RDA Series
Reference Manual

(415) 960-1630 Fax: (415) 964-5181
Document# 7360.0029
Revision A
June 9, 1994

Table of Contents

1 Introduction

This manual describes the installation and operation of the Proxim RDA series radios: the RDA (100-300 mW,121 Kbps) and the RDA2 (100-300 mW, 242 Kbps). In the following sections, the major issues associated with integrating the radio within a system and establishing communication between radios are covered. In addition, a means to test the performance of the radio is described.

This document consists of four major sections: *2) General Information, 3) Theory of Operation, 4) Operation* and *5) Performance Verification Testing. General Information* details the radio specifications and the physical characteristics of the radio board. *Theory of Operation* introduces the primary functional components of the radio and their impact on operation. *Operation* describes the exact procedures to be followed in order to achieve successful communication between radios. *Performance Verification Testing* offers a detailed technique for testing the radio to ensure it complies to its specifications.

2 General Information

> Proxim radios are designed to meet FCC regulations on spread spectrum operation as described in part 15.247 of the code of Federal regulations. However, OEM integration of these radios into equipment may affect radio performance.
>
> A one-time equipment certification is granted by FCC for radio equipped final product. As a result, it is the OEM's responsibility to acquire the FCC certification.

The Proxim RDA series radios are a line of miniature, low power, single board, spread spectrum radio transceivers. This family operates in the 902-928MHz ISM band which has been assigned by the Federal Communications Commission (FCC) for unlicensed use by spread spectrum systems. To help combat any potential interference in this band, the RDA has four independent frequency channels available with full adjacent channel rejection. It also has three additional half channels (seven total) at reduced adjacent channel rejection. The half channels may be used, for example, in alternate cells in a cell-oriented network. The radio is designed to switch channels very rapidly (e.g. for use in repeater or general scanning applications). The RDA2 has three independent frequency channels available with full adjacent channel rejection, since each channel occupies a wider frequency band than those in the RDA.

The RDA series was designed to interface in parallel fashion to a microprocessor bus. The radios have a built-in HDLC controller which implements low level HDLC protocol functions. Since the radio cannot transmit and receive at the same time, it must operate in a half duplex mode. The interface for power, data, and control signals is provided through a 32-pin connector.

All Proxim radios provide a low current Standby mode to simplify power management in applications where power consumption is critical. They also have a carrier detect output signal (CD) that is low when a Proxim compatible spread spectrum signal is present. The received data can be programmed to be gated by this carrier detect signal.

These radios were designed to handle the large range of input signal levels encountered in a dynamic, real-life portable environment. The wide dynamic range allows two radios to operate beside one another, as well as at a distance. An analog Received Signal Strength Indicator (RSSI) output is also provided.

Figure 1 below, is a simplified block diagram of the RDA series radio and illustrates the interaction of the major elements.

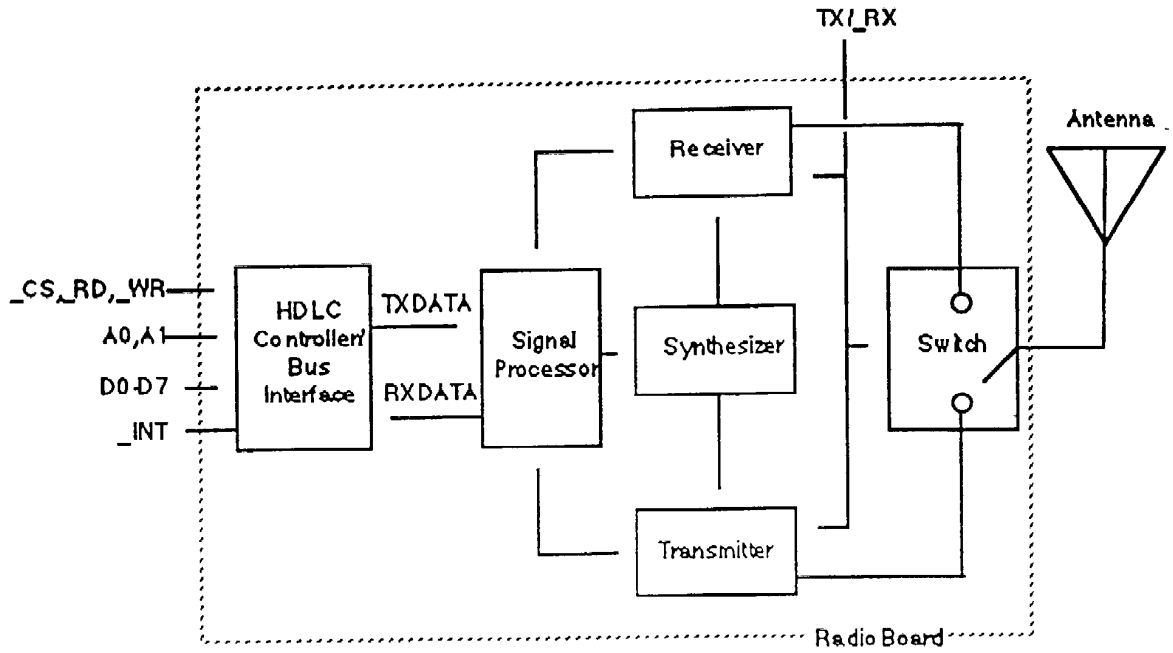

Figure 1 - RDA Series Block Diagram

THE RDA SERIES RADIOS CONTAIN STATIC SENSITIVE DEVICES, AND THEREFORE, SHOULD BE HANDLED USING APPROPRIATE ESD PROCEDURES.

2.1 Specifications

2.1.1 RDA Specifications

General Specifications

Output Power	100-300 mW
Sensitivity (@ $1x10^{-5}$ BER)	-95 dBm (typ), -90 dBm (min)
Frequency Band	902-928 MHz
Number of Channels	4 full channels (7 half channels)
Frequency Control	Synthesized, Software Programmable
Data Rate	121 Kbps

Supplemental Performance Characteristics

1/2 Channel Rejection (3 MHz)	20 dBc (typ)
Adjacent Channel Rejection (6 MHz)	55 dBc (typ)
Alternate Channel Rejection (12 MHz)	60 dBc (typ)
Image Rejection	40 dBc (typ)
meets FCC Part 15.247 (spread spectrum)	
Modulation Bandwidth	
-6 dBc	1.8 MHz (typ)
-40 dBc	4.2 MHz (typ)

Timing

TX turn-on time	100 µsec
TX turn-off time	50 µsec
TX-to-RX switching time	1 msec
RX-to-TX switching time	1 msec
Power-on time (from Standby)	5 msec
Frequency switching time	1 msec

Power

Receive	
5V	65 mA (typ), 75 mA (max)
VBAT	1 µA (typ), 20 µA (max)
Transmit	
5V	65 mA (max)
VBAT (9V)	225 mA
Standby	
5V	<200 µA
VBAT	1 µA (typ), 20 µA (max)
Operating Voltage Range	
5V	4.7V to 5.3V
VBAT	4.5V to 9.0V

Physical Characteristics

Size	2.4" x 3.75" x 0.42"
Weight	2 oz.
Operating Temperature Range	-20° C to +60° C
Storage Temperature Range	-50° C to +85° C

Other Functions

RSSI	Received Signal Strength Indicator
CD	Carrier Detect Indicator

2.1.2 RDA2 Specifications

General Specifications

Output Power	100-300 mW
Sensitivity (@ $1x10^{-5}$ BER)	-90 dBm (min)
Frequency Band	902-928 MHz
Number of Channels	3 full channels
Frequency Control	Synthesized, Software Programmable
Data Rate	242 Kbps

Supplemental Performance Characteristics

Adjacent Channel Rejection (9 MHz)	50 dBc (typ)
Alternate Channel Rejection (12 MHz)	60 dBc (typ)
Image Rejection	40 dBc (typ)
Modulation Bandwidth	
-6 dBc	3.6 MHz (typ)
-40 dBc	8.4 MHz (typ)

Timing

TX turn-on time	100 µsec
TX turn-off time	50 µsec
TX-to-RX switching time	1 msec
RX-to-TX switching time	1 msec
Power-on time (from Standby)	2.5 msec
Frequency switching time	1 msec

Power

Receive	
5V	85 mA (max)
VBAT	1 µA (typ), 20 µA (max)
Transmit	
5V	75 mA (max)
VBAT (9V)	225 mA
Standby	
5V	<200 µA
VBAT	1 µA (typ), 20 µA (max)
Operating Voltage Range	
5V	4.7V to 5.3V
VBAT	4.5V to 9.0V

Physical Characteristics

Size	2.4" x 3.75" x 0.42"
Weight	2 oz.
Operating Temperature Range	-20° C to +60° C
Storage Temperature Range	-50° C to +85° C

Other Functions

RSSI	Received Signal Strength Indicator
CD	Carrier Detect Indicator

2.2 Pinout Description

The radio data/power interface is a 32-pin male connector with 0.025" square posts and 0.1" lead spacing.

RDA Series Radio Pinout Description

Pin	Signal	Function
1-8	D0-D7	The data pins should be connected to the microprocessor data bus.
9	$\overline{RD}$	The read pin controls the radio's read operations.
10	$\overline{WR}$	The write pin controls the radio's write operations.
11	$\overline{CS}$	Chip Select is used to determine the radio's registers.
12-13	A1-A0	The address pins are used for address selection of the registers in the radio's parallel interface section. They should be connected to the microprocessor address bus.
14-16	NC	Not connected.
17-18	GND	Ground.
19	+5V	+5V supply.
20	GND	Ground.
21	NC	Not connected.
22	GND	Ground.
23	$\overline{INT}$	The interrupt pin should be connected to the microprocessor interrupt line. You MUST pull up _INT with a 10K resistor to +5V on your board. The Interrupt Signal is a Level Sensitivity Signal. When an Interupt is generated, this signal will remain low until the Interupt is explicitly cleared by reading or writing to an appropriate register.
24	$\overline{CD}$	Carrier detect (active low) goes active when a valid carrier is detected. Only carriers encoded with the RDA series spreading code are valid.
25	TX/$\overline{RX}$	The transmit/receive line is an input. When high, the radio's transmitter is enabled.
26	GND	Ground.
27	$\overline{STANDBY}$	When set low, this input line resets all digital electronics and puts the radio into its low power state.
28	+5V	+5V supply.
29	RSSI	RSSI (Received Signal Strength Indicator) is an analog output from the demodulator.
30	VBAT	Output stage +5V supply.
31-32	GND	Ground.

2.3 Mechanical Specifications

Figure 2 shows the physical dimensions of the RDA and the RDA2 radios.

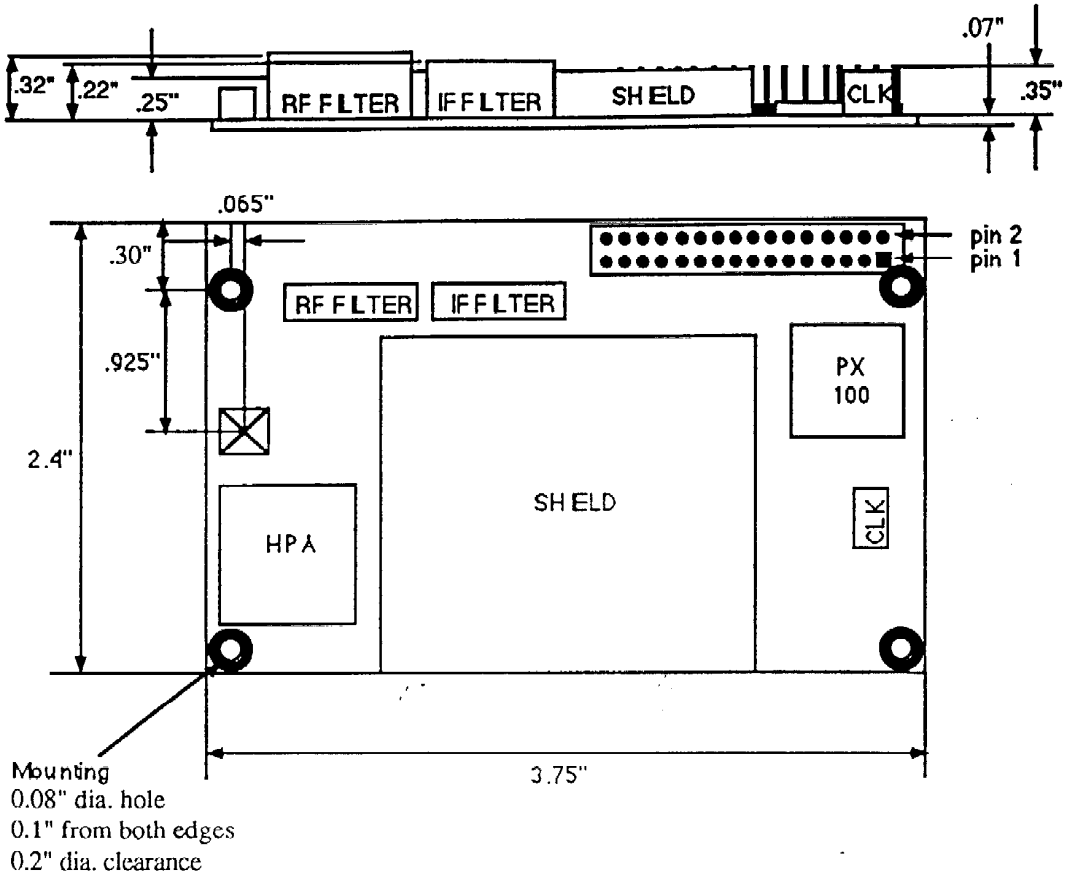

Figure 2 - RDA and RDA2 Physical Dimensions

2.4 Antenna Connection

All Proxim radios include a BFA jack as the antenna interface. Proxim offers BFA compatible cables with an unterminated end.

3 Theory of Operation

This section gives an overview of the components in the RDA series radios. It gives insight into the radio's performance. Section 4 details the radio's operation.

Figure 3 is a block diagram of the RDA series radio.

Figure 4 is an expanded diagram showing the details of the microprocessor bus interface, the HDLC Receive Block, and the HDLC Transmit Block. It shows the various registers accessible by the parallel interface and how they interact with the HDLC controller and radio hardware.

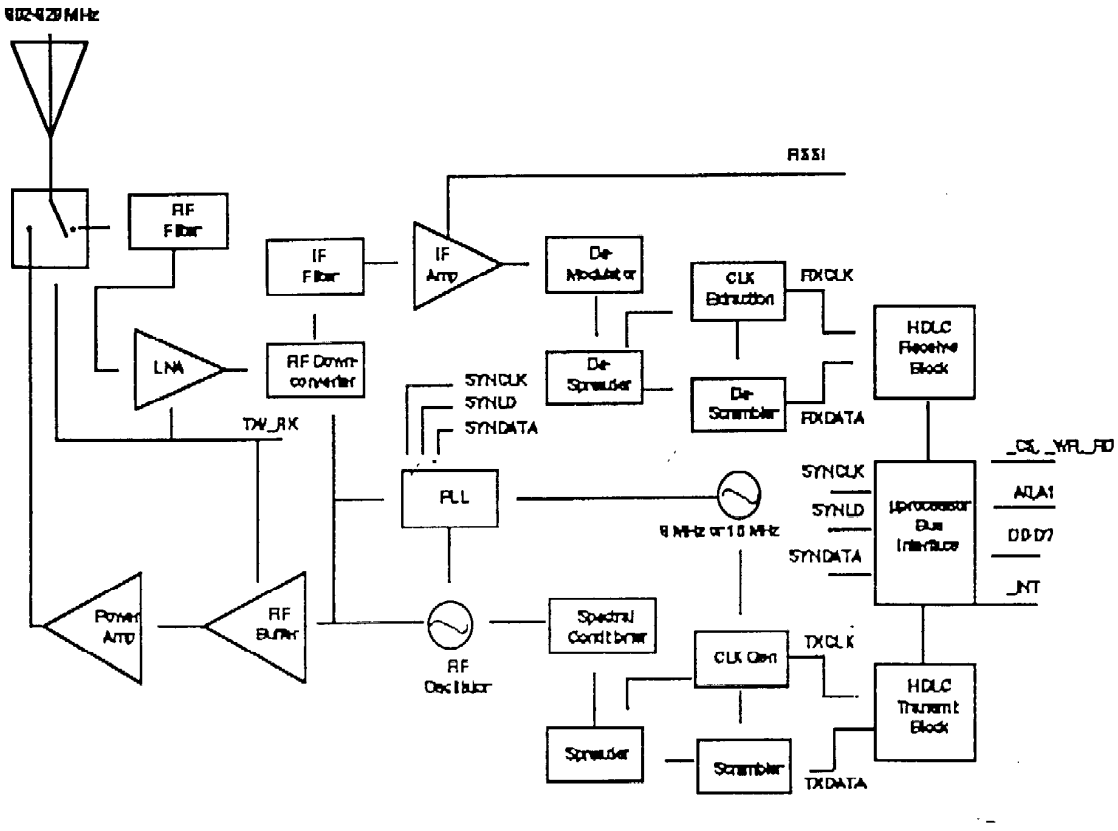

Figure 3 - RDA Series Block Diagram