

## Radio Module for 300-1000 MHz. Band

### RMCx4-1 ; RMCx9-1

#### General Information

The Radio Modules RMCx 4-1 and RMCx 9-1 are transceivers designed for very low power and very low voltage wireless applications. The circuit is mainly intended for the ISM (Industrial, Scientific and Medical) and SRD (Short range Device) frequency bands, at 315, 433, 868 and 915 MHz., or any other frequency in the 300-1000 MHz range. The Module function supporting hardware handshaking and half-duplex communication. The RF Module communicates with a PC or other RS232 devices over an RS232 link. Parameters can be programmed with the RadioComm Windows based PC program, delivered with the RMCx Main Board. The Module reads data from RS232 serial interface, and if reaches 15 bytes, or if for a period of 1mSec do not receive data on Serial Interface, creates a packet and transmits over the RF link. In Receive Mode, the module looks for a valid preamble, a valid SOF (Start Of Frame), reads the packet, extracts the data, check for CRC, and if it's a valid data packet, will send on the serial interface.

The received data is 100% controlled and only valid data will be send via RS line.

The RF link is a half-duplex link (data cannot be send and received at the same time).

The Module is designed to use hardware handshaking. It tells to PC when can receive data and when not. The READY Output of Module (pin 7) can be connected over the RS 232 level converter to the DSUB9 (pin8) CTS, witch controls the data flow.

The range of the system depends on the RF frequency, data rate, output power, type of the antenna, and many other environmental conditions.



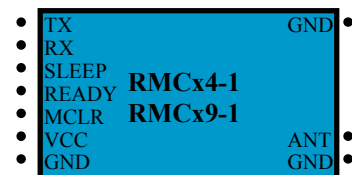
0101...	SOF	LNG	ADDR	DATA	CRC
Preamble 4-255 bites	Start Of Frame	Length Of data	Address (optional)	Data	CRC

The Address is optional, the Modules can be addressed; only the addressed Module will receive the data.

#### Electrical Specification

Supply Voltage	3...3.6	V	
Current consumption			
Receive	8/10	mA	433/868MHz
Transmit	29	mA	433/868MHz
Sleep mode	1	μA	
TX power	10/5/2	DBm	433/868/915 MHz
Receiver sensibility	-107	DBm	RF 2.4 Kbaud
RF impedance	50	Ohm	
2f0	<-62	DBc	
Radio Baud Rate	0.6...19.2	KBaud	Manchester coded FSK or NRZ
Serial Baud Rate	4.8...115.2	kBaud	
Logic "0" input Voltage	0 - 0.9	V	lin -1 μA
Logic "1" input Voltage	2.6 - VDD	V	lin - 1 μA
Logic "0" Output Voltage	0 - 0,4	V	lout 10 mA
Logic "0" Output Voltage	2.8 - VDD	V	lout 10 mA

#### Pin Configuration



- TOP VIEW-

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At the Antenna input of Module, there is a LC filter to reducing the emission of harmonics, so there is no need for other filters.

#### **Programmable Parameters:**

With the help of RMCx MainBoard, some parameters can be programmed:

In a Frequency band (eg. 433 MHz) can be set different TX/RX Frequencies, eg. 433,52 ; 433,68 ; 433,92 MHz, etc.

-TX Power

-20 dBm - +9 dBm (RMCx 4-1)

-20 dBm - +5 dBm (RMCx 9-1)

Radio Baud Rate: 0,6-19,2 Kbaud.

Serial Baud Rate: 4,8-115,2 Kbaud.

Wait time on serial line 1.2 ms, ....

NTZ or MANCHESTER transmit mode.

- Module Address.

- Number of preambles, default is 4.

Can be read the SW version Number.

### RMCx Mainboard

#### **Buttons and Switches:**

##### **Switches**

J7: Battery /External power

J5: KEY / UART Mode.

##### **Buttons:**

A-D : BCD Buttons for the KEY function.

Reset , Tx , Prog : Can be set the modes of operations.

#### **Modes of Operations:**

**KEY:** In this mode of operation, pressing the A-D buttons, the Module will transmit the pressed button BCD coded. If another Main Board is turned on and is switched to KEY mode, the transmitted code will appear on the LED display.

**UART :** In this mode, the Modul will transmit data received on Serial RS232 port. If the length of data is more than 15 bites, (or there is no data for a period of 1ms – this period can be programmed - the Module will raise the READY line (the CTS on the RS232 line will be LO)



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### **Setting the modes of operation:**

Turning on the main board ( or pressing the Reset button) the Module is in Receiving mode. The Power and RX LEDs are lit. Pressing the A-D keys,(KEY Mode) or receiving data on RS line, (UART Mode) the Module packs the data, creates CRC code and transmits on RF link. The Tx Led will be lit for the period of data transmission.

### **Continuous Transmitting Mode:**

Pressing the Tx and Reset button and depressing the Reset button before the TX button, the Module will enter in Tx Mode. The Module transmits the string 'Radio test' on the RF link, With the help of this Mode can be tested the Receive Mode of other Modules, or the range of the system.

### **Programming Mode:**

Pressing the Prog and Reset button and depressing the Reset button before the Prog button, the Module will enter in Programming Mode. In this mode, with the help of the RadioComm program can be set different parameters of the Module.

**Ending the program mode, the Module must be reset, otherwise sending data to the Module will reprogram it, or can be damaged.**

### **RadioComm program:**

With the help of RadioComm.exe Win. based program, the RMCx4-1 and RMCx9-1 Modules the main parameters can be read or write. Pressing the Prog and Reset button and depressing the Reset button before the Prog button, the Module will enter in Programming Mode.

The screenshot shows the 'Radio Module Settings' dialog box with the following fields and options:

- TX Power:** 10 dBm
- UART Baud Rate:** 38.4 kBaud
- Frequency Band:** Band 1
- Radio Baud Rate:** 19.2 kBaud
- TX Frequency:** 433.2324000
- Manchester / NRZ:** Manchester (selected)
- Working Frequency:** < 500 Mhz (selected)
- Working Mode:** RS (selected), Modem, RS
- Wait for Data:** 1.54mSec
- Preamble Number:** 4
- Module Number:** 17
- Send Module Address:** (unchecked)
- Module Number:** 17
- Chars in one Radio Packet:** 15
- SW. Version number:** 1 . 11
- Acknowledge:**
  - ☐ Check For Acknowledge
  - ☐ N Times
  - ☐ Send Acknowledge Character
  - 19**
  - Ack:**
    - ☐ Try N Times
    - ☐ Set Ready
    - 1** N

Buttons at the bottom: Read, Write, Exit.

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Program menus:

**File** =>Exit

**Settings**

=>**Serial port:** can be set the serial port and the Baud Rate of the PC.

**The default Baud Rate of the Module is 38.4.KBaud.**

- **TX Power:** Can be set the output power from -20 dBm to +10 dBm (433MHz) or +5 dBm (900 MHz)
- **TX Frequency:** Can be set the Rx/Tx frequency. Here is the list of the frequencies can be set for the two kind of Modules (MHz):

### **RMCx-4**

433.2324000, 433.3706400, 433.5286286, 433.6164000, 433.9236000, 434.2308000, 434.3185714, 434.4765600, 434.6148000

### **RMCx-9**

868.5501600, 868.6116000, 868.6884000, 868.7871429, 868.9188000, 869.1031200, 869.2260000, 869.3796000, 869.5770857, 869.6560800, 869.8404000, 902.2807200, 902.8336800, 903.3866400, 903.9396000, 904.4925600, 905.0455200, 905.5984800, 906.1514400, 906.7044000, 907.2573600, 907.8103200, 908.3632800, 908.9162400, 909.4692000, 910.0221600, 910.5751200, 911.1280800, 911.6810400, 912.2340000, 912.7869600, 913.3399200, 913.8928800, 914.4458400, 914.9988000, 915.5517600, 916.1047200, 916.6576800, 917.2106400, 917.7636000, 918.3165600, 918.8695200, 919.4224800, 919.9754400, 920.5284000, 921.0813600, 921.6343200, 922.1872800, 922.7402400, 923.2932000, 923.8461600, 924.3991200, 924.9520800, 925.5050400, 926.0580000, 926.6109600, 927.1639200, 927.7168800

- **Working Mode:** RS/Modem. Modem mode available at this time.
- **Preamble Number:** Can be set the number of Preambles (1-255), default is 4.
- **Module Number:** Optional, can be set an Address to the Module. Only Addressed Module will receive data.
- **SW Version number:** The SW version number programmed in the Module.
- **UART Baud Rate:** The Baud Rate of the Modem Serial Line.  
**Attention:** Changing the baud Rate of the Module must change also the Baud Rate of PC (Setting / Serial Port)
- **Radio Baud Rate:** Can be set the Radio Baud Rate and the Manchester or NRZ Mode.
- **Working Frequency:** Inform you, the Module is working on 400 or 900 MHz Band.
- **Wait for data:** can be set the period waiting for data, when data is less than 15 bites.  
Can be set to: 1,54 mS, 428/μS or 146/μSec.
- **Chars in one Radio Packet:** gives information, how many characters can be send in one radio packet.

The **Read** button read parameters from the Module, **Write** button writes data to the Module.

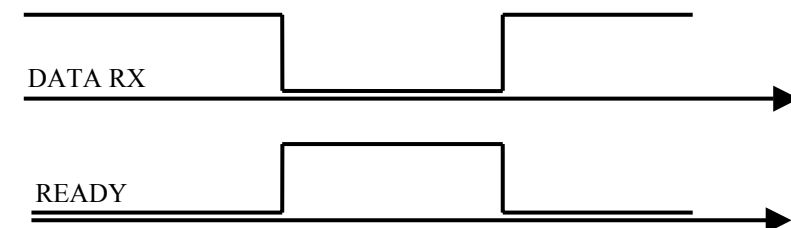
**Transfer** => Text File : Can be send .TXT file via RF link.

**Window** => The Send and Receive Text Boxes can be split horizontally or vertically .

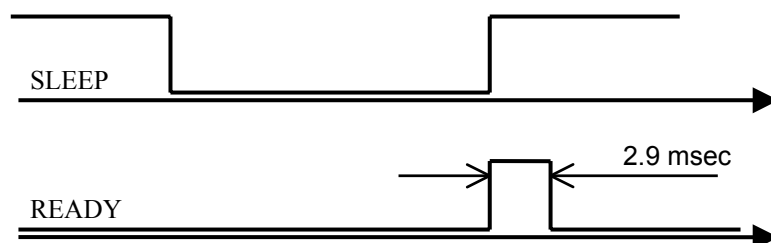
**Help** => About: Version Number of the RadioComm program.

**RMCx4-1 ; RMCx9-1**

The diagram illustrates a low-power transmitter circuit. It features a 5V supply connected to a network of resistors (R1, R2, R3, R4, R5) and two NPN transistors (Q1, Q2). The transistors are configured in a common-emitter arrangement. A 3.3V supply is connected to the circuit, with capacitors C1 (100nF) and C2 (100nF) for decoupling. A reset button (R2) is connected to the 3.3V supply. The radio module (R1) is connected to the 3.3V supply and the antenna (ANT1). The module's pins are labeled: 1 (TX), 2 (RX), 3 (SLEEP), 4 (READY), 5 (MCLR), 6 (VCC), 7 (GND1), 8 (ANT1), 9 (GND2), 10 (GND3). The module is also connected to a 3.3V supply and a reset button (R2) labeled MCP130.



Only when the Ready line is '0' can be send data to serial input.



The Module can be set to Sleep mode setting the SLEEP input to LO. Setting the Sleep input to HI (Exit from sleep Mode) the READY line will be set for a period of 2.9 ms for internal initialization. In this period of time cannot be send data to the Module.

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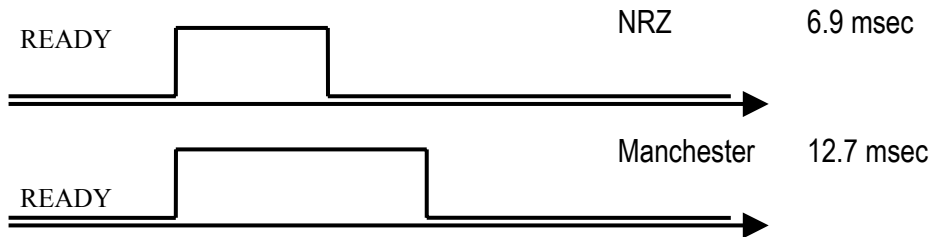
**RMCx4-1 ; RMCx9-1**

### Diagrams for two data transmission example:

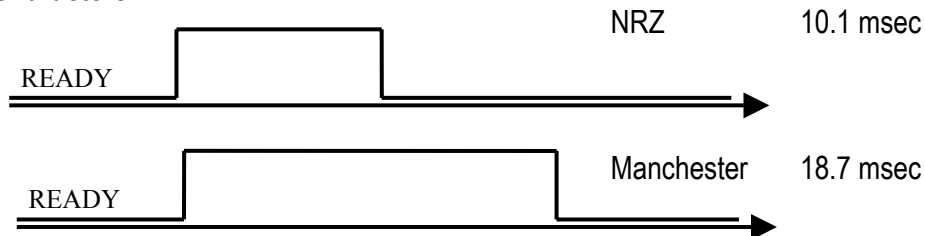
Time diagrams for two examples, sending 3 and 10 characters, Manchester or NRZ coding.

- Radio Baud-Rate: 19200 kBaud.
- 4 byte Preamble
- 2 byte CRC
- SOF
- + 3 or 10 characters.

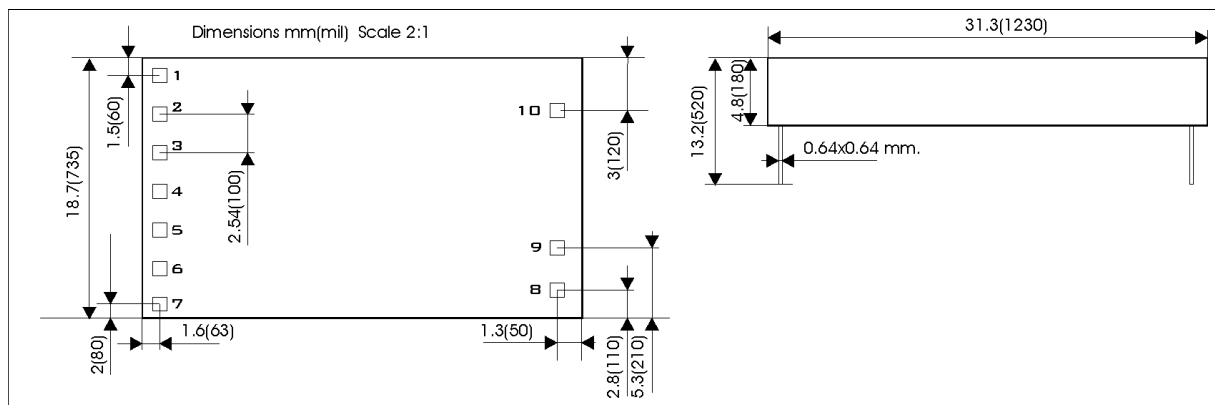
#### 3 Characters



#### 10 Characters



### Dimensions (TOP VIEW)



### Pin assignment

1. UART TX serial Transmit	Output	10. GND
2. UART RX serial Receive	Input	9. Antenna
3. Sleep, active LO	Input	8. GND
4. Ready	Output	
5. Reset, active LO	Input	
6. VCC		
7. GND		

From the diagrams below can be seen, with NRZ coding the transfer speed is double, but with Manchester coding the data transfer is more secure.