# Ramp-RM/LT DVK Hardware

## USER'S GUIDE

## VERSION 1.0

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# REVISION HISTORY

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| 1.0 | 30 April 2014 | Initial Release |
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# INTRODUCTION

The Laird RAMP-RM/LT Development Kit is the standard interface for testing and software development on all Laird RAMP-RM/LT products. The kit includes two RAMP modules and two evaluation boards (EVK) with serial interfaces for programming and test control via the Laird Configuration Utility running on a Windows PC. This application note covers the hardware specifications of the RAMP-RM/LT Development Kit.

# HARDWARE

This section details the Development Kit boards for the RM/LT series RAMP modules including the following:

| RM024 | LT1110 | | LT2510 (EOL) | |
|---|---|---|---|---|
| DVK-RM024-FCC<br>DVK-RM024-CE | DVK-PRM210<br>DVK-PRM211<br>DVK-PRM220 | DVK-PRM221<br>DVK-PRM240<br>DVK-PRM241 | DVK-PRM110<br>DVK-PRM111<br>DVK-PRM112<br>DVK-PRM113 | DVK-PRM120<br>DVK-PRM121<br>DVK-PRM122<br>DVK-PRM123 |

The RM024 family of modules can be evaluated using one of the two RM024 development kit part numbers. The individual RM024 part numbers that can be evaluated with each DVK-RM024 kit are listed below along with the required configuration.

*Table 1: RM024 part numbers for the DVK-RM024-FCC dev kit*

| DVK-RM024-FCC | | | |
|---|---|---|---|
| **RM024 p/n** | **Requirements** | | **Settings/Configuration** |
| RM024-S125-C-xx | EEPROM | Enable u.FL for external antenna | Set address 0xC1 bit 5 == 1 |
| | Hardware | Use external antenna (incl.) | Connect external antenna to u.FL |
| RM024-S125-M-xx | EEPROM | Enable integrated chip antenna | Set address 0xC1 bit 5 == 0 |
| | Hardware | None | N/A |
| RM024-P125-C-xx | EEPROM | Enable u.FL for external antenna | Set address 0xC1 bit 5 == 1 |
| | Hardware | Use external antenna (incl.) | Connect external antenna to u.FL |
| RM024-P125-M-xx | EEPROM | Enable integrated chip antenna | Set address 0xC1 bit 5 == 0 |
| | Hardware | None | N/A |
| RM024-S10-C-xx | EEPROM | Enable u.FL for external antenna | Set address 0xC1 bit 5 == 1 |
| | EEPROM | Set output to low power | Set address 0x63 == 0x03 |
| | Hardware | Use external antenna (incl.) | Connect external antenna to u.FL |
| RM024-S10-M-xx | EEPROM | Enable integrated chip antenna | Set address 0xC1 bit 5 == 0 |
| | EEPROM | Set output to low power | Set address 0x63 == 0x03 |
| | Hardware | None | N/A |
| RM024-P10-C-xx | EEPROM | Enable u.FL for external antenna | Set address 0xC1 bit 5 == 1 |
| | EEPROM | Set output to low power | Set address 0x63 == 0x03 |
| | Hardware | Use external antenna (incl.) | Connect external antenna to u.FL |
| RM024-P10-M-xx | EEPROM | Enable integrated chip antenna | Set address 0xC1 bit 5 == 0 |
| | EEPROM | Set output to low power | Set address 0x63 == 0x03 |
| | Hardware | None | N/A |

*Table 2: RM024 part numbers for the DVK-RM024-CE dev kit*

| DVK-RM024-CE | | | |
|---|---|---|---|
| **RM024 p/n** | **Requirements** | | **Settings/Configuration** |
| RM024-S10-C-xx | EEPROM | Enable u.FL for external antenna | Set address 0xC1 bit 5 == 1 |
| | Hardware | Use external antenna (incl.) | Connect external antenna to u.FL |
| RM024-S10-M-xx | EEPROM | Enable integrated chip antenna | Set address 0xC1 bit 5 == 0 |
| | Hardware | None | N/A |
| RM024-P10-C-xx | EEPROM | Enable u.FL for external antenna | Set address 0xC1 bit 5 == 1 |
| | Hardware | Use external antenna (incl.) | Connect external antenna to u.FL |
| RM024-P10-M-xx | EEPROM | Enable integrated chip antenna | Set address 0xC1 bit 5 == 0 |
| | Hardware | None | N/A |

**Note:** RM024-x50, 50 mW CE modules have been replaced by the RM024-x10 modules due to changes to CE regulations, see EN 300 328 V1.7.1 for more information.

## RM/LT Series DVK Board

The RM and LT series DVK board is provided so the developer can use a standard PC interface to operate the transceivers and to aid in system integration. It uses an RS232 or USB data format to interface to the transceiver.

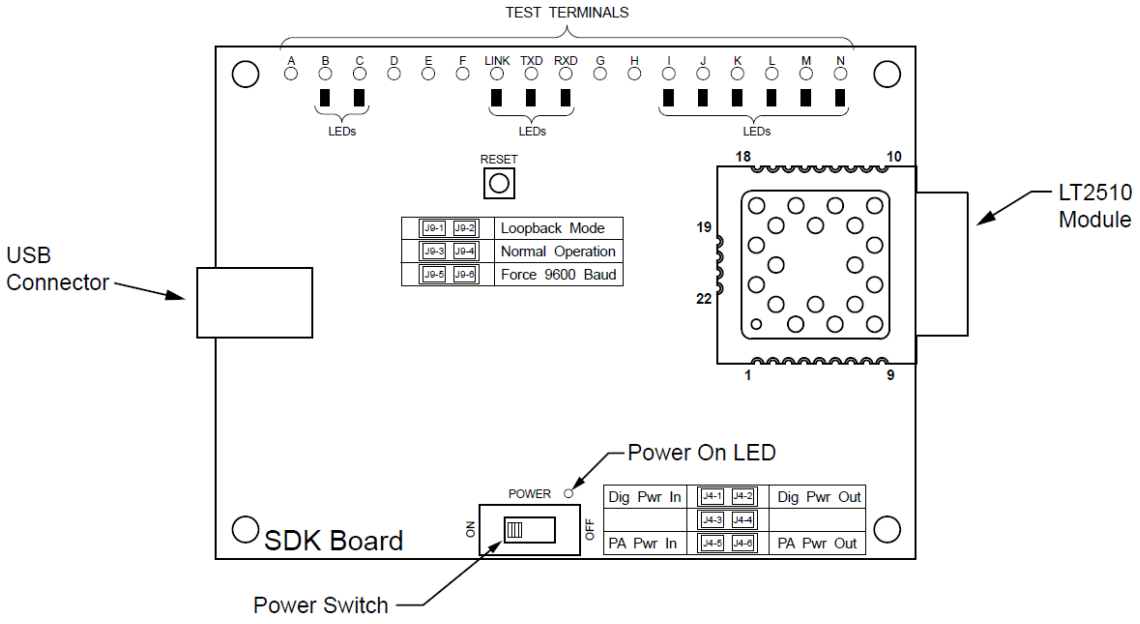


*Figure 1: DVK Board with USB Connector*

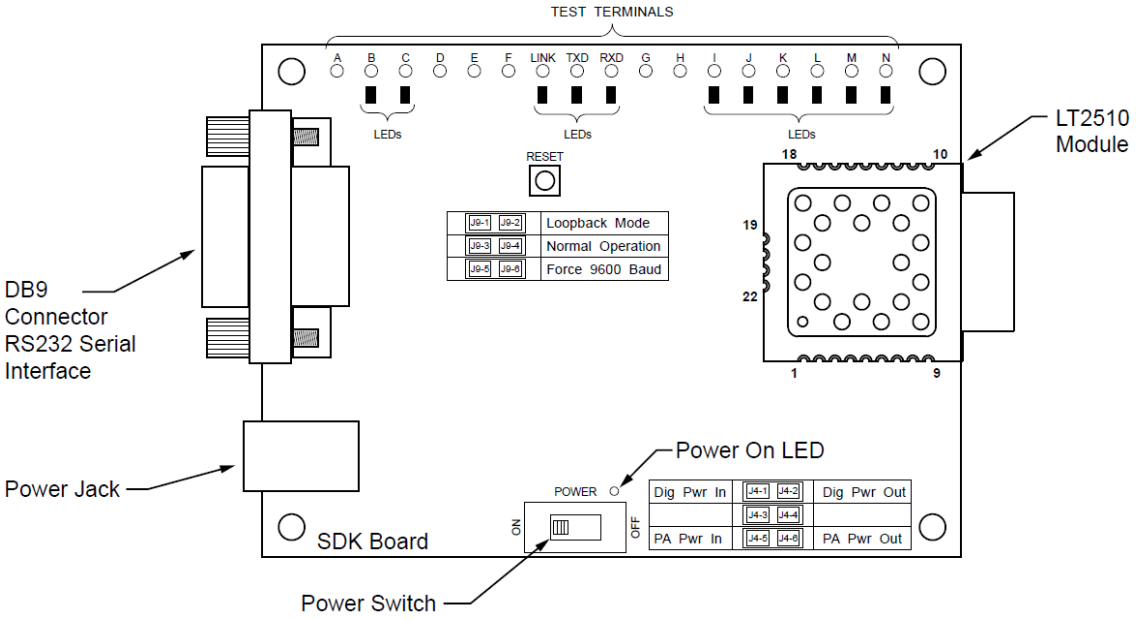


*Figure 2: DVK Board with DB9 Connector*

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**Note:** The LEDs located on the front edge of the board continuously show the configuration and operation of the DVK board. Refer to Table 3 for definitions of the LEDs, and

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Table 4 for DB9 connector pin assignments.

*Table 3: RM024 DVK LEDs*

| LED | LED Color | Purpose |
|---|---|---|
| B | Green | This LED illuminates when GIO_6 is low. |
| C | Red | This LED illuminates when GIO_4 is low. |
| I | Green | This LED illuminates when 9600_BAUD is high. |
| J | Red | This LED illuminates when GIO_7 is low. |
| K | Red | This LED illuminates when GIO_3 is low. |
| L | Green | This LED illuminates when GIO_2 is low. |
| M | Red | This LED illuminates when GIO_1 is low. |
| N | Green | This LED illuminates when GIO_0 is low. |
| LINK | Red | This LED illuminates when In_Range is high. |
| TXD | Green | This LED illuminates when TXD is low. |
| RXD | Red | This LED illuminates when RXD is low. |
| Power | Green | This LED illuminates when the POWER switch is turned on and the module is receiving power. |

*Table 4: DB9 Pins*

| DB9 Pin | Signal Name | Description | Direction |
|---|---|---|---|
| 1 | DCD | Data Carrier Detect | I |
| 2 | RXD | Received Data | I |
| 3 | TXD | Transmitted Data | O |
| 4 | DTR | Data Terminal Ready | O |
| 5 | GND | Signal Ground | |
| 6 | DSR | Data Set Ready | I |
| 7 | RTS | Request to Send | O |
| 8 | CTS | Clear to Send | I |
| 9 | RI | Ring Indicator | I |

**Note:** I/O direction is relative to the PC.

## Power Switch

The RM024 DVK board is equipped with a power switch. Use this switch to turn the power to the board on and off. This power switch should be turned **off** when the USB or power supply cable is connected or disconnected to prevent possible damage to the board. When set to **OFF**, power is removed from the RM series transceiver and the development board.

## Jumper Usage

The RM024 DVK board utilizes a set of jumpers to accomplish certain tasks. There are two sets of jumpers, the J4 set and the J9 set.

### *Jumper Set J4*

Use the J4 set of jumpers to complete the circuits that supply power to the radio. There are two jumpers and *both jumpers* **MUST** *be properly installed* for the module to operate. A jumper **MUST** be installed on J4-1 and J4-2 to supply power to the radio itself. Another jumper MUST also be installed on J4-5 and J4-6 to supply power to the power amplifier.

### *Jumper Set J9*

Use the J9 set of jumpers to control how the development kit board operates. Only one jumper is used with this jumper set. There are three operational modes:

- **Loopback** – Install the jumper on pins J9-1 and J9-2 to operate the unit in loopback mode. This means that the radio receives data and then transmits the same data. The loop is on the serial interface of the module and points back to the radio. This jumper is useful for range testing.
- **Normal Operation** – Install the jumper on pins J9-3 and J9-4 to operate the unit in its normal mode. This means that the radio operates however it is configured using the DVK software application.
- **Force 9600 Baud** – Install the jumper on pins J9-5 and J9-6 to operate the unit only at 9600 Baud. This is a recovery mode that is used when the user is unable to communicate with the radio. This mode places the unit in a known operating state so the user can go in and access the programmed data via the development software.

*Table 5: J4 and J9 Jumper Pins*

| Jumper ID | Label | Usage |
|---|---|---|
| J4-1 | Dig Pwr In | A jumper **MUST** be connected to these two pins for operation. This is the power supply circuit for the radio. |
| J4-2 | Dig Pwr Out | |
| J4-3 | Not Used | Not Used |
| J4-4 | Not Used | Not Used |
| J4-5 | PA Pwr In | A jumper **MUST** be connected to these two pins for operation. This is the power supply circuit for the power amplifier. |
| J4-6 | PA Pwr Out | |
| J9-1 | Loopback | To configure the radio for loopback operation, connect a jumper to these two pins.<br>**Note:** You may **NOT** connect a jumper to the Normal Operation or Force 9600 Baud pins at the same time. |
| J9-2 | Loopback | |
| J9-3 | Normal Operation | During normal operation, connect a jumper to these two pins.<br>**Note:** You may **NOT** connect to the Loopback or Force 9600 Baud pins at the same time. |
| J9-4 | Normal Operation | |
| J9-5 | Force 9600 Baud | To force the radio to operate at 9600 Baud, connect a jumper to these two pins.<br>**Note:** You may **NOT** connect to the Loopback or Normal Operation pins at the same time. |

## Interfacing the RM DVK to RS232 Hardware

The development kit serial board is a DCE (Data Communications Equipment) device. A DCE device is wired to the interface directly with a DTE (Data Terminal Equipment) device. Typically, a DTE device is a PC, while a DCE device is a peripheral. To interface a DCE device to other DCE device or a DTE device to another DTE device, a null modem is required. The null modem swaps pins to convert a DCE device to a DTE device, and vice-versa. Normally, a null modem consists of a female and a male DB9 connector. A typical null modem configuration is shown in Table 6.

*Table 6: Null modem pin configuration*

| DB9 Pin | Signal | DCE Direction | DTE Pin | Signal Name | DTE Direction | Null Modem Female DB9 |
|---|---|---|---|---|---|---|
| 1 | DCD | O | 1 | I | 1 | 4 or NC |
| 2 | RXD | O | 2 | I | 2 | 3 |
| 3 | TXD | I | 3 | O | 3 | 2 |
| 4 | DTR | I | 4 | O | 4 | 6 and 1 or NC |
| 5 | GND | 5 | GND | 5 | | |
| 6 | DSR | 0 | 6 | I | 6 | 4 or NC |
| 7 | RTS | I | 7 | O | 7 | 8 |
| 8 | CTS | 0 | 8 | I | 8 | 7 |
| 9 | RI | 0 | 9 | I | 9 | NC |

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