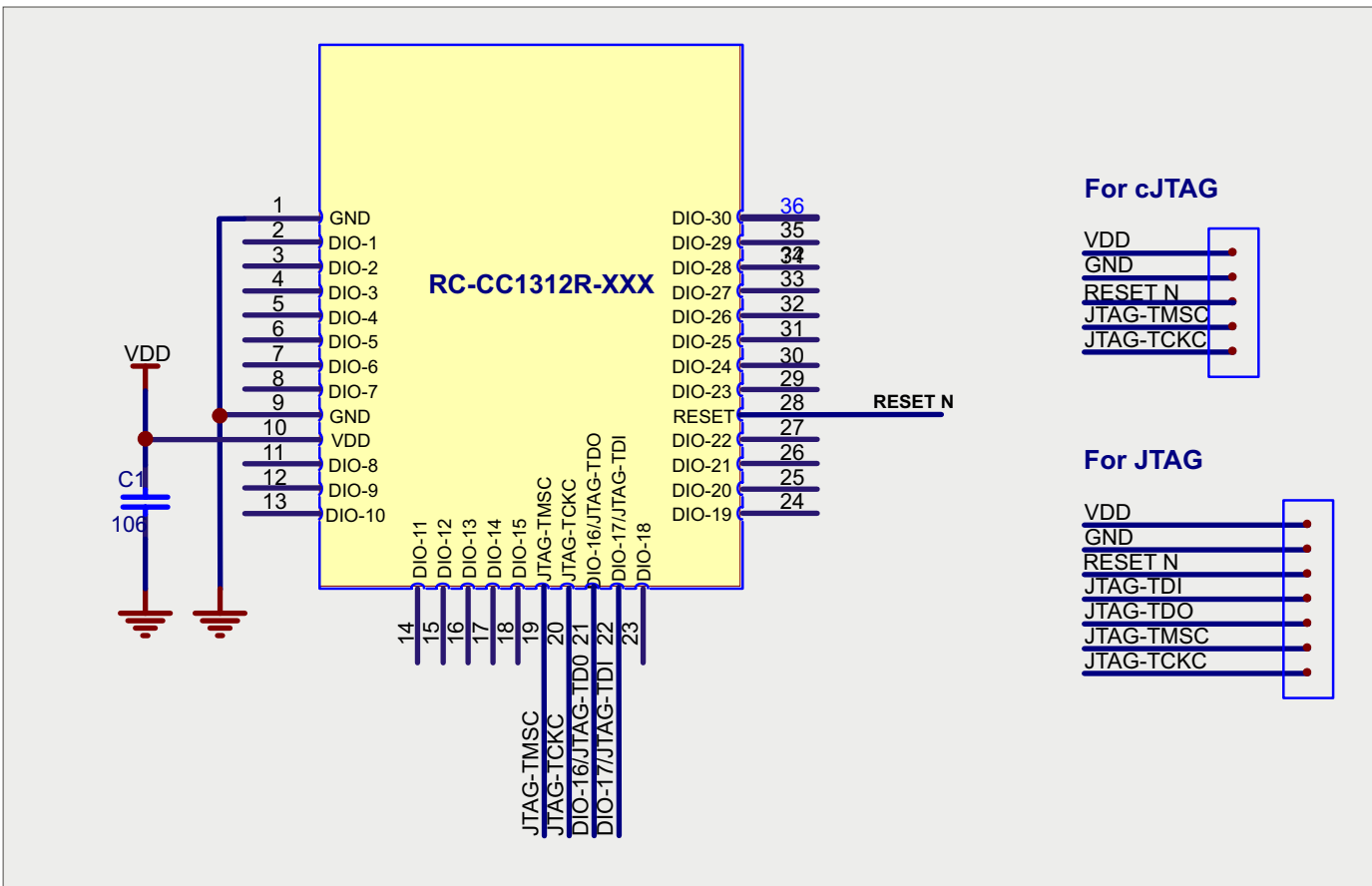
RC-RCQ5-XXX

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

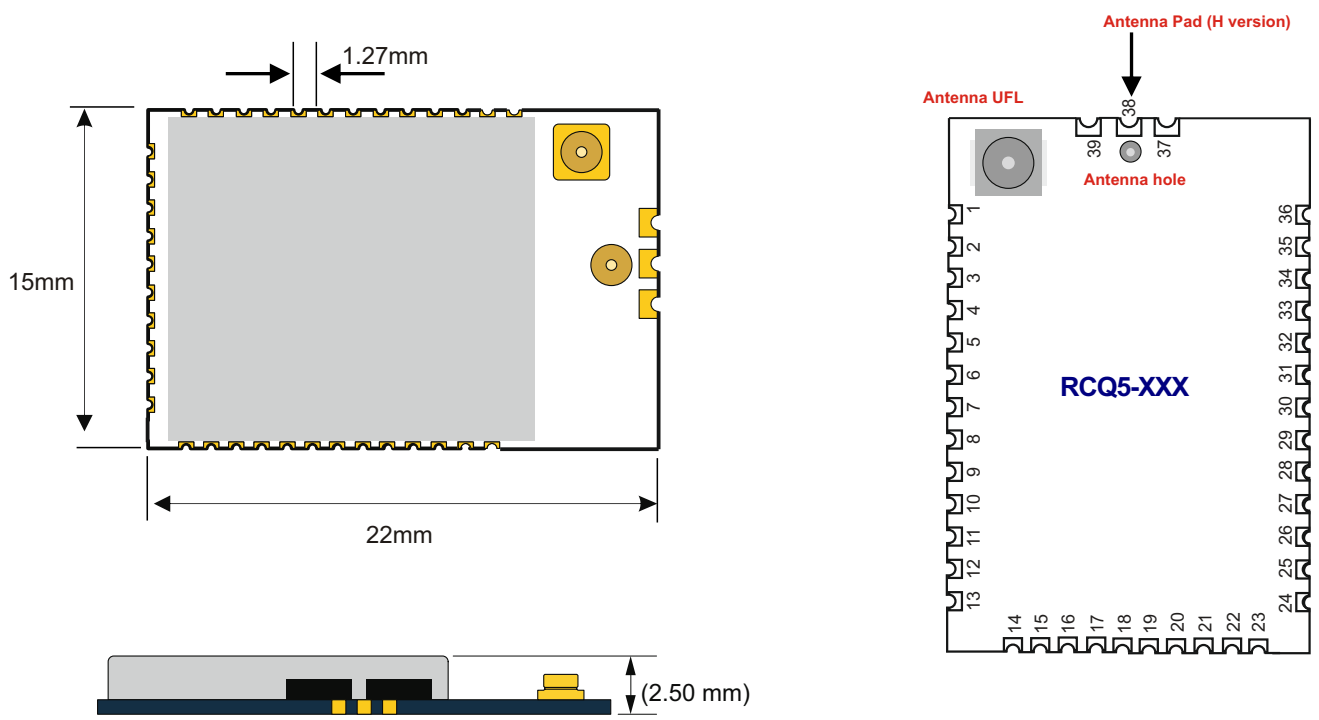


WIRELESS MODULES

REFERENCE SCHEMATICS



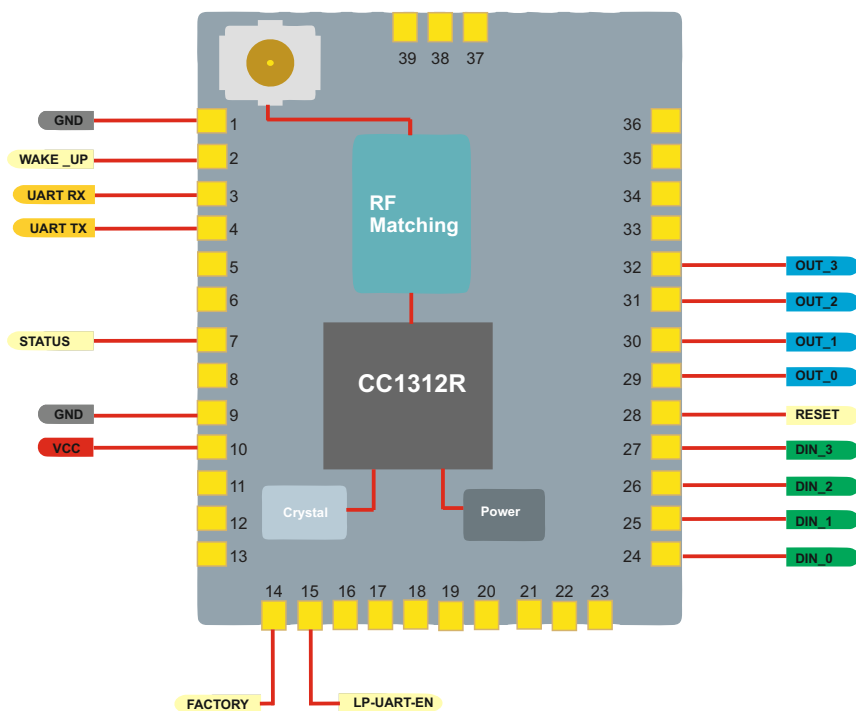
MECHANICAL DIMENSION



RC-RCQ5-XXX

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

PINOUT

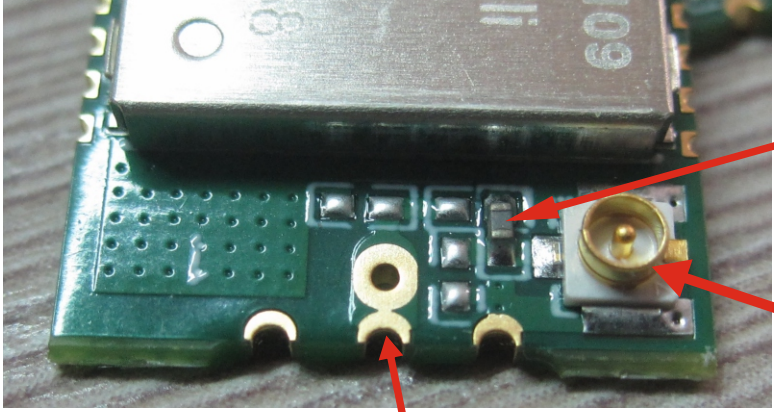


| Pin Descriptions | | | |
|------------------|---------|------------|--|
| Pin Number | Name | Pin Type | Description |
| 1,9,37,39 | GND | Ground pin | Connect to GND |
| 2 | Wake-Up | INPUT | Wake Up from Sleep mode (Low Active) |
| 3 | RX | INPUT | UART RX |
| 4 | TX | OUTPUT | UART TX |
| 7 | STATUS | OUTPUT | - When the system operates normally is HIGH - When the system is in Sleep mode is LOW - When will use Factory Reset this will flash |
| 10 | VDD | POWER | 1.8Volt + 3.8Volt main chip supply |
| 14 | FACTORY | INPUT | - Factory Reset Low Active After pull down this pin, and then powering ON again the pin 7 (STATUS) will flash 5 times and then stay on, means that the factory reset has been restored. |
| 15 | LP-UART | INPUT | LP-UART enable low active |
| 24 | DIN-0 | INPUT | Digital Input DIN-0 |
| 25 | DIN-1 | INPUT | Digital Input DIN-1 |
| 26 | DIN-2 | INPUT | Digital Input DIN-2 |
| 27 | DIN-3 | INPUT | Digital Input DIN-3 |
| 28 | RESET | INPUT | RESET (Active Low internal pullup) |
| 29 | OUT-0 | OUTPUT | Digital Output OUT-0 |
| 30 | OUT-1 | OUTPUT | Digital Output OUT-1 |
| 31 | OUT-2 | OUTPUT | Digital Output OUT-2 |
| 32 | OUT-3 | OUTPUT | Digital Output OUT-3 |

RC-RCQ5-XXX

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

TYPE OF ANTENNA CONNECTION

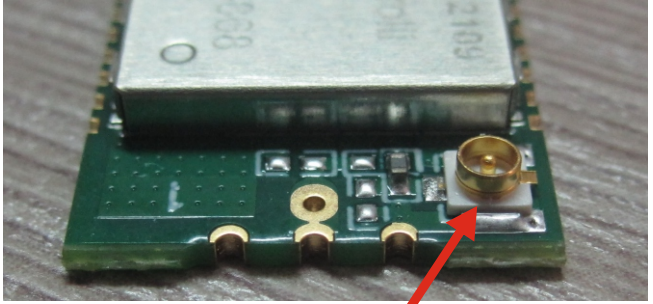


Antenna pad connector

Chip selector

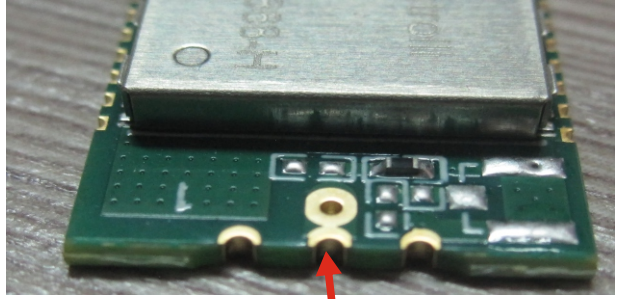
UFL connector

Difference between standard version and «H» version



RCQ5-XXX

- With UFL Connector
- Antenna connection to the UFL connector



RCQ5-XXX-H

- Without UFL Connector
- Antenna connection to hole and pad

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

RECOMMENDED HARDWARE DESIGN

1) Hardware

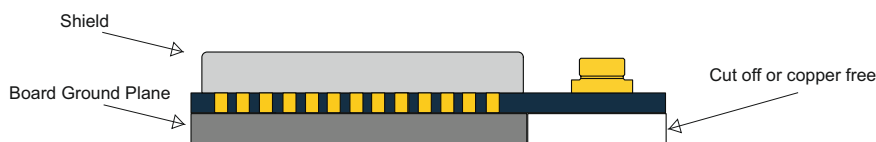
All unused pins should be left floating; do not ground.
All GND pins must be well grounded.
Traces should not be routed underneath the module.

2) Power Supply

The transceiver module must be powered from a regulated voltage.
It is recommended to keep the power supply line for VCC as short and low impedance as possible. Near the power pins it is recommended to insert a ceramic the decoupling capacitor (100nF).

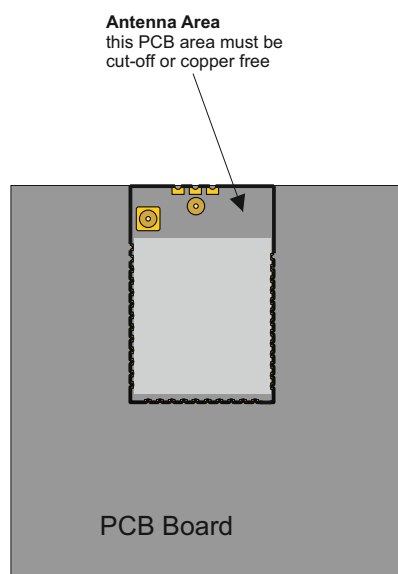
3) Ground Plane

It is recommended to have a copper ground plane under the shielded zone of the module. The ground plane should be unbroken.

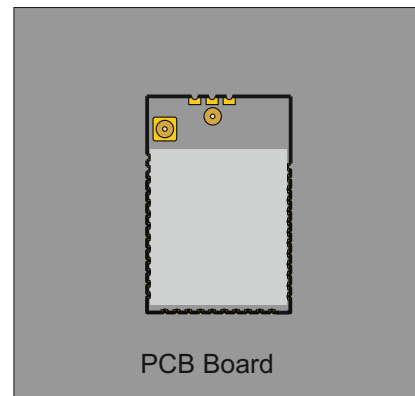


4) Module Placement

The antenna on the PCB has an omnidirectional radiation pattern. To maximize antenna efficiency, an adequate grounding plane must be provided under the module. Instead the areas underneath and surrounding the antenna area must be free of copper.



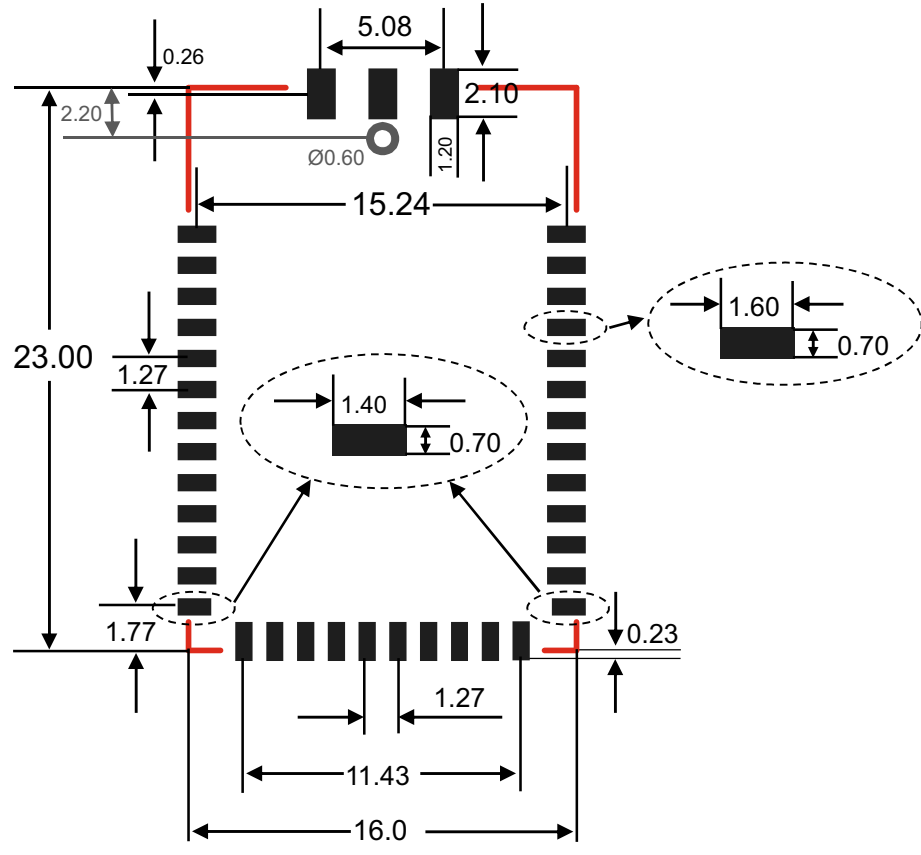
Recommended location XY plane



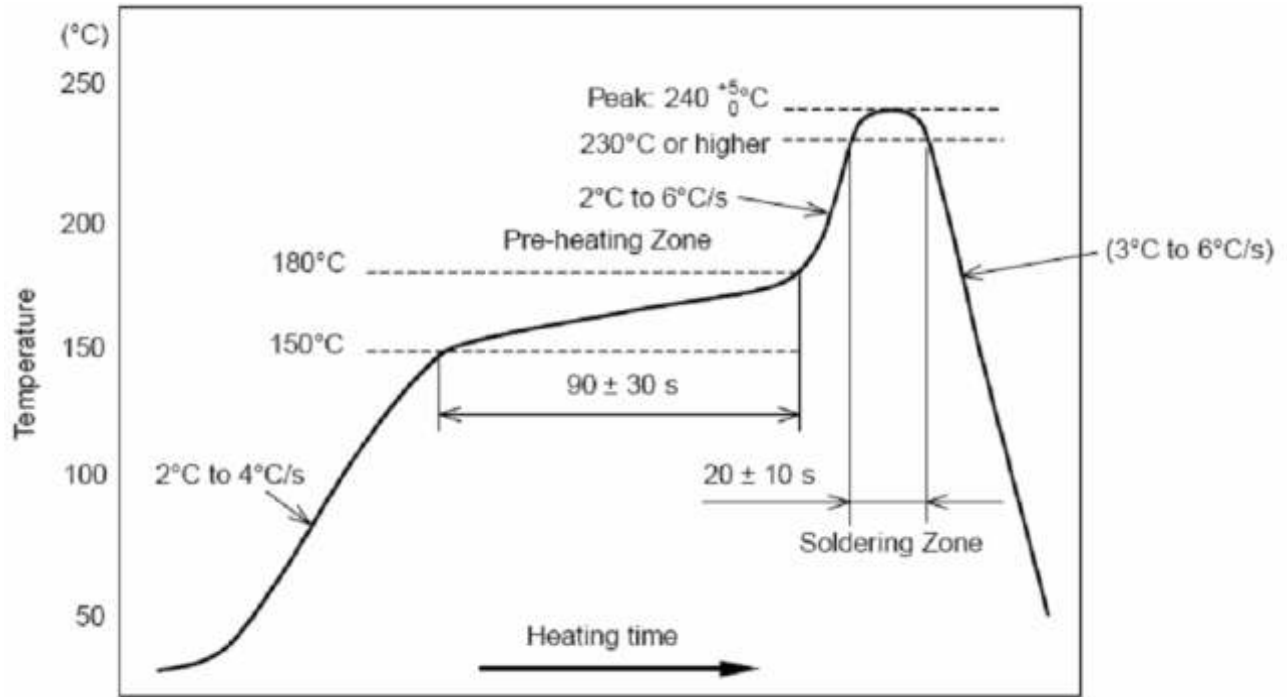
Not Recommended location XY plane

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

RECOMMENDED PCB LAYOUT



Recommended Reflow Profile for Lead Free Solder



- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

AT Command instruction

AT command is based on ASCII code.

Request message: AT+<CMD>[OP][parameter-1,parameter-2,...,parameter-n]<CR><LF>

The default UART baudrate is 115200bps.

| token | Description |
|--------------------------|---|
| AT+ | prefix |
| CMD | command name |
| OP code | operational character, use OP code : [OP1]"=" : setting [OP2]"?" : inquiry current command instruction [OP3]"'" : execution [OP4]"=?" : inquiry current command content |
| Parameter-1, parameter-n | Parameters setting |
| <CR><LF> | |

Response format : <CR><LF>[+CMD:] [parameter-1,parameter-n]<CR><LF>

Or <CR><LF><STATUS><CR><LF>

| token | Description |
|-----------------------------|--|
| | |
| +CMD: | command |
| Parameter-1 ... parameter-n | Back to current character |
| STATUS | execution status "OK" : exe success "ERROR": exe failure |

EVENT Actively report events

When a specific state occurs, the module will send an Event by itself.

Event events are show in the table below.

| ID | EventType | Description |
|----|--------------------|-------------------|
| 01 | +EVT:TXDone | TXDone |
| 02 | +EVT:RXDone | RXDone |
| 03 | +EVT:FACTORY_RESET | Factory reset |
| 04 | +EVT:RSSI=xxxdBm | Report RSSI value |

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

AT Command List

| No. | Command name | Op code | description |
|-----|------------------|--------------|--|
| 01 | AT+VER | =? | Get FW version number. |
| 02 | AT+DEVID | =? | Get device ID |
| 03 | AT+LpNode | =? =[val] | Set\Get whether the module is an LP node. |
| 04 | AT+RX | "" | Let the RF enter the receiving state. |
| 05 | AT+Standby | "" | Let the RF enter the Standby state. |
| 06 | AT+Freq | =? =[val] | Set\Get the RF operating Frequency |
| 07 | AT+TXPW | =? =[val] | Set\Get the RF operating TX power |
| 08 | AT+SYNC | =? =[val] | Set\Get the RF operating SYNC Word |
| 09 | AT+Group | =? =[val] | Set\Get the RF operating Group ID |
| 10 | AT+DR | =? =[val] | Set\Get the RF operating DataRate |
| 11 | AT+Baud | =? =[val] | Set\Get the UART baudrate |
| 12 | AT+AutoRx | =? =[val] | Enable/Disable AutoRx mode. |
| 13 | AT+ACKRSSI | =? =[val] | Enable/Disable auto report RSSI mechanism. |
| 14 | AT+Sleep | "" | Enter sleep mode. |
| 15 | ATZ | "" | Reset the module |
| 16 | AT+FACTORY_RESET | "" | Factory reset |
| 17 | AT+LpUart | =? =[val] | Enable/Disable Low Power UART mechanism. |
| 18 | AT+UDT_EVT | =? =[val] | Enable/Disable EVT report mechanism. |

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

AT Command List

| No. | Command name | Op code | description |
|-----|---------------------|--------------|--|
| 19 | AT+OUTX | =? =[val] | Set \ Get the local Digital Output OUT-0 ÷ OUT-3 |
| 20 | AT+DINX | =? | Get the local value of the Digital Input (DINO ÷ DIN3) |
| 21 | AT+OTA_OUTX | =? =[val] | Set \ Get the Remote Digital Output OUT-0 ÷ OUT-3 |
| 22 | AT+OTA_RDINX | =? | Get the Remote value of the Digital Input (DINO ÷ DIN3) |
| 23 | AT+RDINX | =? =[val] | ALARM FUNCTION If this parameters is setted at 1, when the INPUT go to low level will be trasmitted an ALARM (throught UART) to Remote device |
| 24 | AT+REMOTEIO | =? =[val] | REMOTE I/O FUNCTION Remote I/O functionality actived. |

Parameter Default value

| Parameter | Default value |
|---------------|---------------|
| LpNode | 0 |
| SYNC | Aabbccdd |
| Group | 170 |
| AutoRx | 1 |
| ACKRSSI | 0 |
| LPUart | 0 |
| UDT_EVT | 1 |
| WOR_Duration | 1 |
| DR (DataRate) | 0 |
| UART BaudRate | 0 |
| TX Power | 0 |

Data Rate List

| | Deviation | Bandwidth | Symbol rate |
|---|-----------|-----------|-------------|
| 0 | 25KHz | 98KHz | 50Kbaud |
| 1 | 50KHz | 195.9KHz | 100Kbaud |
| 2 | 100KHz | 273.1KHz | 200Kbaud |
| 3 | 5KHz | 34.1KHz | 2.5Kbaud |

TX Power table

| | | | |
|---|---------|----|-------|
| 0 | 14dBm | 8 | 6dBm |
| 1 | 12.5dBm | 9 | 5dBm |
| 2 | 12dBm | 10 | 4dBm |
| 3 | 11dBm | 11 | 3dBm |
| 4 | 10dBm | 12 | 2dBm |
| 5 | 9dBm | 13 | 1dBm |
| 6 | 8dBm | 14 | 0dBm |
| 7 | 7dBm | 15 | -3dBm |

UART BaudRate

| | |
|---|--------|
| 0 | 115200 |
| 1 | 57600 |
| 2 | 38400 |
| 3 | 19200 |
| 4 | 9600 |
| 5 | 4800 |
| 6 | 2400 |

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

AT Command (Basic Command)

| | |
|-------------|------------------------------------|
| Description | Read Firmware version |
| Syntax | +VER=?<CR><LF> |
| Format | AT+VER=? <CR><LF> |
| Response | <CR><LF>+VER:[parameter-1]<CR><LF> |
| ResultCode | <CR><LF>OK<CR><LF> |

```
1[12:19]>>>AT+VER=?
[12:19]<<<
+VER:v1.2.2_1
OK
```

| | |
|-------------|--------------------------------------|
| Description | Read Device ID |
| Syntax | +DEVID=?<CR><LF> |
| Format | AT+VER=? <CR><LF> |
| Response | <CR><LF>+DEVID:[parameter-1]<CR><LF> |
| ResultCode | <CR><LF>OK<CR><LF> |

```
[12:22]>>>AT+DEVID=?
[12:22]<<<
+DEVID:035f272a004b1200
OK
```

| | |
|----------------|-------------------------------|
| Description | Sleeping Mode |
| Syntax | +Sleep=[parameter-1] <CR><LF> |
| Format Command | AT+Sleep<CR><LF> |
| Result Code | <CR><LF>OK<CR><LF> |
| | |

```
[[12:35]>>>AT+Sleep
[12:35]<<<
OK
```

AT+Sleep means that both BB (BaseBand) and RF enter the lowest power consumption state. After this command the module will no longer respond to any AT command, it will be necessary to use the wake-up pin to return to the previous conditions.

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

AT Command (Basic Command)

| | |
|-------------|--------------------------|
| Description | Reboot the module |
| Syntax | ATZ |
| Format | ATZ <CR><LF> |
| Response | <CR><LF>OK<CR><LF> |
| | |

```
[14:12]>>>ATZ
[14:12]<<<
OK
```

| | |
|-------------|------------------------------------|
| Description | Reset to default value |
| Syntax | +FACTORY_RESET |
| Format | AT+FACTORY_RESET<CR><LF> |
| Response | <CR><LF>OK<CR><LF> |
| | <CR><LF>+EVT:FACTORY_RESET<CR><LF> |

```
[14:16]>>>AT+FACTORY_RESET
[14:16]<<<
OK
+EVT:FACTORY_RESET
```

| | |
|------------------|--|
| Description | Get/Set UDT_EVT |
| Syntax | +UDT_EVT |
| Format Command | AT+UDT_EVT=[parameter-1] <CR><LF> |
| Response Command | <CR><LF> |
| Format Query | AT+UDT_EVT=? <CR><LF> |
| Response Query | <CR><LF>+UDT_EVT=[parameter-1]<CR><LF> |
| | <CR><LF>OK<CR><LF> |

parameter-1 = 0 disable 1 enable

```
[[14:23]>>>AT+UDT_EVT=1
[14:23]<<<
OK
```

```
[[14:22]>>>AT+UDT_EVT=?
[14:22]<<<
+UDT_EVT:1
OK
```

If is not necessary to report +EVT:TxDone and +EVT:RxDone during transmission and reception, this command can be used to turn off EVT reporting events.

| | |
|-------------|----------------------------------|
| Description | Change RF to be wait mode |
| Syntax | +Standby |
| Format | AT+Standby<CR><LF> |
| Response | <CR><LF>OK<CR><LF> |
| | |

```
[[14:34]>>>AT+Standby
[14:34]<<<
OK
```

When we want to leave the receiving state, is possible to use this command to leave the receiving state.

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

AT Command (Low Consumption)

| Description | <i>LpNode functionality</i> |
|------------------|----------------------------------|
| Syntax | +LpNode |
| Format Command | AT+LpNode=[parameter-1] <CR><LF> |
| Response Command | <CR><LF>OK<CR><LF> |
| Format Query | AT+LpNode=? <CR><LF> |
| Response Query | <CR><LF>+LpNode:[parameter-1] |
| Result Code | <CR><LF>OK<CR><LF> |

parameter-1 = 0 disable 1 enable

```
[14:54]>>>AT+LpNode=1
[14:54]<<<
OK
```

```
[14:54]>>>AT+LpNode=?
[14:54]<<<
+LpNode:1
OK
```

When LpNode is turned on (enabled = 1) , when transmitting data, a longer preamble will be added to wake-up the remote receiving module.
When the receiving module is receiving a sleep wake-up reception mechanism will be used to reduce average power consumption.

| Description | <i>Get/Set WOR Duration</i> |
|------------------|--|
| Syntax | +WOR_Duration |
| Format Command | AT+WOR_Duration=[parameter-1] <CR><LF> |
| Response Command | <CR><LF>OK<CR><LF> |
| Format Query | AT+WOR_Duration=? <CR><LF> |
| Response Query | <CR><LF>+WOR_Duration:[parameter-1] |
| Result Code | <CR><LF>OK<CR><LF> |

*parameter-1 = 0 = wakeup every 1000ms
1 = wakeup every 500ms
2 = wakeup every 250ms
3 = wakeup every 125ms*

```
[[15:09]>>>AT+WOR_Duration=1
[15:09]<<<
OK
```

```
[15:10]>>>AT+WOR_Duration=?
[15:10]<<<
+WOR_Duration:1
OK
```

When LpNode is turned on (enable = 1) , entering the receiving state will periodically wake up to receive. This command can set how many seconds to wake-up and enter the receiving state.

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

AT Command (Low Consumption)

This is another instruction to reduce the consumption when the module is managed from UART.

| Description | <i>Get/Set LpUART</i> |
|------------------|---------------------------------------|
| Syntax | +LpUart |
| Format Command | AT+LpUart=[parameter-1] <CR><LF> |
| Response Command | <CR><LF>OK<CR><LF> |
| Format Query | AT+LpUart=? <CR><LF> |
| Response Query | <CR><LF>+LpUart:[parameter-1]<CR><LF> |
| Result Code | <CR><LF>OK<CR><LF> |

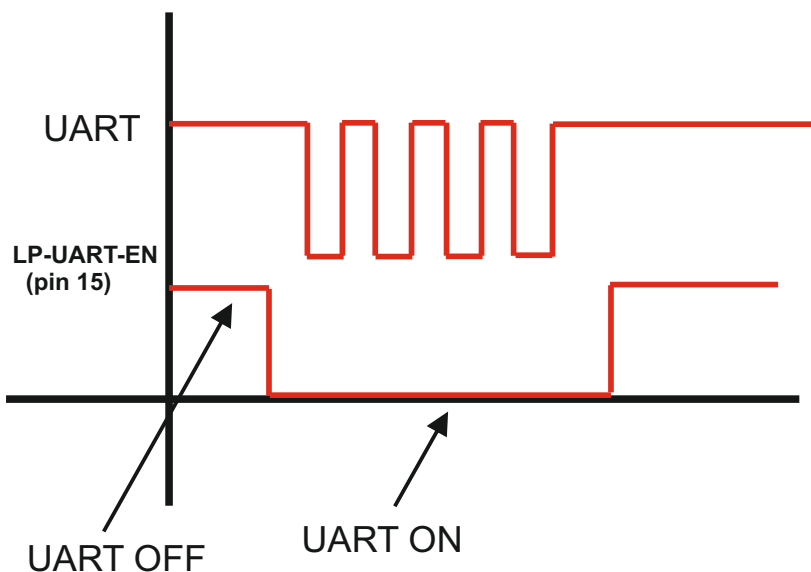
parameter-1 = 0 disable 1 enable

```
[10:04]>>>AT+LpUart=1
[10:04]<<<
OK
```

```
[10:05]>>>AT+LpUart=?
[10:05]<<<
+LpUart:0
OK
```

When LpUart is turned on, when we need to send text or AT command to the module, we need to pull down LP_UART_EN, then the module can receive the command.

- 1) Send the command : AT+LPUART=1**
When you execute this command the UART has been turned off and therefore there will be no response to the commands sent.
- 2) Pull down pin 15 (LP-UART-EN)**
When you pull down pin 15, UART will be opened. This is the condition of lowest possible consumption. It is recommended that after using Pin 15 to turn on the UART, there is a short delay to 20ms to allow the UART to complete initialitation.
- 3) Pull up pin 15 (LP-UART-EN)**
After you pull high pin 15, the UART will be turned off again.



- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

AT Command (Radiofrequency Command)

| | |
|------------------|-------------------------------------|
| Description | Get/Set Frequency |
| Syntax | +Freq |
| Format Command | AT+Freq=[parameter-1] <CR><LF> |
| Response Command | <CR><LF> |
| Format Query | AT+Freq=? <CR><LF> |
| Response Query | <CR><LF>+Freq:[parameter-1]<CR><LF> |
| Result Code | <CR><LF>OK<CR><LF> |

parameter-1 = 433000000-436000000 ---> 433Mhz version
 parameter-1 = 866000000-870000000 ---> 868MHz version
 parameter-1 = 913000000-917000000 ---> 915MHz version

```
[[15:25]>>>AT+Freq=868100000
[15:25]<<<
OK
```

```
[15:26]>>>AT+Freq=?
[15:26]<<<
+Freq:868100000
OK
```

| | |
|------------------|-------------------------------------|
| Description | Set and get TX power |
| Syntax | +TXPW |
| Format Command | AT+TXPW=[parameter-1] <CR><LF> |
| Response Command | <CR><LF> |
| Format Query | AT+TXPW=? <CR><LF> |
| Response Query | <CR><LF>+TXPW:[parameter-1]<CR><LF> |
| Result Code | <CR><LF>OK<CR><LF> |

parameter-1 = 0 : 14dBm 9 : 5dBm
 1 : 12.5dBm 10 : 4dBm
 2 : 12dBm 11 : 3dBm
 3 : 11dBm 12 : 2dBm
 4 : 10dBm 13 : 1dBm
 5 : 9dBm 14 : 0dBm
 6 : 8dBm 15 : -3dBm
 7 : 7dBm
 8 : 6dBm

```
[15:34]>>>AT+TXPW=4
[15:34]<<<
OK
```

```
[15:34]>>>AT+TXPW=?
[15:34]<<<
+TXPW:4
OK
```

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

AT Command (Radiofrequency Command)

| | |
|------------------|-----------------------------------|
| Description | Get/Set Datarate |
| Syntax | +DR |
| Format Command | AT+DR=[parameter-1] <CR><LF> |
| Response Command | <CR><LF>OK<CR><LF> |
| Format Query | AT+DR? <CR><LF> |
| Response Query | <CR><LF>+DR:[parameter-1]<CR><LF> |
| Result Code | <CR><LF>OK<CR><LF> |

parameter-1

| | Deviation | Bandwidth | Symbol rate |
|---|-----------|-----------|-------------|
| 0 | 25KHz | 98KHz | 50Kbaud |
| 1 | 50KHz | 195.9KHz | 100Kbaud |
| 2 | 100KHz | 273.1KHz | 200Kbaud |

```
[15:51]>>>AT+DR=0
[15:51]<<<
OK
```

```
[15:51]>>>AT+DR=?
[15:51]<<<
+DR:0
OK
```

| | |
|-------------|--------------------|
| Description | Rx Mode |
| Syntax | +RX |
| Format | AT+RX<CR><LF> |
| Response | <CR><LF>OK<CR><LF> |

```
[15:56]>>>AT+RX
[15:56]<<<
OK
```

AT+RX, it is only valid for one time. Once the module is restarted or you transfer a piece of data, its state machine will change to idle mode after the transfer is completed.

| | |
|------------------|---------------------------------------|
| Description | Get/Set AutoRx |
| Syntax | +AutoRx |
| Format Command | AT+AutoRx=[parameter-1] <CR><LF> |
| Response Command | <CR><LF>OK<CR><LF> |
| Format Query | AT+AutoRX=? <CR><LF> |
| Response Query | <CR><LF>+AutoRX:[parameter-1]<CR><LF> |
| Result Code | <CR><LF>OK<CR><LF> |

parameter-1 = 0 disable 1 enable

```
[16:01]>>>AT+AutoRx=1
[16:01]<<<
OK
```

```
[16:01]>>>AT+AutoRx=?
[16:01]<<<
+AutoRx:1
OK
```

When AutoRx is turned on (enabled = 1) the system will be in the RX connection state when idle, waiting to receive data.

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

AT Command (Radiofrequency Command)

| | |
|------------------|-------------------------------------|
| Description | Get/Set SYNC word |
| Syntax | +SYNC |
| Format Command | AT+SYNC=[parameter-1] <CR><LF> |
| Response Command | <CR>OK<LF> |
| Format Query | AT+SYNC=? <CR><LF> |
| Response Query | <CR><LF>+SYNC:[parameter-1]<CR><LF> |
| Result Code | <CR><LF>OK<CR><LF> |

parameter-1 = Default is « aabbccdd »

SYNC word is consisting of a total of 4 bytes. The SYNC word in TX and RX need to be consistent and the Group ID also needs to be consistent to transmit data to each other.

```
[16:25]>>>AT+SYNC=aabbccdd
[16:25]<<<
OK
```

```
[16:25]>>>AT+SYNC=?
[16:25]<<<
+SYNC:aabbccdd
OK
```

| | |
|------------------|--------------------------------------|
| Description | Get/Set Group Id |
| Syntax | +Group |
| Format Command | AT+Group=[parameter-1] <CR><LF> |
| Response Command | <CR>OK<LF> |
| Format Query | AT+Group=? <CR><LF> |
| Response Query | <CR><LF>+Group:[parameter-1]<CR><LF> |
| Result Code | <CR><LF>OK<CR><LF> |

parameter-1 = value between 0÷255 (default is 170)

When receiving and transmitting, both the SYNC word and the Group Id need to be consistent to transmit data to each other.

```
16:34]>>>AT+Group=170
[16:34]<<<
OK
```

```
[16:35]>>>AT+Group=?
[16:35]<<<
+Group:170
OK
```

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

AT Command

| Description | <i>Get/Set UART baudrate</i> |
|------------------|-------------------------------------|
| Syntax | +Baud |
| Format Command | AT+Baud=[parameter-1] <CR><LF> |
| Response Command | <CR><LF>OK<CR><LF> |
| Format Query | AT+Baud=? <CR><LF> |
| Response Query | <CR><LF>+Baud:[parameter-1]<CR><LF> |
| Result Code | <CR><LF>OK<CR><LF> |

parameter-1 = value between 0-6
 0=115200 1=57600
 2=38400 3=19200
 4=9600 5=4800
 6=2400

```
[09:58]>>>AT+Baud=0
[09:58]<<<
OK
```

```
[09:58]>>>AT+Baud=?
[09:58]<<<
+Baud:0
OK
```

| Description | <i>Receiving data setting, reply RSSI report</i> |
|------------------|--|
| Syntax | +ACKRSSI |
| Query Command | AT+ACKRSSI=?<CR><LF> |
| Response Command | <CR><LF>+ACKRSSI:<parameter-1><CR><LF> |
| Format Command | AT+ACKRSSI=<parameter-1> <CR><LF> |
| Response Query | <CR><LF>+ACKRSSI:[parameter-1]<CR><LF> |
| Result Code | <CR><LF>OK<CR><LF> |

parameter-1 = 0 disable 1 enable

```
[15:44]>>>AT+ACKRSSI=1
[15:44]<<<
OK
```

```
[15:45]>>>AT+ACKRSSI=?
[15:45]<<<
+ACKRSSI:1
OK
```

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

AT Command (local GPIO functionality)

| | |
|------------------|---|
| Description | Get/Set OUT0÷OUT3 local GPIO |
| Syntax | +OUT[parameter-1][parameter-2] |
| Format Command | AT+OUT[parameter-1]=[parameter-2] <CR><LF> |
| Response Command | <CR><LF>OK<CR><LF> |
| Format Query | AT+OUT[parameter-1]=? <CR><LF> |
| Response Query | <CR><LF>+OUT[parameter-1]:[parameter-2]<CR><LF> |
| Result Code | <CR><LF>OK<CR><LF> |

parameter-1 = 0 : OUT0 1: OUT1 2:OUT2 3:OUT3

parameter-2 = 0 : Low Level 1: High Level

```
[[10:21]>>>AT+OUT0=1
[10:21]<<<
OK
```

```
[10:21]>>>AT+OUT0=?
[10:21]<<<
+OUT0:1
OK
```

With this command is possible to set the OUTPUT (OUT0÷OUT3) of the local device to the desired logic state (0 - 1).

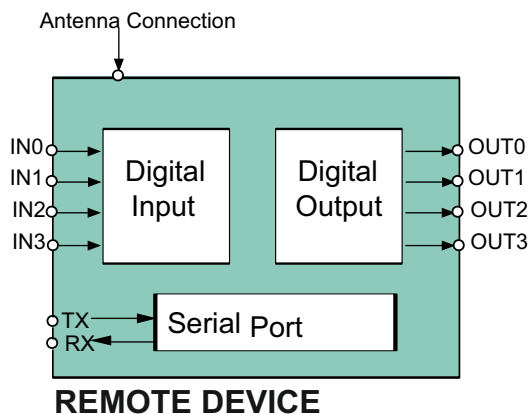
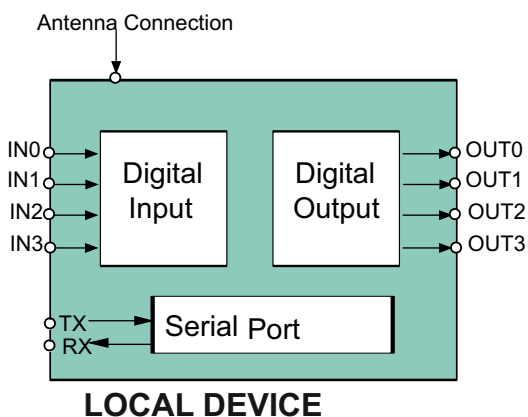
| | |
|----------------|--|
| Description | Get IN0÷IN3 local GPIO |
| Syntax | +RDIN[parameter-1] |
| Format Query | AT+RDIN[parameter-1]=? <CR><LF> |
| Response Query | <CR><LF>+RDIN[parameter-1]:[parameter-2]<CR><LF> |
| Result Code | <CR><LF>OK<CR><LF> |

parameter-1 = 0 : IN0 1: IN1 2:IN2 3:IN3

parameter-2 = 0 : low level 1: high level

```
[10:34]>>>AT+RDIN0=?
[10:34]<<<
+RDIN0:1
OK
```

With this command is possible to interrogate the 4 digital inputs of the local device (IN0÷IN3).



- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

AT Command (Over The Air GPIO functionality)

| | |
|------------------|---|
| Description | Get/Set OUT0÷OUT3 Over The Air GPIO |
| Syntax | +OTA_OUT[parameter-1][parameter-2] |
| Format Command | AT+OTA_OUT[parameter-1]=[parameter-2] <CR><LF> |
| Response Command | <CR><LF>OK<CR><LF> |
| Format Query | AT+OTA_OUT[parameter-1]=? <CR><LF> |
| Response Query | <CR><LF>+OTA_OUT[parameter-1]:[parameter-2]<CR><LF> |
| Result Code | <CR><LF>OK<CR><LF> |

parameter-1 = 0:OUT0 1:OUT1 2:OUT2 3:OUT3
 parameter-2 = 0: Low Level 1: High Level

```
[10:41]>>>AT+OTA_OUT1=1
[10:41]<<<
+EVT:TxDone

OTA_OK
+EVT:RxDone
```

```
[10:42]>>>AT+OTA_OUT1=?
[10:42]<<<
+EVT:TxDone

+OTA_OUT1:1

OTA_OK
+EVT:RxDone
```

With this command is possible to set the OUTPUT (OUT0÷OUT3) of the remote device to the desired logic state (0 - 1).

| | |
|----------------|--|
| Description | Get IN0÷IN3 Over The Air GPIO |
| Syntax | +OTA_RDIN[parameter-1] |
| Format Query | AT+OTA_RDIN[parameter-1]=? <CR><LF> |
| Response Query | <CR><LF>+OTA_RDIN[parameter-1]:[parameter-2]<CR><LF> |
| Result Code | <CR><LF>OK<CR><LF> |

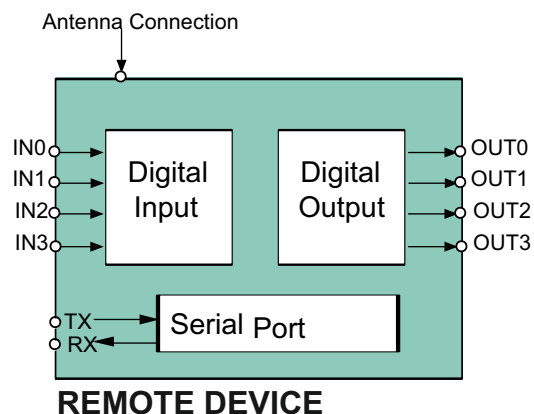
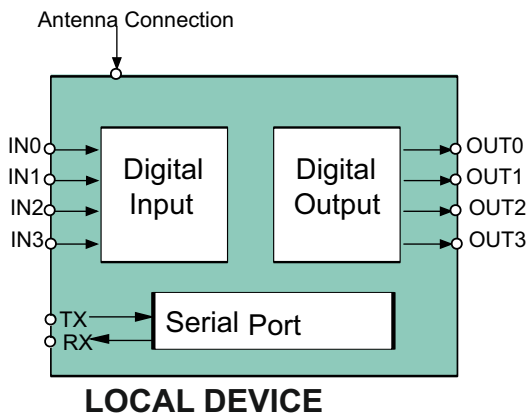
parameter-1 = 0: IN0 1: IN1 2: IN2 3: IN3 parameter-2 = 0: low level 1: high level

```
[10:47]>>>AT+OTA_RDIN1=?
[10:47]<<<
+EVT:TxDone

+OTA_RDIN1:1

OTA_OK
+EVT:RxDone
```

With this command is possible to interrogate the 4 digital inputs of the remote device (IN0÷IN3).



- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

AT Command (**ALARM Notification Function**)

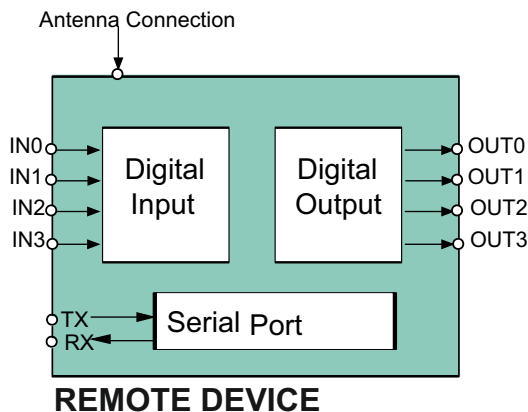
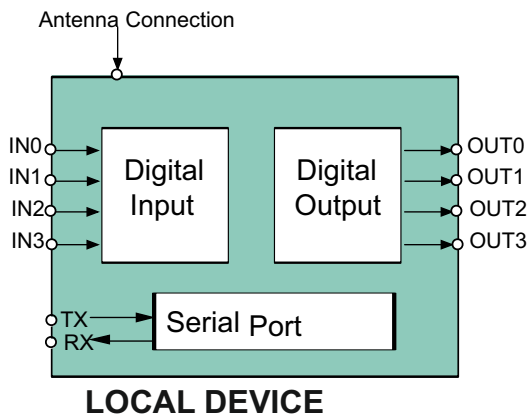
| | |
|------------------|---|
| Description | Get/Set DINX |
| Syntax | +DIN[parameter-1]=[parameter-2] |
| Format Command | AT+DIN[parameter-1]=[parameter-2] <CR><LF> |
| Response Command | <CR><LF>OK<CR><LF> |
| Format Query | AT+DIN[parameter-1]=? <CR><LF> |
| Response Query | <CR><LF>+DIN[parameter-1]:[parameter-2]<CR><LF> |
| Result Code | <CR><LF>OK<CR><LF> |

parameter-1 = 0 : DIN-0 1: DIN-1 2: DIN-2 3: DIN-3
 parameter-2 = 0 : Low Level 1: High Level

```
[15:38]>>>AT+DIN0=1
[15:38]<<<
OK
```

```
[[15:38]>>>AT+DIN0=?
[15:38]<<<
+DIN0:1
OK
```

When this function is enable (on the single DIN-0 ÷DIN-3) if for any reason the DIN_X input will go to low level, the module will send the «Alarm_X_1» string throught the AIR. When we restore DIN-X to a high level, it wil send the «Alarm_X_0» string trougtht RF.



- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

AT Command (IO Mirroring Function)

| | |
|------------------|------------------------------------|
| Description | Get/Set RemoteIO |
| Syntax | +RemotelON=[parameter-1] |
| Format Command | AT+RemotelO=[parameter-1] <CR><LF> |
| Response Command | <CR><LF>OK<CR><LF> |
| Format Query | AT+RemotelO=? <CR><LF> |
| Response Query | <CR><LF>+RemotelO:[parameter-1] |
| Result Code | <CR><LF>OK<CR><LF> |

parameter-1 = 0 : disable 1: enable

```
[16:07]>>>AT+RemotelO=1
[16:07]<<<
OK
```

```
[16:07]>>>AT+RemotelO=?
[16:07]<<<
+RemotelO:1
OK
```

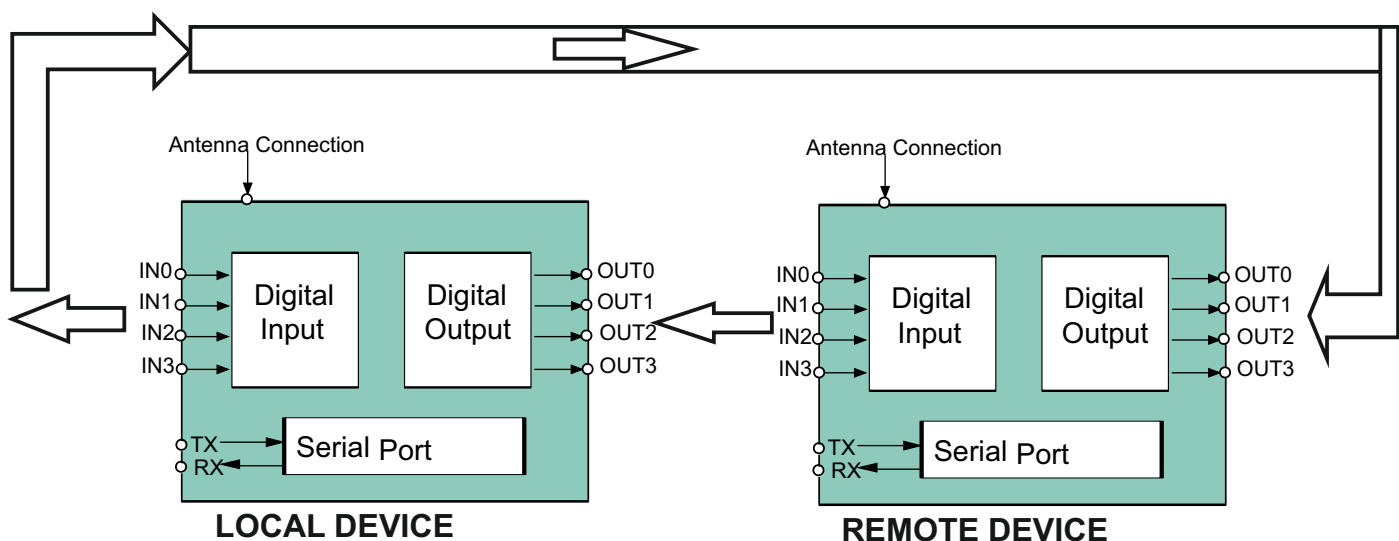
When the RemoteIO function is enabled :

- the status value of the digital inputs IN0÷IN3 (local device) is mirrored on the digital outputs OUT0÷OUT3 (remote device).
- the status value of the digital inputs IN0÷IN3 (remote device) is mirrored on the outputs digital OUT0÷OUT3(local device).

Point to point transmission

When the RemoteIO function is turned on, the AutoRx function will be automatically enabled.

Whne the RemoteIO function is turned on, AT+OUTx an AT+DINx will be temporarily disabled.



- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

Quick Start Guide (Evaluation Board)

Serial Interface based on Prolific PL2303
The demoboard uses a USB / RS232 interface based on the PL2303 Prolific chip. The related drivers can be downloaded on the website: <http://www.prolific.com.tw>.

OUT1 ÷ OUT4 Digital Output

IN-1 ÷ IN-4 Digital Input

Antenna SMA Connector

RC-CC1312R-XXX Transceiver Module

Power JUMP
With this JUMP is possible to Power ON the board, from the USB or from the

RESET

SLEEP
Push this button to WAKE-UP from Sleep mode.

Factory Reset
Push this button and in the same time push the RESET button. The LED Status will flash for 5

LED STATUS
When the system :
- operates normally is turned ON
- is in SLEEP mode is turned OFF
- is in Factory Reset will flash for 5

The Evaluation KIT is composed :

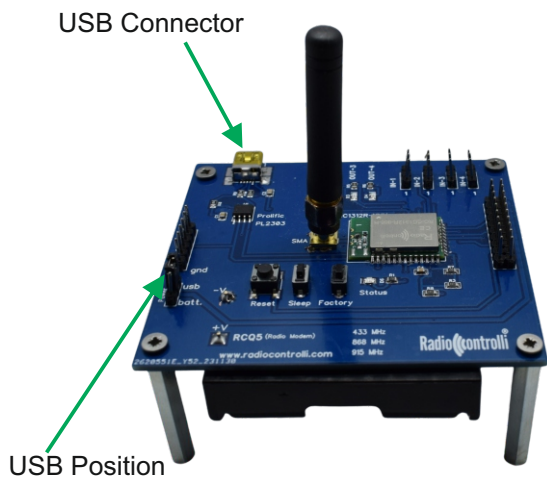
- N.2 Evaluation board
- N.2 Antenna SMA
- N.2 Battery Pack
- N.2 USB Cable



RC-RCQ5-XXX

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

Quick Start Guide



- Make sure the jumper is in the USB position (USB powered)
- Connect the Personal computer to the USB connector check the correct recognition of the drivers Prolific, in case of problems these drivers can be downloaded from the website: <http://www.prolific.com.tw>.

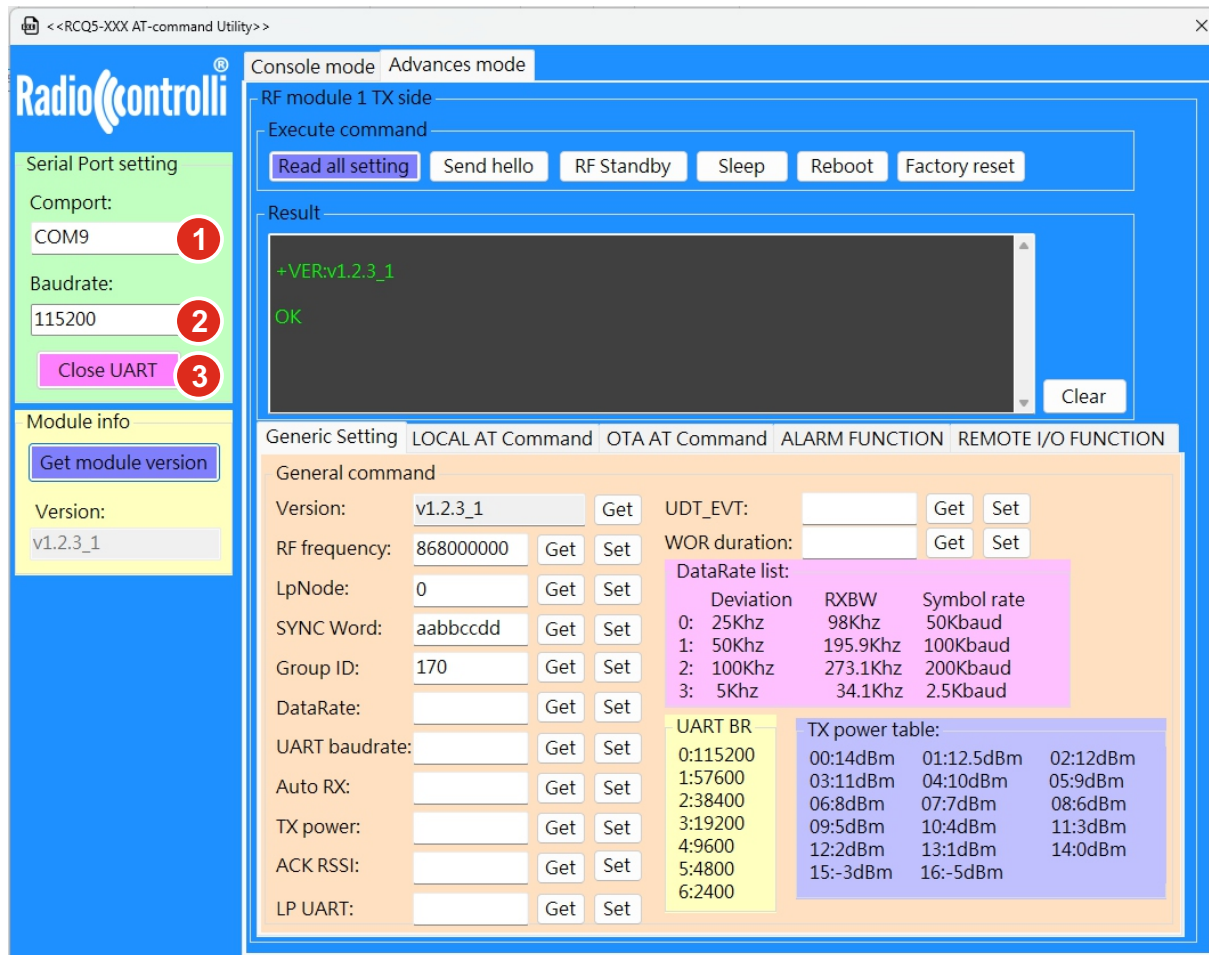
For user to start quickly to use the smart radio modem RCQ5, it will be necessary to use a standard windows serial terminal (for example Putty, Real Term ect) or you can use a RadioControlli application downloadable from the following link :

[DOWNLOAD AT COMMAND](#)

The test will be done using two modules : one as RX, the other as TX. Launch the application denominated RCQ5-XXX.exe.

Setting radio parameters

- 1) Input the Comport and set the baudrate (115200 by default).
- 2) Click «Open UART»



<<RCQ5-XXX AT-command Utility>>

RadioControlli

Console mode Advances mode

RF module 1 TX side

Execute command

Read all setting Send hello RF Standby Sleep Reboot Factory reset

Result

```
+VER:v1.2.3_1
OK
```

Clear

Generic Setting LOCAL AT Command OTA AT Command ALARM FUNCTION REMOTE I/O FUNCTION

General command

| | | | | | | | | | |
|----------------|-----------|-----|----------|----------------|--------|----------|-----------------|-----|-------|
| Version: | v1.2.3_1 | Get | UDT_EVT: | | Get | Set | | | |
| RF frequency: | 868000000 | Get | Set | WOR duration: | | Get | Set | | |
| LpNode: | 0 | Get | Set | DataRate list: | | | | | |
| SYNC Word: | aabbccdd | Get | Set | 0: | 25Khz | 98Khz | 50Kbaud | | |
| Group ID: | 170 | Get | Set | 1: | 50Khz | 195.9Khz | 100Kbaud | | |
| DataRate: | | Get | Set | 2: | 100Khz | 273.1Khz | 200Kbaud | | |
| UART baudrate: | | Get | Set | 3: | 5Khz | 34.1Khz | 2.5Kbaud | | |
| Auto RX: | | Get | Set | UART BR | | | TX power table: | | |
| TX power: | | Get | Set | 0: | 115200 | 01: | 12.5dBm | 02: | 12dBm |
| ACK RSSI: | | Get | Set | 1: | 57600 | 03: | 11dBm | 04: | 10dBm |
| LP UART: | | Get | Set | 2: | 38400 | 06: | 8dBm | 07: | 7dBm |
| | | | | 3: | 19200 | 09: | 5dBm | 10: | 4dBm |
| | | | | 4: | 9600 | 12: | 2dBm | 13: | 1dBm |
| | | | | 5: | 4800 | 15: | -3dBm | 16: | -5dBm |
| | | | | 6: | 2400 | | | | |

- 1) Entry the port number
- 2) Entry the baud rate default (115200)
- 3) Open serial port

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

Setting radio parameters

1) It is possible to verify the single parameter through the «GET» command

433MHz Default Setting

| | |
|---------------|-------------------|
| RF Frequency | 433920000 |
| DataRate | 0 (25KHz 50Kbaud) |
| TX Power | +10dBm |
| LpNode | 0 |
| SYNC Word | aabbccdd |
| Group ID | 170 |
| UART Baudrate | 0 (115200) |
| AutoRX | 1 |
| ACK RSSI | 0 |
| Lp UART | 0 |
| UDT_EVT | 1 |
| WOR_duration | 1 (wake-up 500ms) |

868MHz Default Setting

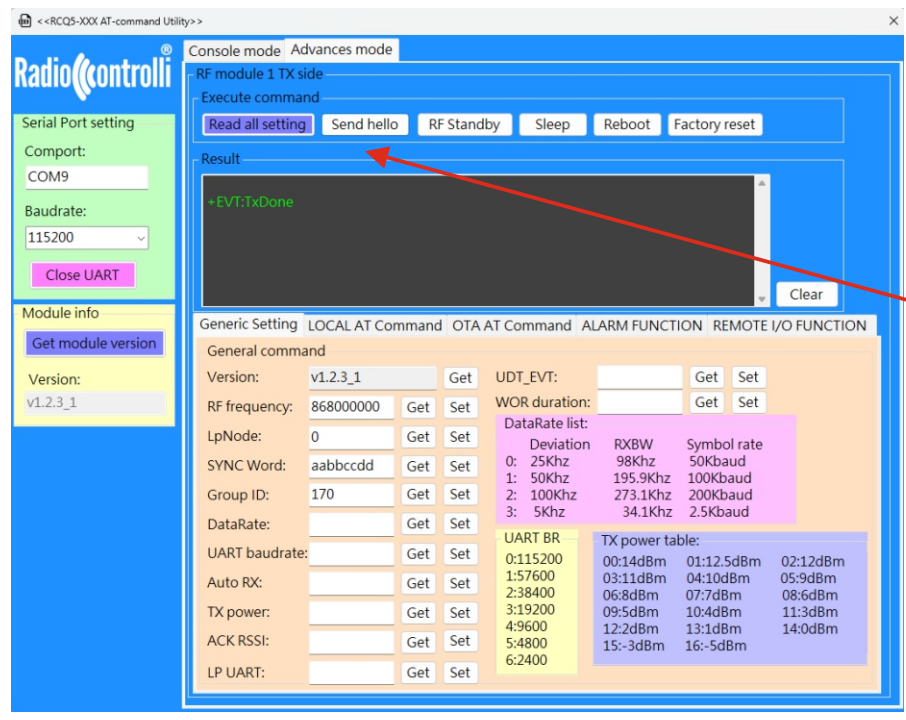
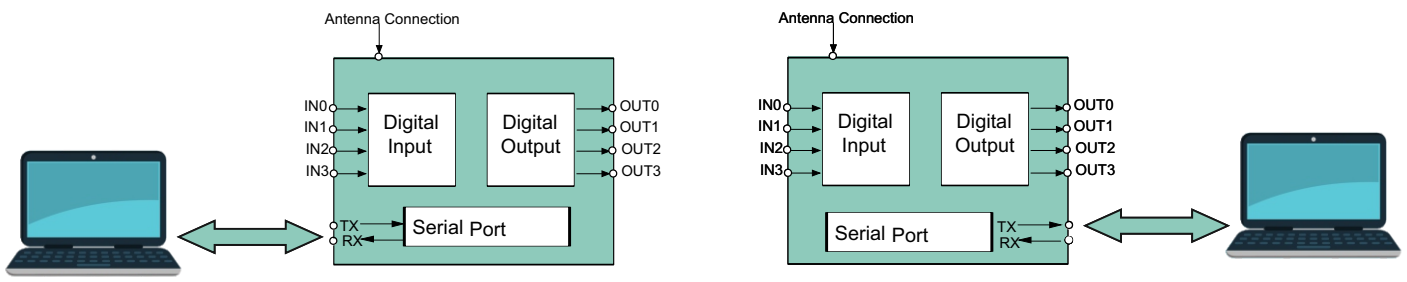
| | |
|---------------|-------------------|
| RF Frequency | 868000000 |
| DataRate | 0 (25KHz 50Kbaud) |
| TX Power | +14dBm |
| LpNode | 0 |
| SYNC Word | aabbccdd |
| Group ID | 170 |
| UART Baudrate | 0 (115200) |
| AutoRX | 1 |
| ACK RSSI | 0 |
| Lp UART | 0 |
| UDT_EVT | 1 |
| WOR_duration | 1 (wake-up 500ms) |

915MHz Default Setting

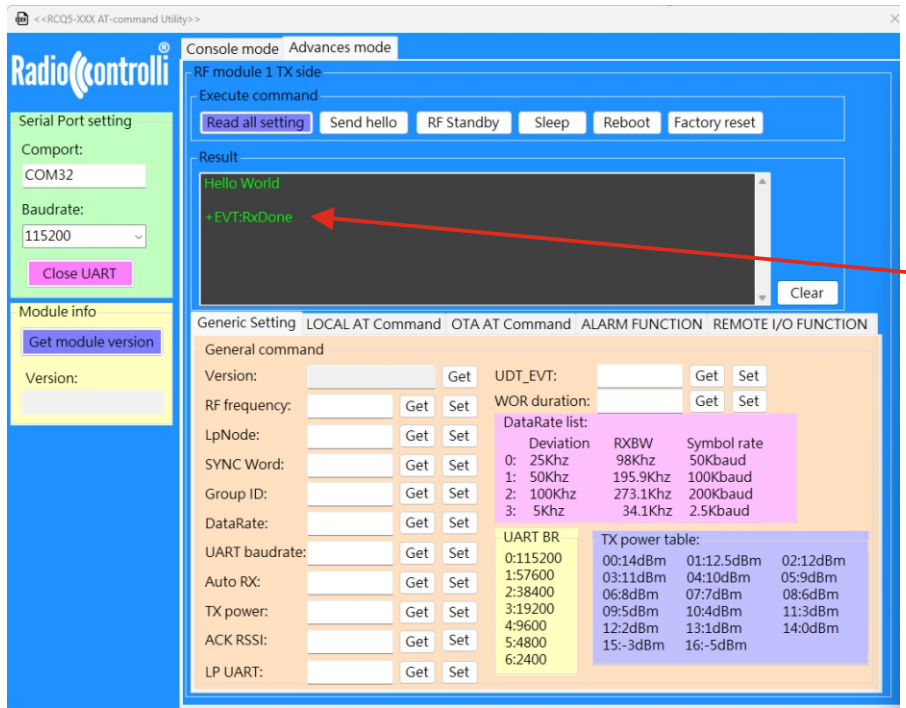
| | |
|---------------|-------------------|
| RF Frequency | 915000000 |
| DataRate | 0 (25KHz 50Kbaud) |
| TX Power | +14dBm |
| LpNode | 0 |
| SYNC Word | aabbccdd |
| Group ID | 170 |
| UART Baudrate | 0 (115200) |
| AutoRX | 1 |
| ACK RSSI | 0 |
| Lp UART | 0 |
| UDT_EVT | 1 |
| WOR_duration | 1 (wake-up 500ms) |

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

Quick Start : RADIO MODEM ==> First message sent
 After all these sets, we are ready to send the first message :



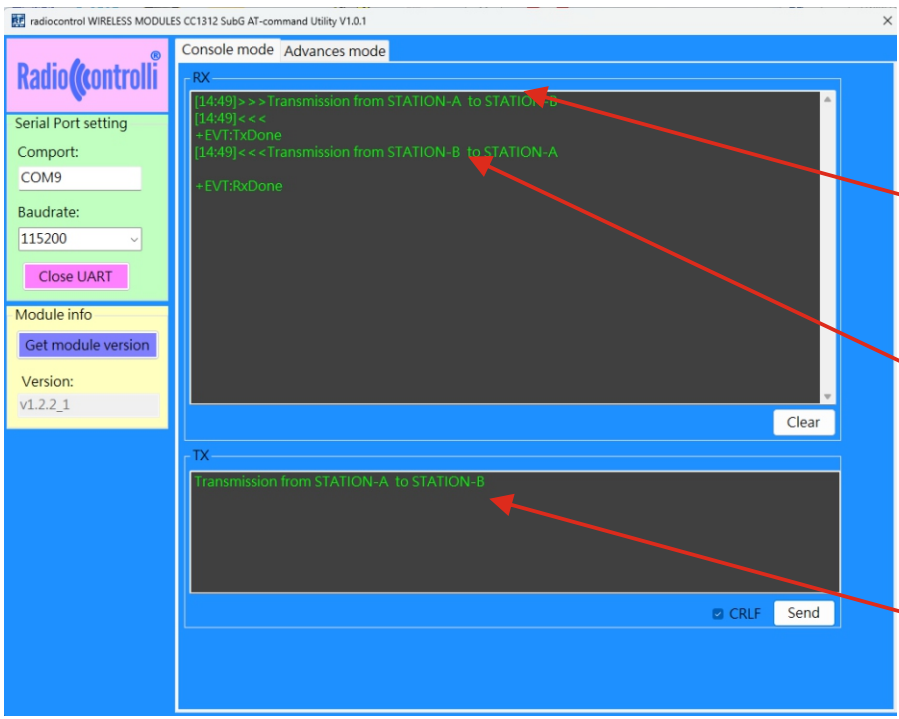
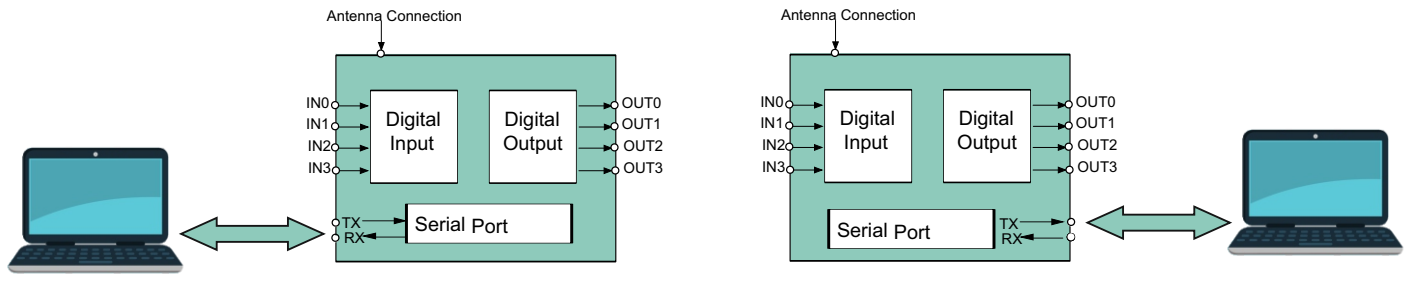
Transmission Station :
 Push this button



Receiving Station :
 Message received

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

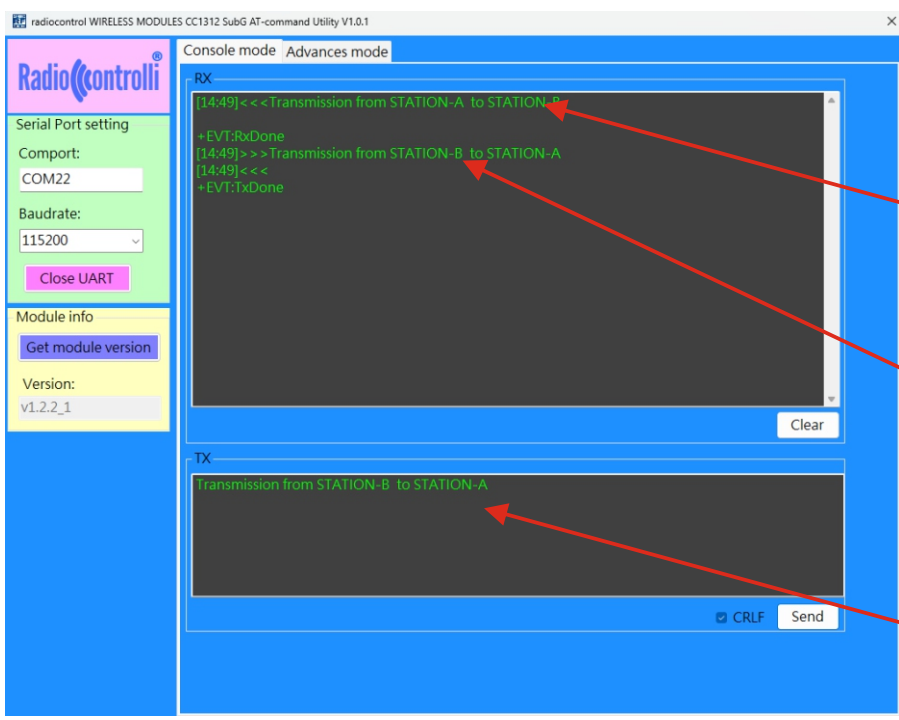
Quick Start : RADIO MODEM ==> Second message sent with Console mode



Message Sent

Message Received from STATION-B

Message Sent



Message Received from STATION-A

Message Sent

Message Sent

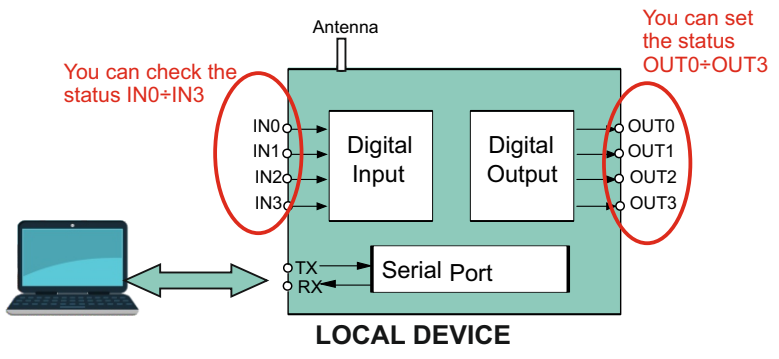
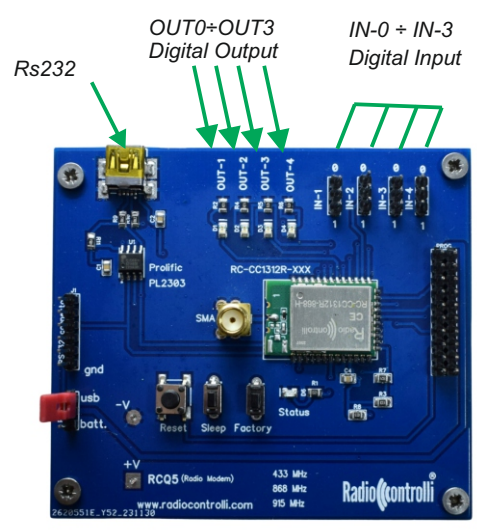
RC-RCQ5-XXX

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

Quick Start : LOCAL AT COMMANDS

It is possible to :

- Set The Digital Output OUT0÷OUT3 to the desired logical state.
 AT+OUT1=1 with this command the OUT1 go to high level.
 AT+OUT1=0 with this command the OUT1 go to low level.
- Verify the logic state of the Digital Output OUT0÷OUT3
 AT+OUT1=? the value of the logical state of the OUT1 output will be returned.
- Verify the logic state of the Digital Input IN0÷IN3
 AT+RDIN1=? the value of the logical state of the IN1 input will be returned.



Radiocontrolli Console mode Advances mode

RF module 1 TX side

Execute command

Read all setting Send hello RF Standby Sleep Reboot Factory reset

Result

```
+EVT:TxDone
+EVT:TxDone
+EVT:TxDone
```

Generic Setting LOCAL AT Command OTA AT Command ALARM FUNCTION REMOTE I/O FUNCTION

| OUT0÷OUT3 | | | | IN0÷IN3 | | | |
|-----------|----------------------|-----|-----|---------|----------------------|-----|--|
| DO0: | <input type="text"/> | Get | Set | DI0: | <input type="text"/> | Get | |
| DO1: | <input type="text"/> | Get | Set | DI1: | <input type="text"/> | Get | |
| DO2: | <input type="text"/> | Get | Set | DI2: | <input type="text"/> | Get | |
| DO3: | <input type="text"/> | Get | Set | DI3: | <input type="text"/> | Get | |

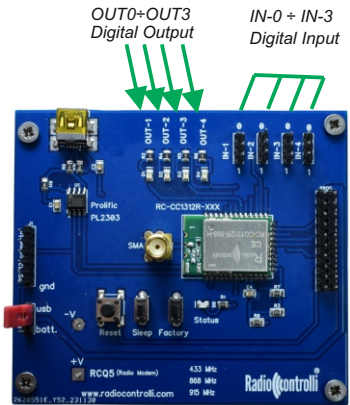
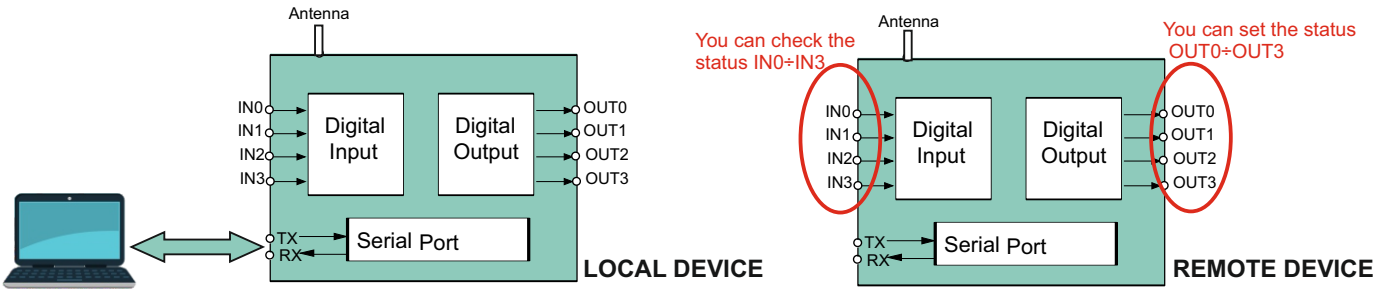
Instructions: Set ==> AT+OUTX=1 AT+RDINX=?
 Get ==> AT+OUTX=?

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

Quick Start : OVER THE AIR (OTA) AT COMMANDS

It is possible to :

- Set The Digital Output OUT0÷OUT3 of the REMOTE DEVICE to the desired logical state.
 AT+OTA_OUT1=1 with this command the OUT1 of the REMOTE DEVICE go to high level.
 AT+OTA_OUT1=0 with this command the OUT1 of the REMOTE DEVICE go to low level.
- Verify the logic state of the Digital Output OUT0÷OUT3
 AT+OTA_OUT1=? the value of the logical state of the OUT1 output will be returned.
- Verify the logic state of the Digital Input IN0÷IN3
 AT+OTA_RDIN1=? the value of the logical state of the IN1 input will be returned.



RadioControlli Application
OTA AT Command

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

Quick Start : ALARM FUNCTIONS

It is possible to Enable the ALARM FUNCTION for every Digital Input with the following AT command :

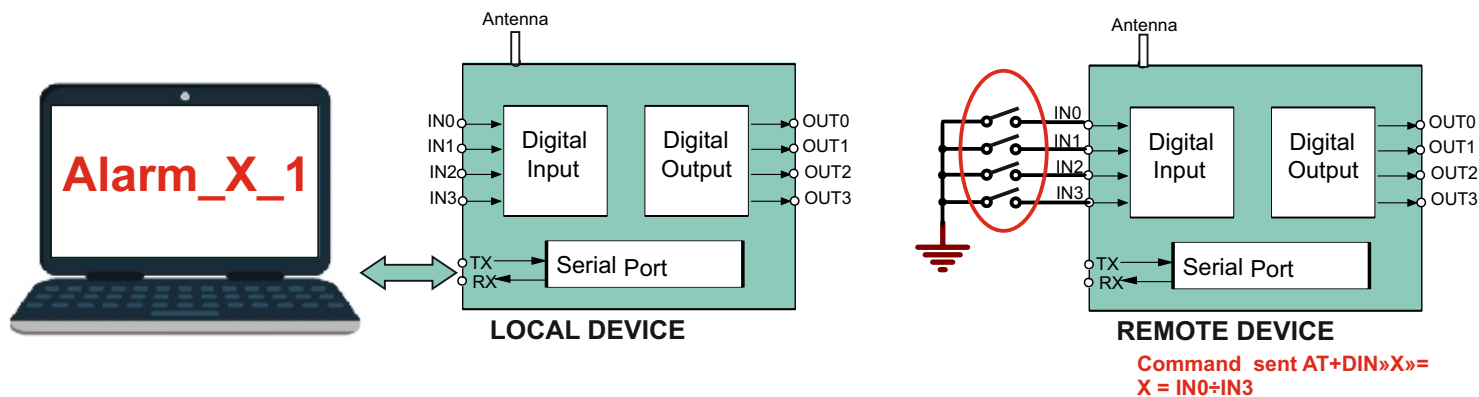
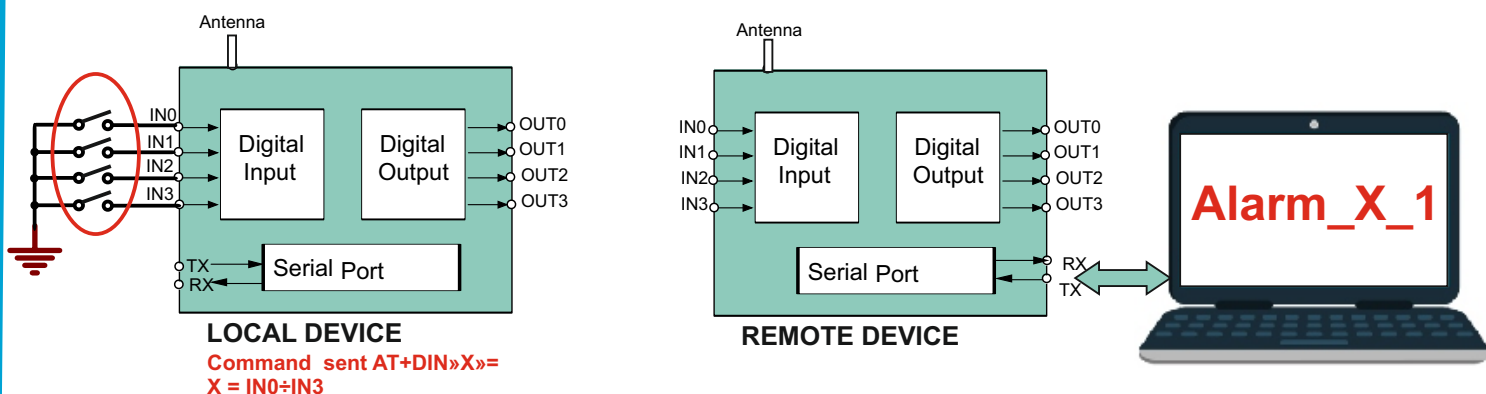
AT+DINX=1 with this command, when the digital input INX (DEVICE A IN0÷IN3) change status a message will be transmitted via UART to the DEVICE B : **Alarm_0_1** mean : The input IN0 has moved to logical level 1.
when this digital input come back to low level a message will be sent via UART : **Alarm_0_0**

This is valid for all 4 digital input IN0÷IN3.

When an digital Input go to LOW LEVEL the message will be transmitted via UART to the REMOTE DEVICE.

IN0 -----> **Alarm_0_1** IN1 -----> **Alarm_1_1** IN2 -----> **Alarm_2_1** IN3 -----> **Alarm_3_1**

If the digital Input change status from LOW LEVEL to HIGH LEVEL another message will be transmitted via UART to the REMOTE DEVICE : **Alarm_X_0**



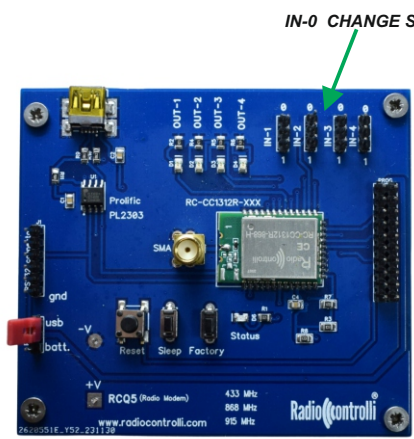
RC-RCQ5-XXX

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

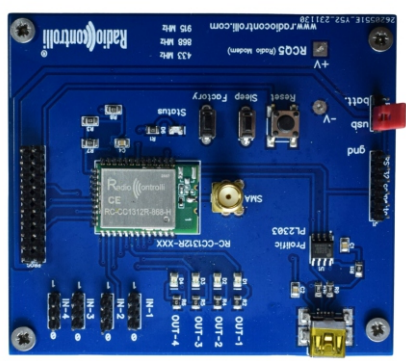


Quick Start : ALARM FUNCTIONS

Below the RadioControlli application to verify this functionality. On the remote station the alarm had been enabled on IN0.



DEVICE A



DEVICE B



The screenshot shows the 'ALARM FUNCTION' tab in the software. It includes a console window with the following output:

```
Alarm_0_1
+EVT:RxDone
Alarm_0_1
+EVT:RxDone
```

Below the console, there are controls for 'ENABLE ALARM FUNCTION (Local Device)' and 'ALARM Received'. The 'ENABLE ALARM FUNCTION' section has four rows for DIN0-3, each with 'Get' and 'Set' buttons. The 'ALARM Received' section shows four status indicators: RDIN-0 (red circle), RDIN-1 (green circle), RDIN-2 (green circle), and RDIN-3 (green circle). A red arrow points from the 'RDIN-0' indicator to the console output, and another red arrow points from the 'RDIN-0' indicator to the text below.

Instructions:
 Set ==> AT+DINX=1
 Get ==> AT+DINX=?

Alarm Received
 mean that the digital input In0 of the remote station went to logical level 0

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

Quick Start : REMOTE I/O FUNCTIONS

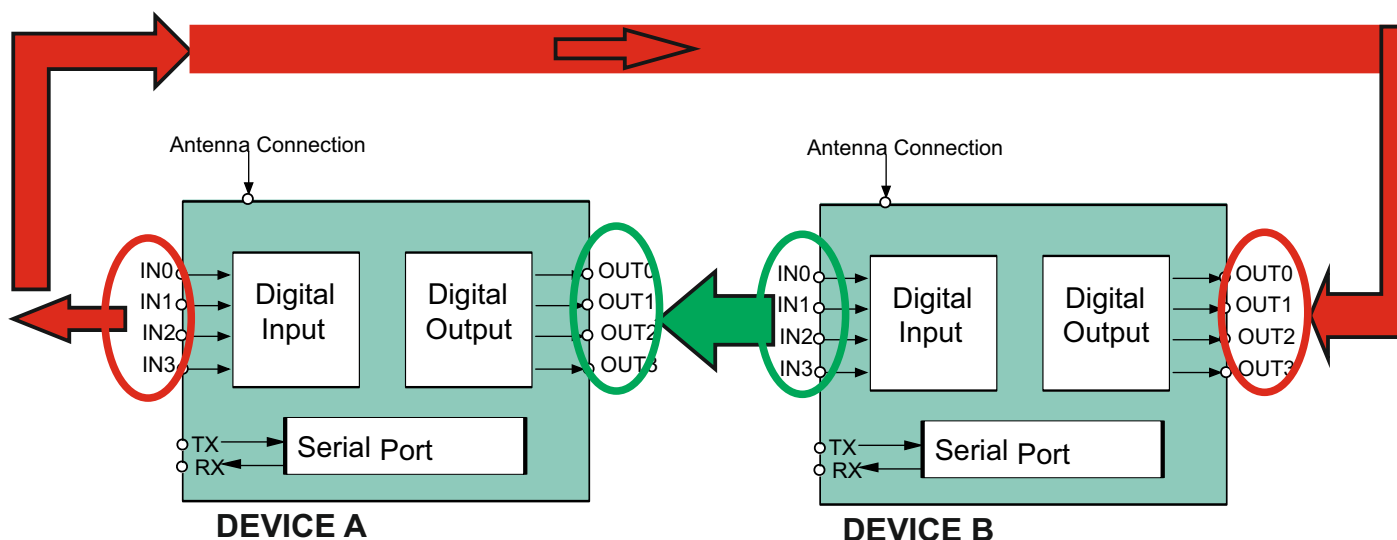
It is possible to Turn ON and turn OFF the remote IO mirroring function.

When we enable the Remote I/O function, if any Digital Input is changed on the Station A, the digital output of the remote Station B will also mirror these states at the same time.

The instruction to turn ON this functionality is : AT+RemoteIO=1

The instruction to turn OFF this functionality is : AT+RemoteIO=0

- Since this is two-way mirror, it is recommended to use point-to-point transmission.
- When the RemoteIO function is turned on, the AutoRx function will be automatically enabled.
- When the RemoteIO function is turned on, AT+OUTx and AT+DINx will be temporarily disabled.



When this function is enabled :

The digital outputs of Station B will follow the states of the digital inputs of Station A in lockstep.

If the digital input IN x (Station A) is at logical zero level then the digital output OUT x (Station B) will be at logical level 0, if the digital input IN x (Station A) is at logical level 1 the output will also digital OUT x (station B) will be at logic level 1.

The digital outputs of Station A will follow the states of the digital inputs of Station B in lockstep.

If the digital input IN x (Station B) is at logical zero level then the digital output OUT x (Station A) will be at logical level 0, if the digital input IN x (Station B) is at logical level 1 the output will also digital OUT x (station A) will be at logic level 1.

RC-RCQ5-XXX

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality

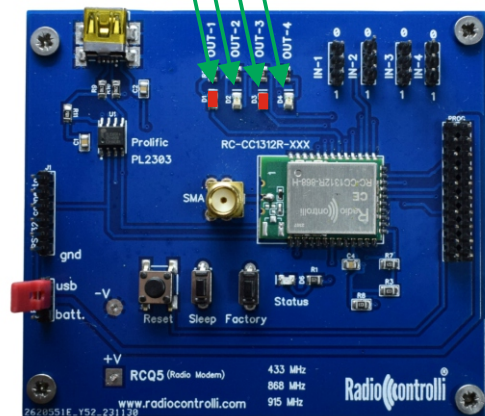
Quick Start : REMOTE I/O FUNCTIONS

IN-0=CLOSE=LOW LEVEL
IN-1=OPEN=HIGH LEVEL
IN-2=CLOSE=LOW LEVEL
IN-3=OPEN=HIGH LEVEL



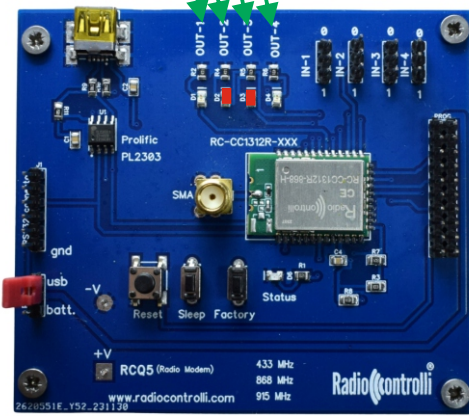
DEVICE A

OUT-0 = TURN ON = LOW LEVEL
OUT-1 = TURN OFF = HIGH LEVELL
OUT-2 = TURN ON = LOW LEVEL
OUT-3 = TURN OFF = HIGH LEVELL



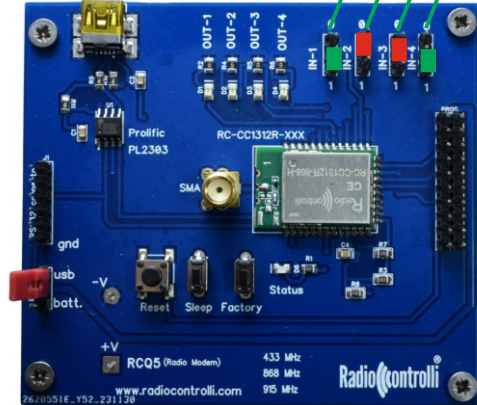
DEVICE B

OUT-0 = TURN OFF = HIGH LEVELL
OUT-1 = TURN ON = LOW LEVEL
OUT-2 = TURN ON = LOW LEVEL
OUT-3 = TURN OFF = HIGH LEVELL



DEVICE A

IN-0=OPEN=HIGH LEVEL
IN-1=CLOSE=LOW LEVEL
IN-2=CLOSE=LOW LEVEL
IN-3=OPEN=HIGH LEVEL



DEVICE B

RC-RCQ5-XXX

- Radio Modem
- Over The Air Command
- Alarm Function
- Remote I/O Functionality



WIRELESS MODULES

