

*RADIO MODULE*  
**MRX-002S**

**UHF AM RECEIVER MODULE**

PRELIMINARY

**DATA SHEET**

***Radios, Inc.***

October 26, 2007 Preliminary Data Sheet

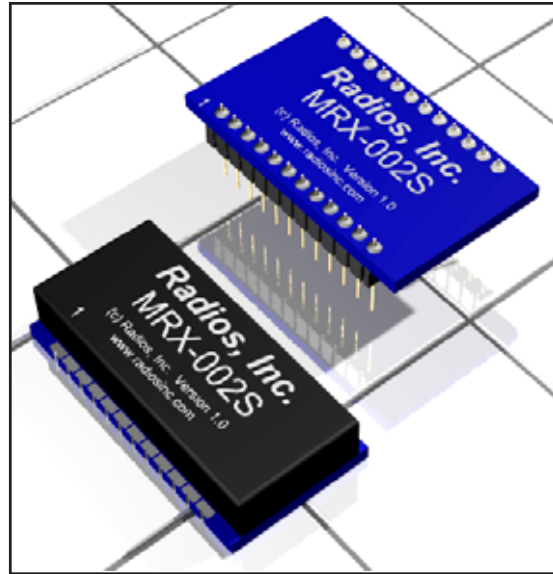
# MRX-002S

## UHF AM RECEIVER MODULE

The MRX-002S is an on-off keyed (OOK) high performance, ultra compact, long range receiver for remote wireless applications. The receiver operates at 315, 390, 418, and 433 MHz, and is primarily intended for use in part 15.231 systems. Because all tuning is automatic and the module functions are completely integrated, this module is both a highly reliable and low cost solution for high volume wireless applications. An external antenna is the only component required, therefore the receiver can be easily integrated into other applications. The MRX-002S contains two features that are not found in the MRX-002. The

MRX-002S contains a SAW filter and/or a low noise amplifier, which reduce noise and increase selectivity and sensitivity.

The MRX-002S is an enhanced version of the MRX-001 and the MRX-011. Specifically, the MRX-002S contains both Shutdown and Wakeup features. These features are perfect for low and ultra-low power applications, such as RKE and remote controls. Additionally, post-detection data filtering is internal to the receiver. Finally, the MRX-002S comes in two versions: fixed-mode (FIX), which functions as a conventional, superhet receiver and increases selectivity and sensitivity, and sweep mode (SWP), which sweeps a wider RF spectrum and allows the receiver to be used with low cost, LC transmitters.



### Key Features

- Low cost
- Commonly employed RKE frequencies
- Wide operating temperature range
- Low power consumption
- Compact surface-mount packages
- Data rate up to 10kbps
- Small size
- Power down pin
- No production tuning
- Fast enable time
- 5V operation
- 3mA current consumption at 5V

### Typical Applications

- Remote controls
- Garage openers / Gate controls
- Keyless entry
- Lighting control
- Periodic data transfer
- Remote access
- Guard patrol / Lone worker protection
- Domestic / Commercial security
- Fire / Security alarms
- General wire elimination

### Contact Information

Radios, Inc.  
1408 Center Avenue  
Oostburg, WI 53070

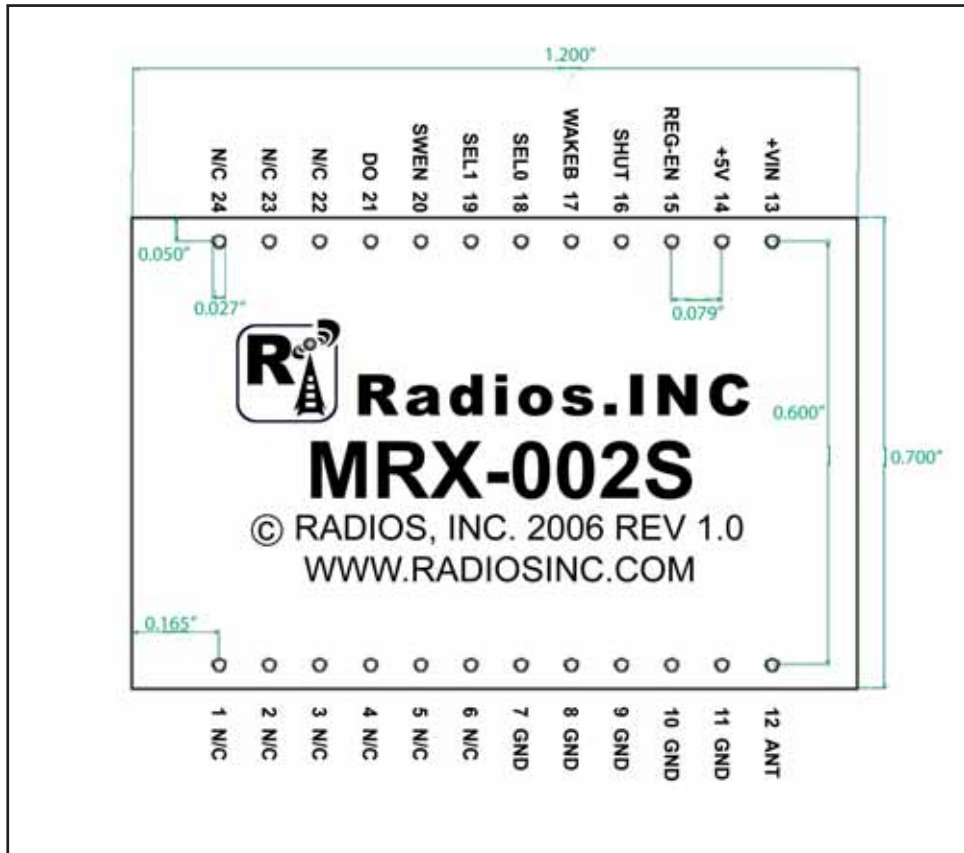
Phone: 920-564-6622  
Fax: 920-564-6630  
Email: sales@radiosinc.com

# MRX-002S

## UHF AM RECEIVER MODULE

### Mechanical and Pin Diagram DIP Package

\* Note: Pinouts of surface mount and through-hole packages are mirrored



### DIP Package

#### Pin Description

Pin Num	Pin Name	Description	Pin Num	Pin Name	Description
Pin 1	N/C	No Connect	Pin 13	+VIN	Positive Supply Pin (5-16V)
Pin 2	N/C	No Connect	Pin 14	+5V	Regulated Output (5V)
Pin 3	N/C	No Connect	Pin 15	REG-EN	Regulator Enable (2-VCC)
Pin 4	N/C	No Connect	Pin 16	SHUT	Shutdown (0-5V)
Pin 5	N/C	No Connect	Pin 17	WAKEB	Wakeup (0-5V)
Pin 6	N/C	No Connect	Pin 18	SEL0	Bandwidth Select Bit 0 (0-5V)
Pin 7	Gnd	Ground	Pin 19	SEL1	Bandwidth Select Bit 1 (0-5V)
Pin 8	Gnd	Ground	Pin 20	SWEN	Sweep Enable (0-5V)
Pin 9	Gnd	Ground	Pin 21	DO	Data Output (0-5V)
Pin 10	Gnd	Ground	Pin 22	N/C	No Connect
Pin 11	Gnd	Ground	Pin 23	N/C	No Connect
Pin 12	Ant	RF Input (50 Ohms)	Pin 24	N/C	No Connect

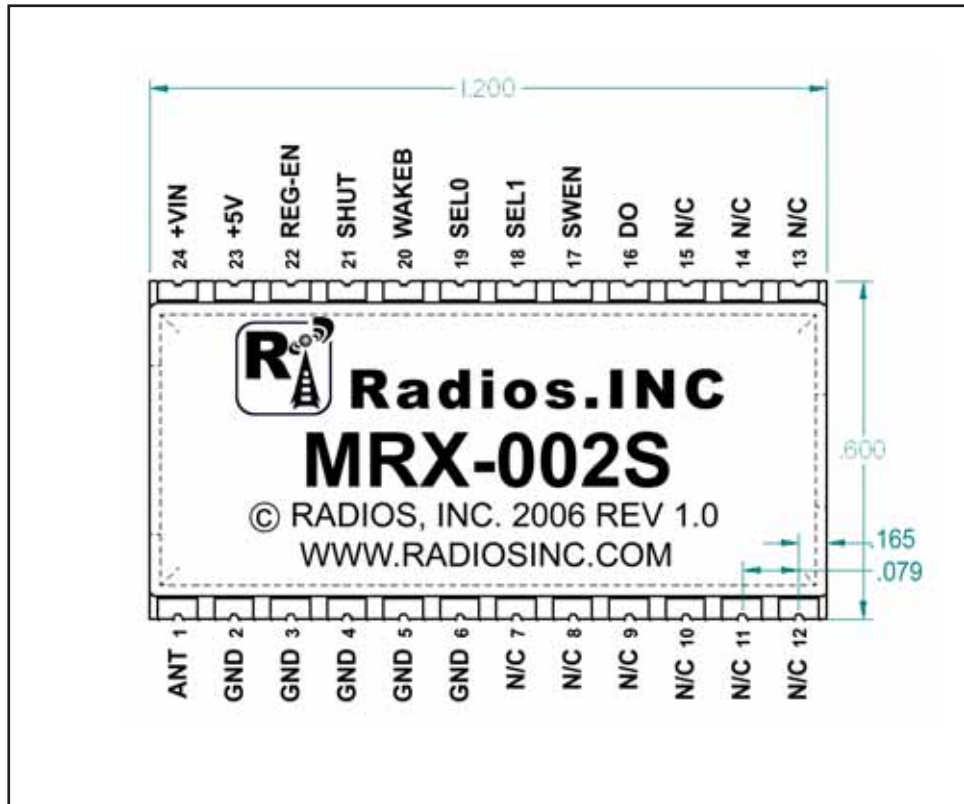
\*\* Verify pin configurations are correct before connecting power or resulting damage may occur.

# MRX-002S

## UHF AM RECEIVER MODULE

### Mechanical and Pin Diagram Surface Mount Package

\* Note: Pinouts of surface mount and through-hole packages are mirrored



### Surface Mount Package

#### Pin Description

Pin Num	Pin Name	Description	Pin Num	Pin Name	Description
Pin 1	Ant	RF Input (50 Ohms)	Pin 13	N/C	No Connect
Pin 2	Gnd	Ground	Pin 14	N/C	No Connect
Pin 3	Gnd	Ground	Pin 15	N/C	No Connect
Pin 4	Gnd	Ground	Pin 16	DO	Data Output (0-5V)
Pin 5	Gnd	Ground	Pin 17	SWEN	Sweep Enable (0-5V)
Pin 6	Gnd	Ground	Pin 18	SEL1	Bandwidth Select Bit 1 (0-5V)
Pin 7	N/C	No Connect	Pin 19	SEL0	Bandwidth Select Bit 0 (0-5V)
Pin 8	N/C	No Connect	Pin 20	WAKEB	Wakeup (0-5V)
Pin 9	N/C	No Connect	Pin 21	SHUT	Shutdown (0-5V)
Pin 10	N/C	No Connect	Pin 22	REG-EN	Regulator Enable (2-VCC)
Pin 11	N/C	No Connect	Pin 23	+5V	Regulated Output (5V)
Pin 12	N/C	No Connect	Pin 24	+VIN	Positive Supply Pin (5-16V)

\*\* Verify pin configurations are correct before connecting power or resulting damage may occur.

# MRX-002S

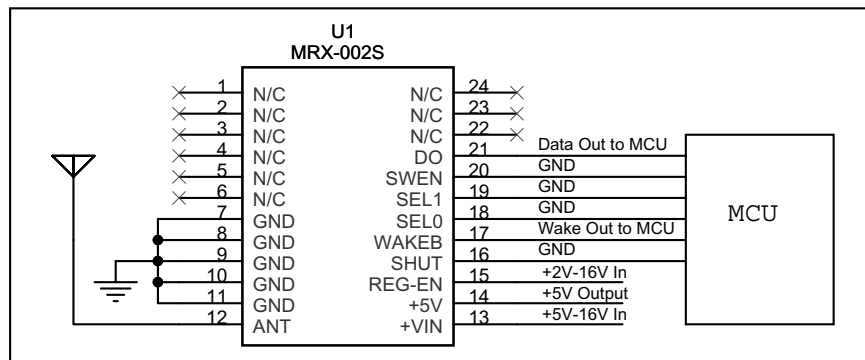
## UHF AM RECEIVER MODULE

Pin Detail			
Pin Number		Pin Name	Description
DIP	Surface Mount		
12	1	Ant	This is the receive RF input, internally ac-coupled. Connect this pin to the receive antenna.
7,8,9,10,11	2,3,4,5,6	Gnd	Ground
1,2,3,4,5,6,22,23,24	7,8,9,10,11,12,13,14,15	N/C	No Connect
21	16	DO	Data output pin.
20	17	SWEN	Controls the operating mode of the receiver. When high, the receiver is in sweep mode. When low, the module operates as a conventional single-conversion superheterodyne receiver (fixed mode) - this is the recommended mode of operation. This pin is internally pulled-up to VCC.
19	18	SEL1	Programs desired Demodulator Filter Bandwidth. This pin is internally pulled-up to VCC. See Table 1.
18	19	SEL0	Programs desired Demodulator Filter Bandwidth. This pin is internally pulled-up to VCC. See Table 1.
17	20	WAKEB	Wakeup output (active-low) that indicates detection of an incoming RF signal. Pin goes low when a constant RF carrier is detected.
16	21	SHUT	Shutdown-mode logic-level control input. Pull low to enable the receiver. Internally pulled-up to VCC.
15	22	REG-EN	In a regulated module, this pin powers on the module with a 2-16V supply input. Pulling this pin low disables module. In a non-regulated module, this is a no connect.
14	23	+5V	In a regulated module, this is a 5V output from the onboard regulator when REG-EN is high (2-16V). In a non-regulated module, this is the 4.75V to 5.5V power supply input.
13	24	+VIN	In a regulated module, this is the power supply pin of the module. Input 5-16V to power a regulated module. In a non-regulated module, this is a no connect.

Table 1			
Programmable Bandwidth Configurations			
SEL0	SEL1	Sweep Mode (bps)	Fixed Mode (bps)
0	0	625	1250
1	0	1250	2500
0	1	2500	5000
1	1	5000	10000

*\*Note: 1=VCC, 0=GND*

### Typical Application Schematic



MRX-002S, 433.92MHz Fixed, 1250bps Bandwidth

# MRX-002S

## UHF AM RECEIVER MODULE

### Electrical Limits

Sym	Parameters	Min	Typ	Max	Unit	Notes
<b>Absolute Maximum Ratings</b>						
VCC	Supply Voltage - Regulated	5		16	V	
	Supply Voltage - Not Regulated	4.75		5.5	V	
	Storage Temperature Range	0		70	°C	
V <sub>EN</sub>	Enable Input Voltage	0		16	V	
<b>Operating Ratings</b>						
V <sub>EN</sub>	Enable Input Voltage	0		VCC	V	
TA	Ambient operating temperature	0		70	°C	

### Electrical Characteristics

This device is ESD sensitive. Do not operate or store near strong electrostatic fields. Use appropriate ESD precautions. All voltages are with respect to Ground.

Parameters	Test Conditions	Min	Typ	Max	Unit
<b>Power Supply</b>					
Operating Current	433.92MHz		24		mA
Quiescent Current	REG-EN <math>\neq 0.4V</math> (shutdown)		0.01		$\mu A$
Operating Voltage	Regulated	5		16	V
	Not Regulated	4.75		5.5	V
<b>RF/IF Section</b>					
Receiver Sensitivity (Note 1, 3)	315MHz		-97		dBm
	433.92MHz		-95		dBm
IF Bandwidth	Note 3		0.43		MHz
Receive Data Rate		0.1		4.8	kbps
RF Input Range		300		440	MHz
Maximum Receiver Input	Rs = 50 $\Omega$		-20		dBm
Spurious Reverse Isolation	ANT pin, Rs = 50 $\Omega$ Note 2		30		$\mu V_{rms}$
AGC Attack / Decay ratio	T(Attack) / T(Decay)		0.1		
Oscillator Turn-on Time			TBD		s
<b>Digital Section</b>					
Output Current	DO pin, Push-Pull		10		$\mu A$
Output High Voltage	DO pin, I <sub>out</sub> = 1 $\mu A$	0.9VCC			V
Output Low Voltage	DO pin, I <sub>out</sub> = 1 $\mu A$			0.1VCC	V
Output Tr, Tf	DO pin, Cload=15pF			10	$\mu sec$
<b>Regulator Enable Input</b>					
Input Low Voltage	Regulator OFF			0.6	V
Input High Voltage	Regulator ON	2.0			V
Enable Input Current	REG-EN = 0.6V; Regulator OFF		0.01		$\mu A$

# MRX-002S

## UHF AM RECEIVER MODULE

### Electrical Characteristics - CONT.

**Note 1:** Sensitivity is defined as the average signal level measured at the input necessary to achieve  $10e-2$  Bit Error Rate (BER). The input signal is defined as a return-to-zero (RZ) waveform with 50% average duty cycle at a data rate of 2400bps. The RF input is assumed to be matched into 50 ohms.

**Note 2:** Spurious reverse isolation represents the spurious components which appear on the RF input (ANT) pin measured into 50 ohms with an input RF matching network.

**Note 3:** Sensitivity, a commonly specified Receiver parameter, provides an indication of the Receiver's input referred noise, generally input thermal noise. However, it is possible for a more sensitive receiver to exhibit range performance no better than that of a less sensitive receiver, if the "ether" noise is appreciably higher than the thermal noise. "Ether" noise refers to other interfering "noise" sources, such as FM radio stations, pagers, etc.

A better indicator of receiver range performance is usually given by its Selectivity, often stated as Intermediate Frequency (IF) or Radio Frequency (RF) bandwidth, depending on receiver topology. Selectivity is a measure of the rejection by the receiver of "ether" noise. More selective receivers will almost invariably provide better range. Only when the receiver selectivity is so high that most of the noise on the receiver input is actually thermal will the receiver demonstrate sensitivity-limited performance.

**Note 4:** Exceeding the absolute maximum ratings may damage the device.

**Note 5:** The device is not guaranteed to function outside its operating ratings.

PRELIMINARY

## **MRX-002S**

---

### **UHF AM RECEIVER MODULE**

#### **Technical Support:**

Radios, Inc. is committed to providing its customers with excellent technical support and the resources necessary to assist them with their product development. All technical support is provided free of charge. Customers have several options to obtain assistance. First, any questions or concerns can be e-mailed to Radios, Inc. at [information@radiosinc.com](mailto:information@radiosinc.com). We monitor our e-mail daily, and will respond to all questions promptly. Additionally, to speak directly to a technical support representative, customers can call Radios, Inc. at 920-564-6622.

#### **Compliance:**

Embedded wireless modules are intended for use as component devices which require peripheral elements to operate. Radios, Inc.'s modules are intended to be used in products requiring compliance. They are, however, not pre-approved by the FCC or any other agency worldwide unless so stated. The user or customer understands that regulatory compliance may be required prior to the sale or operation of the module or development system, and agrees to abide by all laws governing the module's or development system's use in the country of operation.

The approval process of embedded wireless modules in the United States is relatively uncomplicated. The Federal Communications Commission (FCC) is the governing body in the US that specifies its requirements in the Code of Federal Regulations (CFR), Title 47. Title 47 consists of several volumes and it is necessary to first identify the correct section that applies to your application. These rules require that a device which intentionally creates RF emissions be FCC compliant; i.e., pre-tested for compliance and assigned an identification number. Radios, Inc. offers pre-screening at one of our affiliate test sites. Final certification is then accomplished by an independent test laboratory. After passing compliance testing, you will be issued a unique ID number which must be placed on each product manufactured.

Any questions dealing with interpretations of the rules relating to testing or compliance should be addressed to:

FCC  
Equipment Authorization Division  
Customer Service Branch, MN 1300F2  
7435 Oakland Mills Road  
Columbia, MD 21046



## **MRX-002S**

---

### **UHF AM RECEIVER MODULE**

#### **Returns:**

Products may be returned directly to Radios, Inc. for evaluation. Returns, without exception, must have a valid RMA number attached. RMA numbers can be obtained by calling a customer service representative at Radios, Inc. If a product is found to be defective and is returned within 90 days of purchase, Radios, Inc. may repair or replace, at its option, said defective product. The warranty does not apply to any products which have been disassembled, modified or subjected to conditions exceeding the application specifications. Under no circumstances will Radios, Inc. be responsible for losses, financial or other, arising from the use or failure of a device in an application or for losses arising from failure to meet delivery requirements, other than the repair, replacement, or refund limited to the original product purchase price. No other warranties, express, implied, or statutory, including warranty of fitness for a particular purpose, apply.

#### **Product Warranty and Disclaimer Information:**

Radios, Inc. is dedicated to providing its customers with the best possible products, and is continually working on improving the quality and function of its entire product line. Therefore, Radios, Inc. reserves the right to make changes to the design, specifications, or manufacturing of its products without notice. The information contained in this data sheet is believed to be complete, accurate, and reliable as of the time of publication. Because product specifications are based on representative lot samples, however, values can vary from lot to lot and are not guaranteed. Radios, Inc. does not assume any liability or responsibility arising from the application or use of any product described herein, and makes no guarantee, warranty, or representation regarding the suitability or legality of any product for use in a specific application. Radios, Inc. does not assume any liability for any infringement of patents or other rights of third parties which may result from the use of its products. No product sold by Radios, Inc. is intended for use in a life critical application, or any application where the safety of property is at risk. The user assumes full and complete responsibility for any use of Radios, Inc.'s products in an application where the safety of life or property is at stake.

Radios, Inc., its suppliers, and its licensors shall in no event be liable for any damages arising from the use of or inability to use this product. This includes business interruption, loss of business information, or other losses that may arise from the use of this product. Some devices described in this publication are patented. Under no circumstances shall any user be conveyed any license or right to the use or ownership of these patents.

#### **Copyright:**

Radios Inc. reserves the right to all proprietary or commercial information contained in this data sheet. This data sheet is protected by copyright, and any unauthorized copying, reproduction, or dissemination is strictly prohibited without the prior written approval of Radios Inc.

# MRX-002S

## UHF AM RECEIVER MODULE

### Editorial Information:

Last Updated (Date)  
October 26, 2007 PRELIMINARY

### Product Ordering Information:

MRX-002S L - 433 D 600 SW SQ R A - B

Packaging:	B - Bulk TB - Tube TR - Tape and Reel
Antenna:	A - Antenna - No Antenna
Voltage Regulation:	R - Regulated - Not Regulated
Squelched:	SQ - Squelched - Not Squelched
Sweep/Fixed:	SW - Sweep - Fixed
Baud Rate:	600 = 600 bps = 1200 bps 2400 = 2400 bps 4800 = 4800 bps 9600 = 9600 bps
Package:	D - Through-hole S - Surface Mount SC - Surface Mount with Cap
Frequency: (based on module's frequency range)	310 = 310 MHz 315 = 315 MHz 390 = 390 MHz 418 = 418 MHz 433 = 433.92 MHz XXX = Custom Frequency
LNA:	L - Low Noise Amplifier - No Low Noise Amplifier