RADIO MODULE
MRX-002

## UHF AM RECEIVER MODULE

PRELIMINARY

DATA SHEET

Radios, Inc.

October 26, 2007 Preliminary Data Sheet

MRX-002

UHF AM RECEIVER MODULE

The MRX-002 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.
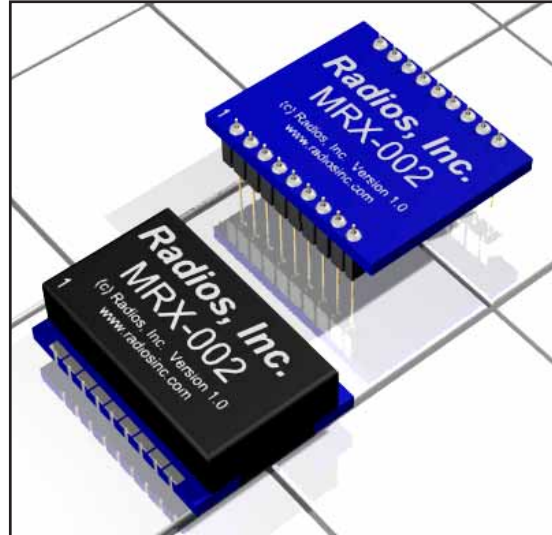
The MRX-002 is an enhanced version of the MRX-001 and the MRX-011. Specifically, the MRX-002 contains both Shutdown and Wakeup features. These features are perfect for low and ultra-low power applications, such as RKE and remote controls. Additionally, post-detection data filtering is internal to the receiver. Finally, the MRX-002 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

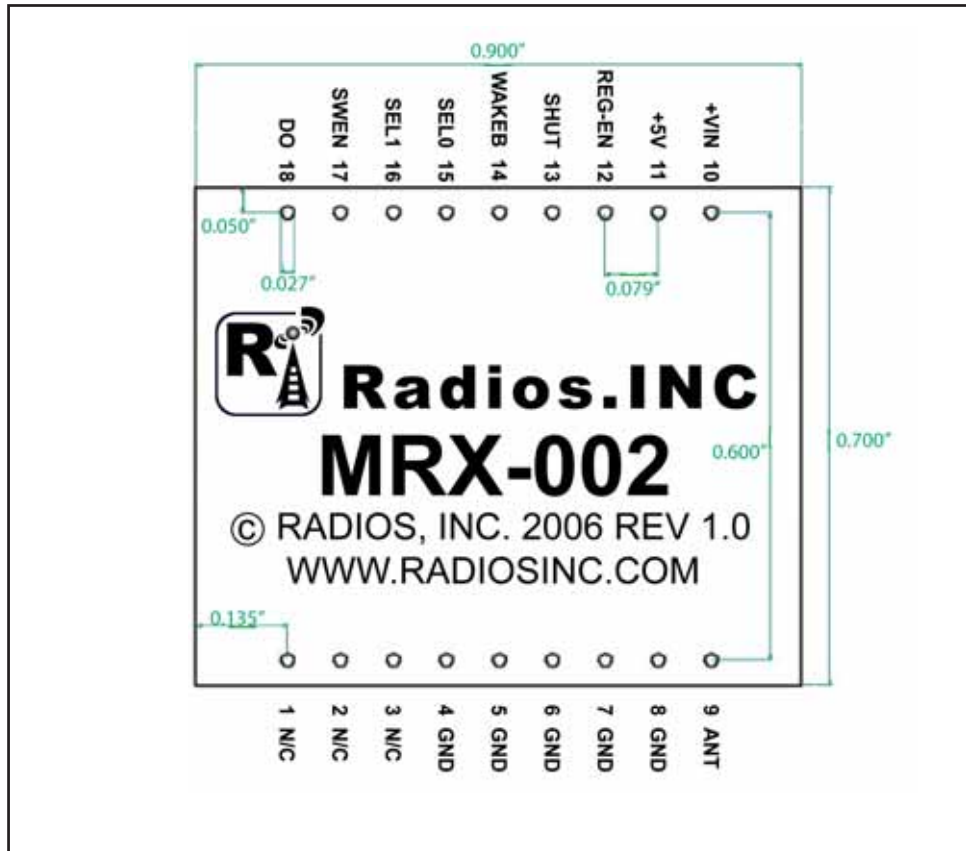| Contact Information	
Radios, Inc. 1408 Center Avenue Oostburg, WI 53070	Phone: 920-564-6622 Fax: 920-564-6630 Email: sales@radiosinc.com

MRX-002

UHF AM RECEIVER MODULE

Mechanical and Pin Diagram
DIP Package

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

DIP Package

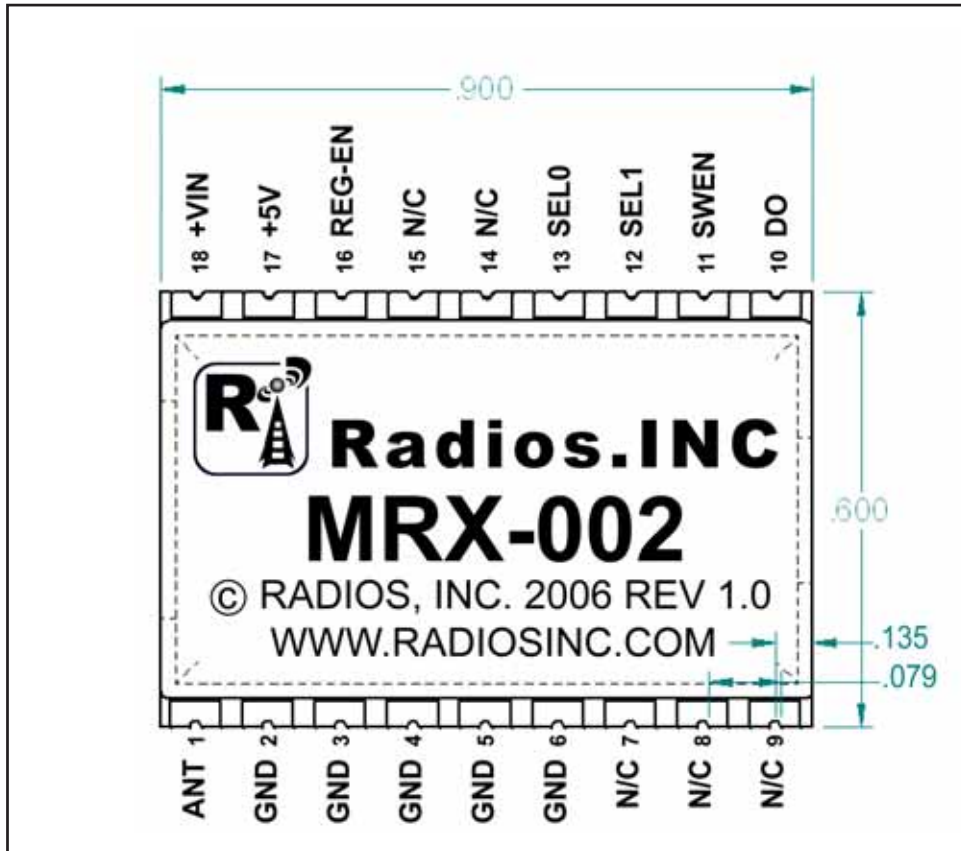| Pin Description					
Pin Num	**Pin Name**	**Description**	**Pin Num**	**Pin Name**	**Description**
Pin 1	N/C	No Connect	Pin 10	+VIN	Positive Supply Pin (5-16V)
Pin 2	N/C	No Connect	Pin 11	+5V	Regulated Output (5V)
Pin 3	N/C	No Connect	Pin 12	REG-EN	Regulator Enable (2-VCC)
Pin 4	Gnd	Ground	Pin 13	SHUT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

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

MRX-002

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 10	DO	Data Output (0-5V)
Pin 2	Gnd	Ground	Pin 11	SWEN	Sweep Enable (0-5V)
Pin 3	Gnd	Ground	Pin 12	SEL1	Bandwidth Select Bit 1 (0-5V)
Pin 4	Gnd	Ground	Pin 13	SEL0	Bandwidth Select Bit 0 (0-5V)
Pin 5	Gnd	Ground	Pin 14	WAKEB	Wakeup (0-5V)
Pin 6	Gnd	Ground	Pin 15	SHUT	Shutdown (0-5V)
Pin 7	N/C	No Connect	Pin 16	REG-EN	Regulator Enable (2-VCC)
Pin 8	N/C	No Connect	Pin 17	+5V	Regulated Output (5V)
Pin 9	N/C	No Connect	Pin 18	+VIN	Positive Supply Pin (5-16V)

** Verify pin configurations are correct before connecting power or resulting damage may occur.
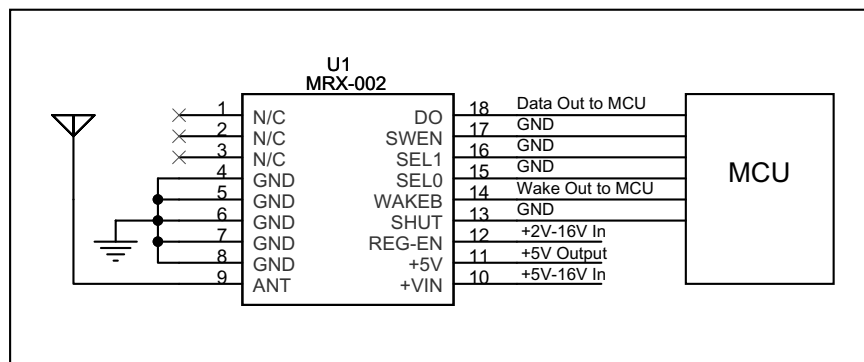
MRX-002

UHF AM RECEIVER MODULE

Pin Detail			
Pin Number		**Pin**	
DIP	**Surface Mount**	**Name**	**Description**
9	1	Ant	This is the receive RF input, internally ac-coupled. Connect this pin to the receive antenna.
4,5,6,7,8	2,3,4,5,6	Gnd	Ground
1,2,3	7,8,9	N/C	No Connect
18	10	DO	Data output pin.
17	11	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.
16	12	SEL1	Programs desired Demodulator Filter Bandwidth. This pin is internally pulled-up to VCC. See Table 1.
15	13	SEL0	Programs desired Demodulator Filter Bandwidth. This pin is internally pulled-up to VCC. See Table 1.
14	14	WAKEB	Wakeup output (active-low) that indicates detection of an incoming RF signal. Pin goes low when a constant RF carrier is detected.
13	15	SHUT	Shutdown-mode logic-level control input. Pull low to enable the receiver. Internally pulled-up to VCC.
12	16	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.
11	17	+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.
10	18	+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-002, 433.92MHz Fixed, 1250bps Bandwidth

MRX-002

UHF AM RECEIVER MODULE

Electrical Limits

Sym	Parameters	Min	Typ	Max	Unit	Notes
	Absolute Maximum Ratings					
VCC	Supply Voltage - Regulated	5		16	V	
	Supply Voltage - Not Regulated	4.75		5.5	V	
	Storage Temperature Range	0		70	°C	
V_{EN}	Enable Input Voltage	0		16	V	
	Operating Ratings					
V_{EN}	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
Power Supply					
Operating Current	433.92MHz		2		mA
Quiescent Current	REG-EN </= 0.4V (shutdown)		0.01		µA
Operating Voltage	Regulated	5		16	V
	Not Regulated	4.75		5.5	V
RF/IF Section					
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 = 50Ω		-20		dBm
Spurious Reverse Isolation	ANT pin, Rs = 50Ω Note 2		30		µVrms
AGC Attack / Decay ratio	T(Attack) / T(Decay)		0.1		
Oscillator Turn-on Time			TBD		s
Digital Section					
Output Current	DO pin, Push-Pull		10		µA
Output High Voltage	DO pin, Iout = 1µA	0.9VCC			V
Output Low Voltage	DO pin, Iout = 1µA			0.1VCC	V
Output Tr, Tf	DO pin, Cload=15pF			10	µsec
Regulator Enable Input					
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		mA

MRX-002

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 he 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.

MRX-002

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. 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:

<div align="center">

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

</div>

MRX-002

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-002

UHF AM RECEIVER MODULE

Editorial Information:

(Date)

Last Updated   October 26, 2007 PRELIMINARY

Product Ordering Information:

MRX-002 - 433 D 4800 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:	310 = 310 MHz
(based on module's frequency range)	315 = 315 MHz
	390 = 390 MHz
	418 = 418 MHz
	433 = 433.92 MHz
	XXX = Custom Frequency