RADIO MODULE

MXR-505S

UHF FM TRANSCEIVER MODULE

DATA SHEET

Radios, Inc.

June 8, 2010 Preliminary Data Sheet

MXR-505S

UHF FM TRANSCEIVER MODULE

The MXR-505S is a frequency shift keyed (FSK) high performance, ultra compact, long range transceiver operating at the 902-928 MHz and 868.25 MHz bands. This integrated modularized transceiver is designed for use in half-duplex, bidirectional RF links. The multi-channeled MXR-505S is intended for use in UHF radio equipment in compliance with both the North American Federal Communications Commission (FCC) part 15.247 and 15.249 systems and the European Telecommunications Standard Institute (ETS) specification EN300 200.

The transmitter is composed of both a PLL frequency synthesizer and a power amplifier. The synthesizer uses a voltage-controlled crystal oscillator, a dual-modulus prescaler, programmable frequency dividers, and a phase-detector. The power amplifier's output power can be programmed to seven different levels.

The MXR-505S has zero IF architecture which enables channel filtering with low-power, integrated low-pass filters. Each channel includes a pre-amplifier and a third order Sallen-Key RC low-pass filter that protects the switched-capacitor filter from strong adjacent channel signals. The main channel filter is a switched-capacitor implementation of a six-pole elliptic low pass filter. The cutoff frequency of the Sallen-Key RC filter can be programmed to four different frequencies: 100kHz, 150 kHz, 230 kHz, and 340 kHz. A receive signal strength indicator circuit indicates the received signal level. The MXR-505S is a well-designed transceiver suitable for a variety of RF applications, particularly voice applications and high volume OEM applications. The MXR-505S is for sale with and without an on-board microprocessor so that the user can manually address the module if that is required. **Note:** The MXR-505S is compatible with HHDS-ML-M but is **NOT** compatible with HHDS-ML-P.

Key Features

- Low cost
- Wide supply voltage range
- Wide operating temperature range
- Easily integrated
- Low power consumption
- Compact surface-mount packages/Small Size
- 2.5V operation
- Simple serial programming interface
- Baud rate from 1200 to 200,000 bps
- Spread spectrum
- External reset pin
- Exceptional sensitivity: -111dBm
- Receive signal stength (RSSI) pin
- No production tuning

Typical Applications

- Remote controls
- Garage openers / Gate controls
- Keyless entry
- Lighting control
- Home / Industrial automation
- Continuous / Periodic data transfer
- Wireless networking
- Remote access
- Remote monitoring / Telemetry
- Medical monitoring / Call systems
- Guard patrol / Lone worker protection
- Domestic / Commercial security
- Fire / Security alarms
- Long-range RFID
- Automated meter reading

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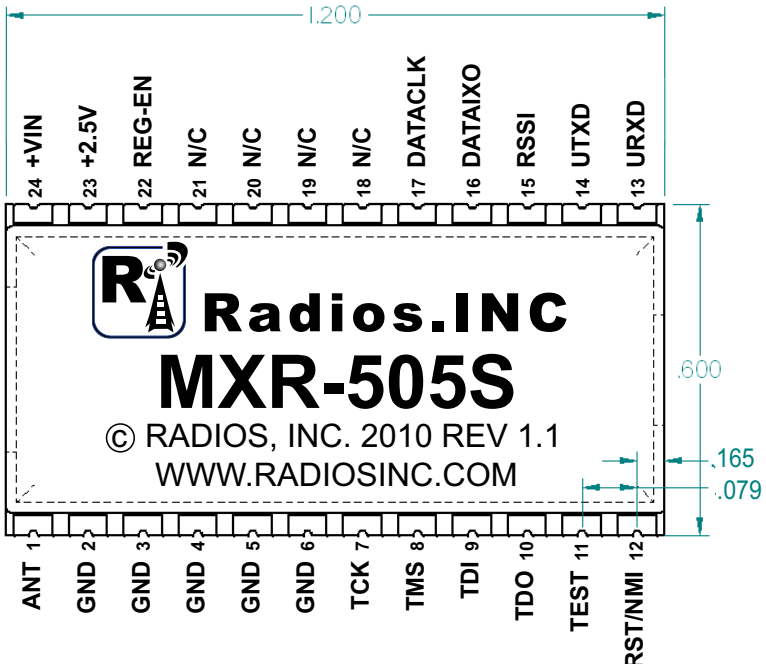
Mechanical and Pin Diagram
Surface Mount Package



Surface Mount Package

Pin Description

Pin Num	Pin Name	Description	Pin Num	Pin Name	Description
Pin 1	Ant	RF Input/Output (50 Ohms)	Pin 13	URXD	Receive Data Out—UART mode (0-2.5V)
Pin 2	Gnd	Ground	Pin 14	UTXD	Transmit Data Out—UART mode (0-2.5V)
Pin 3	Gnd	Ground	Pin 15	RSSI	Receive Signal Strength Indicator (0-2.5V)
Pin 4	Gnd	Ground	Pin 16	DATAIXO	Data Input/Output (0-2.5V)
Pin 5	Gnd	Ground	Pin 17	DATACLK	Data Clock Output (0-2.5V)
Pin 6	Gnd	Ground	Pin 18	N/C	No Connect
Pin 7	TCK	No Connect	Pin 19	N/C	No Connect
Pin 8	TMS	No Connect	Pin 20	N/C	No Connect
Pin 9	TDI	No Connect	Pin 21	N/C	No Connect
Pin 10	TDO	No Connect	Pin 22	REG-EN	Regulator Enable (2-VCC)
Pin 11	TEST	No Connect	Pin 23	+2.5V	Regulated Output (2.5V)
Pin 12	RST/NMI	No Connect	Pin 24	+VIN	Positive Supply Pin (2.6-16V)

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

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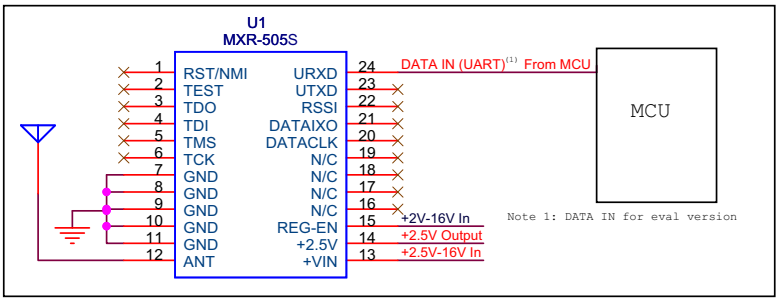
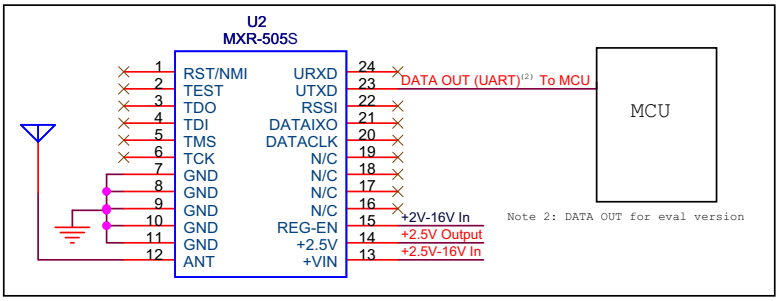
Pin Detail

Pin Number	Pin Name	Description
1	Ant	This is the RF input/output, internally ac-coupled. Connect this pin to the antenna.
2,3,4,5,6	Gnd	Ground
18,19,20,21	N/C	No Connect
7,8,9,10,11,12	N/C	No Connect. Programming use only.
13	URXD	Receive data in—USART0/UART mode
14	UTXD	Transmit data out—USART0/UART mode
15	RSSI	Received signal strength indicator output
16	DATAIXO	Data input/output pin
17	DATACLK	Receive/Transmit data clock input
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.
23	+2.5V	In a regulated module, this is a 2.5V output from the onboard regulator when REG-EN is high (2-16V). In a non-regulated module, this is the 2.0V to 2.5V power supply input.
24	+VIN	In a regulated module, this is the power supply pin of the module. Input 2.5-16V to power a regulated module. In a non-regulated module, this is a no connect.

Typical Application Schematic



Transmit Mode



Receive Mode

MXR-505S Communication

Using HHDS-ML

When using the MXR-505S with the HHDS-ML for communication, no manual addressing is needed. Follow the instructions in the HHDS-ML user guide for setup instructions and how to insert the module into the socket. Continue following user guide instructions for how to communicate between two HHDS-ML's using MXR-505S modules. Communication is accomplished simply by pushing one of the three buttons on the HHDS-ML.

EVAL Protocol - Separate from HHDS-ML

Communication with the MXR-505S is accomplished through a universal asynchronous receive/ transmit (UART) peripheral interface. The UART uses 8-bit, non-parity, LSB, 1200bps baud format. The maximum number of data bytes that can be transmitted or received in one packet is 50. The user will transmit data through the UART on the MXR-505S via the URXD pin: pin 24 of the DIP module or pin 13 of the surface mount module. The MXR-505S will packetize and wirelessly transmit the data. Once the data is received on the other side, the MXR-505S will demodulate the data and send the received data out to the user via the UTXD pin: pin 23 of the DIP module or pin 14 of the surface mount module. The data being sent through the UART should follow a specific protocol.

NOTE: THE COMMUNICATION PROTOCOL BELOW CANNOT BE USED WITH THE EVAL VERSION OF THE DEVELOPMENT SYSTEM.

The communication protocol is outlined below:

Byte #1 **Number of Bytes** – The number of bytes is one byte containing the total number of data bytes. This byte should not be included in the number of bytes. Therefore, the number of bytes should be one less than the total number of bytes being sent or received. The maximum number of data bytes that can be transmitted or received is 50; therefore, the number of bytes should not exceed 50.

Bytes #2-51 **Data Bytes** – The data bytes are the actual data byte values being transmitted or received by the MXR-505S. The MXR-505S can send or receive a maximum of 50 data bytes per packet. The first two bytes are used as preamble bytes by Radios, Inc. to differentiate the detection of data from noise.

When the first byte is received through the UART on the MXR-505S, the user will have one second to send the remaining data bytes to the MXR-505S. If the MXR-505S does not receive all of the data bytes within that second, the data the MXR-505S did receive will be dumped. For example, if the user sends a 10 for the number of bytes and then only sends five more bytes within one second, the MXR-505S assumes this is corrupted data and does not transmit the packet. The five bytes the MXR-505S did receive will be discarded and the MXR-505S will wait for a new packet of data to be received.

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Electrical Limits

Sym	Parameters	Min	Typ	Max	Unit	Notes
	Absolute Maximum Ratings					
VCC	Supply Voltage - Regulated	2.6		16	V	
	Supply Voltage - Not Regulated	2.0		2.5	V	
	Voltage on any Pins	-0.5		2.7	V	
	Storage Temperature Range	0		70	°C	
	Lead Temperature		260		°C	
V_{EN}	Enable Input Voltage	0		16	V	
					kV	
	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					
RF Frequency Operating Range		850		950	MHz
Power Down Current			0.3		µA
Standby current			280		µA
Operating Voltage	Regulated	2.6		16	V
	Not Regulated	2.0		2.5	V
VCO and PLL Section					
Reference Frequency		4		40	MHz
PLL Lock Time, Rx -> Rx	915MHz to 915.5MHz		0.8		ms
3kHz bandwidth	902MHz to 927MHz		1.3		ms
PLL Lock Time, Rx -> Rx	915MHz to 915.5MHz		0.3		ms
20kHz bandwidth					
Switch Time, same frequency	Rx – Tx		0.9		ms
3kHz loop bandwidth	Tx – Rx		0.8		ms
	Standby Rx		2.1		ms
	Standby Tx		2.1		ms
Charge Pump Current	VCPOUT = 1.1V, CP_HI = 0	100	125	170	µA
	VCPOUT = 1.1V, CP_HI = 1	420	500	680	µA
Transmit Section					
Output Power	R_{LOAD} = 50 Ohms, Pa2-0-111		10		dBm
	R_{LOAD} = 50 Ohms, Pa2-0-001		-8		dBm
Output Power Tolerance	Over temperature range		2		dB
	Over power supply range		3		dB
Tx Current Consumption	R_{LOAD} = 50 Ohms, Pa2-0-111		28		mA
	R_{LOAD} = 50 Ohms, Pa2-0-001		14		mA
Binary FSK Frequency Separation	Bitrate = 200kbps	20		500	kHz
Data Rate	VCO modulation	20		200	
	Divider modulation			20	kbps
Occupied bandwidth	38.4kbps, b = 2, 20dBc		120		kHz
	125kbps, b = 2, 20dBc		450		kHz
	200kbps, b = 2, 20dBc		750		kHz
2nd Harmonic	FCC part 15			-20	dBc
3rd Harmonic	R_{LOAD} 50 Ohms			-41.2	dBm
Spurious Emission <902 MHz	(using antenna matching network)			-49.2	dBm
Spurious Emission >928 MHz				-41.2	dBm

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Electrical Characteristics - CONT.

Receive Section					
Rx Current Consumption	All functions turned on		13.5		mA
	LNA bypass		10.9		mA
	Switch cap filter bypass with LNA		10.9		mA
	Bypass of switch cap and LNA		8.6		mA
Rx Current Consumption Variation	Over temperature		4		mA
Receiver Sensitivity	2.4kbps, b=16, SC=50kHz, BER 10^{-3}		-111		dBm
	4.8kbps, b=16, SC=50kHz, BER 10^{-3}		-110		dBm
	19.2kbps, b=8, SC=200kHz, BER 10^{-3}		-107		dBm
	38.4kbps, b=4, BER 10^{-3}		-104		dBm
	76.8kbps, b=2, BER 10^{-3}		-101		dBm
	125kbps, b=2, BER 10^{-3}		-100		dBm
	200kbps, b=2, BER 10^{-3}		-97		dBm
Receiver Maximum Input Power	125kbps, b=2		-12		dBm
	20kbps, b=10		-10		dBm
Receiver Sensitivity Tolerance	Over temperature		4		dB
	Over power supply range		1		dB
Receiver Bandwidth		50		350	kHz
Co-Channel Rejection	19.2kbps, b=8, SC=133kHz				dB
Adjacent Channel Rejection	500kHz spacing, 19.2kbps				
main filter cut off frequency 133kHz	1MHz, 19.2kbps				dB
					dB
Blocking	Offset +/-1MHz		55		dB
	Offset +/-2MHz		58		dB
	Offset +/-5MHz		48		dB
	Offset +/-10MHz		50		dB
	Offset +/-30MHz		60		dB
1dB Compression			-34		dBm
Input IP3	2 tones with 1MHz separation		-25		dBm
LO Leakage			-90		dBm
Spurious Emission	<1GHz, EN 300 220			-57	dBm
	>1GHz, EN 300 220			-47	dBm
Input Impedance			50		Ohms
RSSI Dynamic Range			50		dB
RSSI Output Voltage	Pin = -110dBm		0.9		V
	Pin = -60dBm		2		V
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		µA

Note 1. Exceeding the absolute maximum rating may damage the device.

Note 2. The device is not guaranteed to function outside its operating rating.

Note 3. Devices are ESD sensitive. Handling precautions recommended. Human body model, 1.5k in series with 100pF.

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, x1000.

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

Returns:

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Editorial Information:

	(Date)
Last Updated	June 12, 2009 PRELIMINARY
	November 18, 2009 VERSION 1.1

Product Ordering Information:

MXR-505S E - 915 4800 R -B

Packaging:	B - Bulk TB - Tube TR - Tape and Reel
Voltage Regulation:	R - Regulated - Not Regulated
Baud Rate:	600 = 600 bps = 1200 bps 2400 = 2400 bps 4800 = 4800 bps 9600 = 9600 bps 14400 = 14,400 bps 28800 = 28,800 bps 57600 = 57,600 bps
Frequency: (based on module's frequency range)	915 = 915 MHz XXX = Custom Frequency
Protocol:	E - Eval * RI - RINet

* Eval software for use with HHDS-ML M only. Will not work for other applications.