



RM2510 Wireless HART™ 2.4 GHz Radio Module

Product Description

Rosemount Inc.'s RM2510 Wireless HART™ 2.4GHz Radio Module has been specifically designed to interface with industrial and process control equipment designed and marketed by the Emerson family of companies. The RM2510 is designed to be fully compliant with the wireless HART™ specification. It uses a DSSS modulation type and multiple channel selection for optimum interference rejection and >99% communication reliability. The RM2510 utilizes the global license-free 2.4GHz band at output power levels that are compatible with government regulations throughout the world.

The RM2510's very low power consumption characteristics make it perfect for battery powered equipment. The multi-functional interface of the RM2510 is flexible enough for it to be integrated into many types of sensors. From pressure, temperature, and flow monitoring to machinery health and valve position control, the RM2510 is the best choice for wireless HART™ compatible communications.

Key Features

Reliable Networking

- Mesh networking for redundancy and high reliability (> 99.9% typical network reliability)
- Dynamic channel selection for interference rejection
- Every RM2510 acts as both an endpoint and a router, increasing network reliability.
- Automatic self-organizing mesh-networking capability built-in

Easy Integration

- Well-defined multi-functional interfaces
- High-level Data Link Control (HDLC) serial interface with bidirectional flow control
- Industrial temperature range -40 °C to +85 °C

802.15.4 Standard Radio

- +8 dBm (6.3 mW) conducted RF output power
- -90 dBm receiver sensitivity
- 300 m outdoor range (typical)

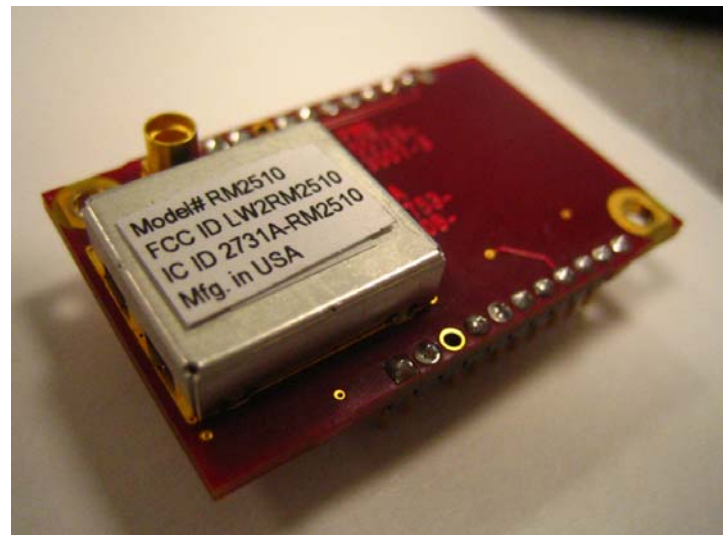


Table of Contents

1.0	Absolute Maximum Ratings	3
2.0	Normal Operating Conditions	3
3.0	Electrical Specifications	4
4.0	Radio	4
4.1	Detailed Radio Specifications	4
4.2	Antenna Specifications.....	5
5.0	Pinout	5
6.0	Physical Drawing	7
7.0	Regulatory and Standards Compliance	8

1.0 Absolute Maximum Ratings

The absolute maximum ratings shown below should under no circumstances be violated. Permanent damage to the device may be caused by exceeding one or more of these parameters.

Table 1 Absolute Maximum Ratings

Parameter	Min	Typ	Max	Units	Comments
Supply voltage (V_{DD} to V_{SS})	-0.3		3.6	V	
Voltage on any digital I/O pin	-0.3		$V_{DD} + 0.3$ up to 3.6	V	
Input RF level			10	dBm	Input power at antenna connector
Storage temperature range	-40		+85	°C	
VSWR of antenna			3:1		
ESD protection					
Antenna pad			±250	V	HBM
All other pads			±2	kV	HBM
			±200	V	CDM

* All voltages are referenced to V_{SS}



Caution! ESD sensitive device. Precaution should be used when handling the device in order to prevent permanent damage.

2.0 Normal Operating Conditions

Table 2 Normal Operating Conditions

Parameter	Min	Typ	Max	Units	Comments
Operational supply voltage range (between V_{DD} and V_{SS})	2.75	3.0	3.3	V	Including noise and load regulation
Voltage on analog input pins	0		1.8	V	
Voltage supply noise			100	mV _{p-p}	50 Hz to 2 MHz
Peak current			85 18 6 12	mA mA mA mA	Flash write 35 ms max TX, 5 ms maximum Searching for network, 60 minutes maximum RM2510 boot, see section Error! Reference source not found..
Operating temperature range	-40		+85	°C	
Maximum allowed temperature ramp during operation			8	°C/min	-40 °C to +85 °C
Operating relative humidity	10		90	% RH	Non-condensing

Unless otherwise noted, Table 3 assume V_{DD} is 3.0 V and temperature is 25 °C.

Table 3 RM2510 Current Consumption

Parameter	Min	Typ	Max	Units	Comments
Transmit		18		mA	
Receive		6		mA	
Sleep		2.5		µA	

3.0 Electrical Specifications

Table 4 Device Load

Parameter	Min	Typ	Max	Units	Comments
Total capacitance			0.5	μF	

Unless otherwise noted, V_{DD} is 3.0 V and temperature is $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$.

Table 5 Digital I/O Type 1

Digital Signal	Min	Typ	Max	Units	Comments
V_{IL} (low-level input voltage)	-0.3		0.6	V	
V_{IH} (high-level input voltage)	$0.8 \times V_{DD}$		$V_{DD} + 0.3$	V	
V_{OL} (low-level output voltage)			0.4	V	
V_{OH} (high-level output voltage)	2.4			V	
Digital current*					
Output source (single pin)		3.7		mA	25 °C
Output sink (single pin)		2.0		mA	25 °C
Input leakage current		50		nA	

* This current level guarantees that the output voltage meets V_{OH} and V_{OL} specifications above.

Table 6 Digital I/O Type 2

Digital Signal	Min	Typ	Max	Units	Comments
V_{IL} (low-level input voltage)	-0.3		0.6	V	
V_{IH} (high-level input voltage)	$0.8 \times V_{DD}$		$V_{DD} + 0.3$	V	
V_{OL} (low-level output voltage, multi-function I/O configured as output)	0		0.6	V	$I_{OL} < 0.6\text{ mA}$, 85 °C
V_{OH} low-level output voltage, multi-function I/O configured as output)	$V_{DD} - 0.6$		V_{DD}	V	$I_{OH} > -0.4\text{ mA}$, 85 °C
Digital current*					
Output source (single pin, multifunction I/O configured as output)		0.4		mA	25 °C
Output sink (single pin, multifunction I/O configured as output)		0.6		mA	25 °C
Input leakage current		50		nA	

* This current level guarantees that the output voltage meets V_{OH} and V_{OL} specifications above.

4.0 Radio

4.1 Detailed Radio Specifications

Table 7 Radio Specifications

Parameter	Min	Typ	Max	Units	Comments
Operating frequency	2.4000		2.4835	GHz	
Number of channels		15			
Channel separation		5		MHz	
Occupied channel bandwidth		2.7		MHz	At -20 dBc

Parameter	Min	Typ	Max	Units	Comments
Frequency Accuracy	-50		+50	kHz	
Modulation					IEEE 802.15.4 DSSS
Raw data rate		250		kbps	
Receiver operating maximum input level		0		dBm	
Receiver sensitivity		-92.5		dBm	At 50% PER, $V_{DD} = 3\text{ V}$, 25 °C
		-90		dBm	At 1% PER, $V_{DD} = 3\text{ V}$, 25 °C, (inferred from 50% PER measurement)
Output power, conducted			+8	dBm	$V_{DD} = 3\text{ V}$, 25 °C
Range*	Indoor	100		m	25 °C, 50% RH, 1 meter above ground, +2 dBi omni-directional antenna
	Outdoor	300		m	

* Actual RF range performance is subject to a number of installation-specific variables including, but not restricted to ambient temperature, relative humidity, presence of active interference sources, line-of-sight obstacles, near-presence of objects (for example, trees, walls, signage, and so on) that may induce multipath fading. As a result, actual performance varies for each instance.

4.2 Antenna Specifications

The antenna must meet specifications in Table 8.

Table 8 Antenna Specifications

Parameter	Value
Frequency range	2.4–2.4835 GHz
Impedance	50 Ω
Maximum VSWR	3:1
Antenna Connector	MMCX

When the RM2510 is placed inside an enclosure, the antenna should be mounted such that the radiating portion of the antenna protrudes from the enclosure, and connected using a coaxial cable. For optimum performance, allow the antenna to be positioned vertically when installed.

5.0 Pinout

The following is the pinout for the RM2510 module.

Table 9 Pinout Assignments for the RM2510

Pin Number	Pin Description	I/O (relative to radio)
1-1	Circuit Common/Ground	Input
1-2	Power Supply (2.75 V to 3.3 V)	Input
1-3	Keying Pin (no function)	N/A
1-4	Data Transmit (Sensor Board to Radio)	Input
1-5	Data Receive (Radio to Sensor Board)	Output
1-6	Diagnostics LED	Output
1-7	Radio Ready-to-Send (also DIM wake-up)	Output
1-8	Radio Clear-to-Send	Output
1-9	Sensor Board Clear-to-Send	Input
1-10	Radio Time Packet	Input
1-11	Radio Baud Rate Input	Input

2-1	Radio Reset Line	Input
2-2	SPI Chip Select	Input
2-3	Keying Pin (no function)	N/A
2-4	SPI Bus (MISO)	Output
2-5	SPI Bus (MOSI)	Input
2-6	SPI Bus (Clock)	Input
2-7	JTAG (TCK)	Input
2-8	JTAG (TDO)	Output
2-9	JTAG (TDI)	Input
2-10	JTAG (TMS)	Input
2-11	Flash Enable	Input

6.0 Physical Drawing

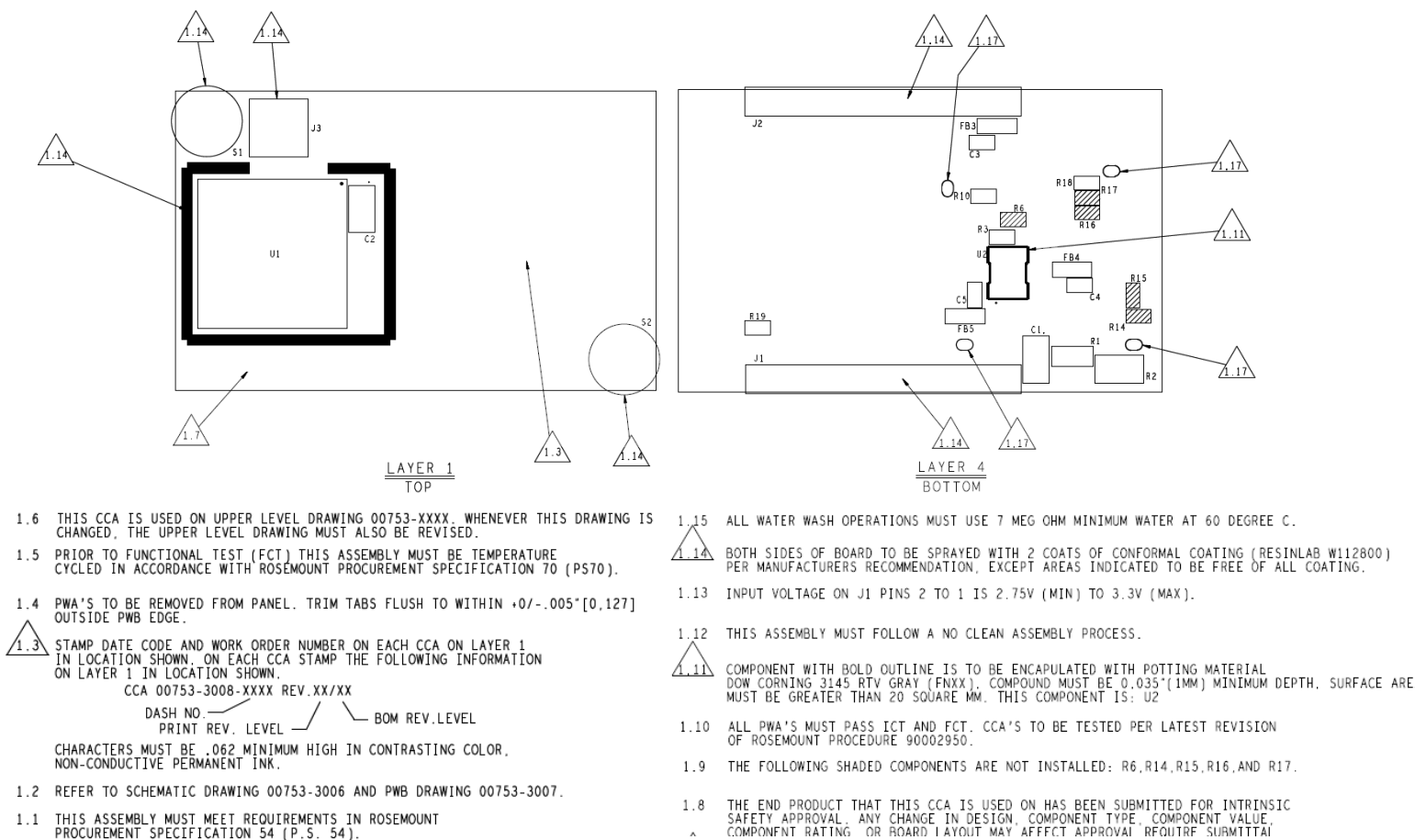


Figure 1 RM2510 Mechanical Drawing

7.0 Regulatory and Standards Compliance

The RM2510 has achieved modular radio certification on a reference design for the United States, Canada and the Europe. The reference design has been certified for Part 15.247 (Intentional Radiator) of the FCC rules and regulations, Industry Canada RSS-210, ETSI EN 300 328 and ETSI EN 301-489-17.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

The RM2510 complies with Part 15.247 modular (Intentional Radiator) FCC rules and regulations. Changes or modifications not expressly approved by Rosemount Inc. could void the user's authority to operate the equipment.

7.1 FCC Testing

In order to fulfill FCC certification requirements, products incorporating the RM2510 must comply with the following:

1. An external label must be provided on the outside of the final product enclosure specifying the FCC identifier as described in 7.3 below.
2. The antenna must be electrically identical to the FCC-approved antenna specifications for the RM2510 as described in 7.2 with the exception that the gain may be lower than specified in Table 14.
3. The device integrating the RM2510 may not cause harmful interference, and must accept any interference received, including interference that may cause undesired operation.
4. An unintentional radiator scan must be performed on the device integrating the RM2510, per FCC rules and regulations, CFR Title 47, Part 15, Subpart B. See FCC rules for specifics on requirements for declaration of conformity.

7.2 FCC-approved Antenna

The FCC-approved antenna specifications for the RM2510 is an antenna with a Maximum gain of +2dBi, vertical polarization, and frequency of 2.4 to 2.485GHz.

7.3 Final FCC Labeling Requirements

The outside of the final product enclosure must have a label with the following (or similar) text specifying the FCC identifier. The FCC ID and

certification code must be in Latin letters and Arabic numbers and visible without magnification.

Contains transmitter module FCC ID: LW2RM2510

Or

Contains FCC ID: LW2RM2510

7.4 IC Testing

The RM2510 is certified for modular Industry Canada (IC) RSS-210 approval. The OEM is responsible for its product to comply with IC ICES-003 and FCC Part 15, Sub. B - Unintentional Radiators. The requirements of ICES-003 are equivalent to FCC Part 15 Sub. B and Industry Canada accepts FCC test reports or CISPR 22 test reports for compliance with ICES-003.

7.5 Final IC Labeling Requirements

The Original Equipment Manufacturer (OEM) must ensure that IC labeling requirements are met. The outside of the final product enclosure must have a label with the following (or similar) text specifying the IC identifier. The IC ID and

certification code must be in Latin letters and Arabic numbers and visible without magnification

Contains IC: 2731A-RM2510

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