RNXV Dual Relay Evaluation Board User's Guide

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ISBN: 978-1-62077-724-4

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Object of Declaration: RNXV Dual Relay Evaluation Board

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This declaration of conformity is issued by the manufacturer.
The development/evaluation tool is designed to be used for research and development in a laboratory environment. This development/evaluation tool is not a Finished Appliance, nor is it intended for incorporation into Finished Appliances that are made commercially available as single functional units to end users under EU EMC Directive 2004/108/EC and as supported by the European Commission's Guide for the EMC Directive 2004/108/EC (8th February 2010).
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Signed for and on behalf of Microchip Technology Inc. at Chandler, Arizona, USA

Derek Carlson
VP Development Tools

16-July-2013
Date

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Preface

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DSXXXXXA", where "XXXXX" is the document number and "A" is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® IDE online help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the RNXV Dual Relay Evaluation Board User's Guide. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Warranty Registration
- Recommended Reading
- The Microchip Web Site
- Development Systems Customer Change Notification Service
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes how to use the RNXV Dual Relay Evaluation Board. The manual layout is as follows:

- **Chapter 1. "Overview"** – This chapter describes the RNXV Dual Relay Evaluation Board as a dual relay I/O reference design that demonstrates the RN171XV series of Wi-Fi® modules and RN41/42XV series of Bluetooth platforms.
- **Chapter 2. "Getting Started"** – This chapter describes the hardware and software setup for RNXV Dual Relay Evaluation Board which enables users to evaluate the RNXV 802.11 b/g (Wi-Fi) or RNXV 802.15.1 (Bluetooth®) based modules.

- **Chapter 3. "Application Interface Concerns"** – This chapter provides design concerns related to powering the evaluation board, sensor interface settings, mode settings, and restoring factory settings for RN171XV and RN41/42XV modules mounted on RNXV Evaluation Board.
- **Appendix A. "RN-XV-RD2 Evaluation Board Schematic and PCB Details"** – This appendix provides the RN-XV-RD2 Evaluation Board schematic, PCB layout and Bill of Materials (BOM).

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	*MPLAB® IDE User's Guide*
	Emphasized text	...is the *only* compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	*File>Save*
Bold characters	A dialog button	Click **OK**
	A tab	Click the **Power** tab
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
Plain Courier New	Sample source code	`#define START`
	Filenames	`autoexec.bat`
	File paths	`c:\mcc18\h`
	Keywords	`_asm, _endasm, static`
	Command-line options	`-Opa+, -Opa-`
	Bit values	`0, 1`
	Constants	`0xFF, 'A'`
Italic Courier New	A variable argument	*`file`*`.o`, where *`file`* can be any valid filename
Square brackets [ ]	Optional arguments	`mcc18 [options]` *`file`* `[options]`
Curly brackets and pipe character: { | }	Choice of mutually exclusive arguments; an OR selection	`errorlevel {0|1}`
Ellipses...	Replaces repeated text	`var_name [, var_name...]`
	Represents code supplied by user	`void main (void) { ... }`

WARRANTY REGISTRATION

Please complete the enclosed Warranty Registration Card and mail it promptly. Sending in the Warranty Registration Card entitles you to receive new product updates. Interim software releases are available at the Microchip web site.

RECOMMENDED READING

This user's guide describes how to use the RNXV Evaluation Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

RN171 Module Data Sheet (DS75084)

RN171XV Module Data Sheet

RN41 Module Data Sheet

RN42 Module Data Sheet

RN41XV-RN42XV Module Data Sheet

PICDEM™ PIC18 Explorer Demonstration Board User's Guide (DS51721)

Explorer 16 Development Board User's Guide (DS51589)

WiFly Command Reference, Advanced Features and Applications User's Guide

THE MICROCHIP WEB SITE

Microchip provides online support through our web site at http://www.microchip.com. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
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The Development Systems product group categories are:

- **Compilers** – The latest information on Microchip C compilers and other language tools. These include the MPLAB® C compiler; MPASM™ and MPLAB 16-bit assemblers; MPLINK™ and MPLAB 16-bit object linkers; and MPLIB™ and MPLAB 16-bit object librarians.
- **Emulators** – The latest information on the Microchip MPLAB REAL ICE™ in-circuit emulator.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debugger, MPLAB ICD 3.
- **MPLAB® IDE** – The latest information on Microchip MPLAB IDE, the Windows® Integrated Development Environment for development systems tools. This list is focused on the MPLAB IDE, MPLAB SIM simulator, MPLAB IDE Project Manager and general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include the MPLAB PM3 device programmers and the PICkit™ 3 development programmers.

CUSTOMER SUPPORT

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- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or FAE for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through our web site at: http://support.microchip.com

DOCUMENT REVISION HISTORY

Revision A (December 2013)

This is the initial released version of the document.

NOTES:

Chapter 1. Overview

1.1 INTRODUCTION

The RNXV Dual Relay Evaluation Board is a dual relay I/O reference design that demonstrates the RN171XV series of Wi-Fi® modules and RN41/42XV series of Bluetooth® platforms. This convenient reference design includes a USB cable that connects directly from the board to a computer/laptop for configuring the module, over the UART. The board has two relays capable of switching up to 240 volts and multiple push buttons for reset, Ad hoc/WPS mode, and AP mode. Also includes status LEDs and jumpers for quickly evaluating the RN171XV series of modules. The board has connectors to connect to the RNXV module, as well as headers that enable for prototyping. It is compatible with all RNXV antenna options. The kit does not include any RNXV modules.

The RNXV modules with Wi-Fi connectivity or Bluetooth are helpful in replacing the existing systems with 802.15.4 modules. The RNXV modules are pre-loaded with firmware to simplify integration and minimize applications development time. The modules are based on the popular 2 x 10 (2mm) socket footprint often found in embedded applications.

The RNXV Dual Relay Evaluation Board (RN-XV-RD2) details can be downloaded from the Microchip web site http://www.microchip.com/RN-XV-RD2.

This chapter discusses the following topics:

- RNXV Dual Relay Evaluation Board Features
- RNXV Dual Relay Evaluation Kit Contents and Part Details
- RNXV Dual Relay Evaluation Board Contents
- RNXV Dual Relay Evaluation Board Related Demo Applications

1.2 RNXV DUAL RELAY EVALUATION BOARD FEATURES

The RNXV Dual Relay Evaluation Board has the following features:

- Supports ultra low-power FCC/CE/IC certified 2.4 GHz IEEE 802.11b/g RN171 module through RN171XV
- Supports low-power FCC/CE/IC certified 2.4 GHz IEEE 802.15.1 RN41/42 modules through RN41/42XV
- Supports several antenna options, depending on the RN171XV, RN41XV and RN42XV modules selected
- Powers up RN171XV, RN41XV and RN42XV modules
- Reference design for evaluating the RN171XV 802.11 b/g Wi-Fi module
- Kit includes a standard USB cable that connects directly from the board to a PC for programming the module over the UART
- Contains two 10-amp relays capable of switching up to 240V
- Built-in temperature sensor
- External temperature probe connector
- Status LEDs (3) that mimic the LEDs on the RN171XV module supports debugging
- Four push button switches and jumpers to simplify development

- Ten GPIO pins accessible via the 3.3V headers
- Voltage regulator
- Supports several RN171XV antenna options: Wire, SMA connector, U.FL connector
- WPS (FN) push button for easy configuration of RN171XV Module
- Reset (RST) push button wakes the RN171XV module
- Hardware interface: USB via FTDI chipset
- Brings the RNXV signals out on headers for easy debugging
- The evaluation board's moisture sensitivity level (MSL) is 1
- Dimensions - 1150 mm x 960 mm

1.3 RNXV DUAL RELAY EVALUATION KIT CONTENTS AND PART DETAILS

The package kit contents contain the following development tools listed in Table 1-1 with part number details.

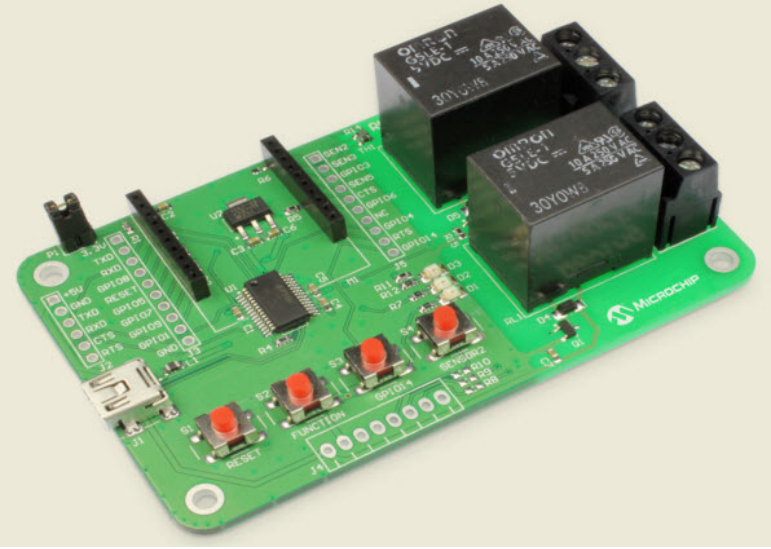
1.3.1 Kit Contents

TABLE 1-1: RNXV DUAL RELAY EVALUATION KIT CONTENTS

Description	Part Number
RNXV Dual Relay Evaluation Board	RN-XV-RD2
USB Cable	—

Figure 1-1 illustrates the evaluation kit contents of RN-XV-RD2.

FIGURE 1-1: EVALUATION KIT CONTENTS



RN-XV-RD2

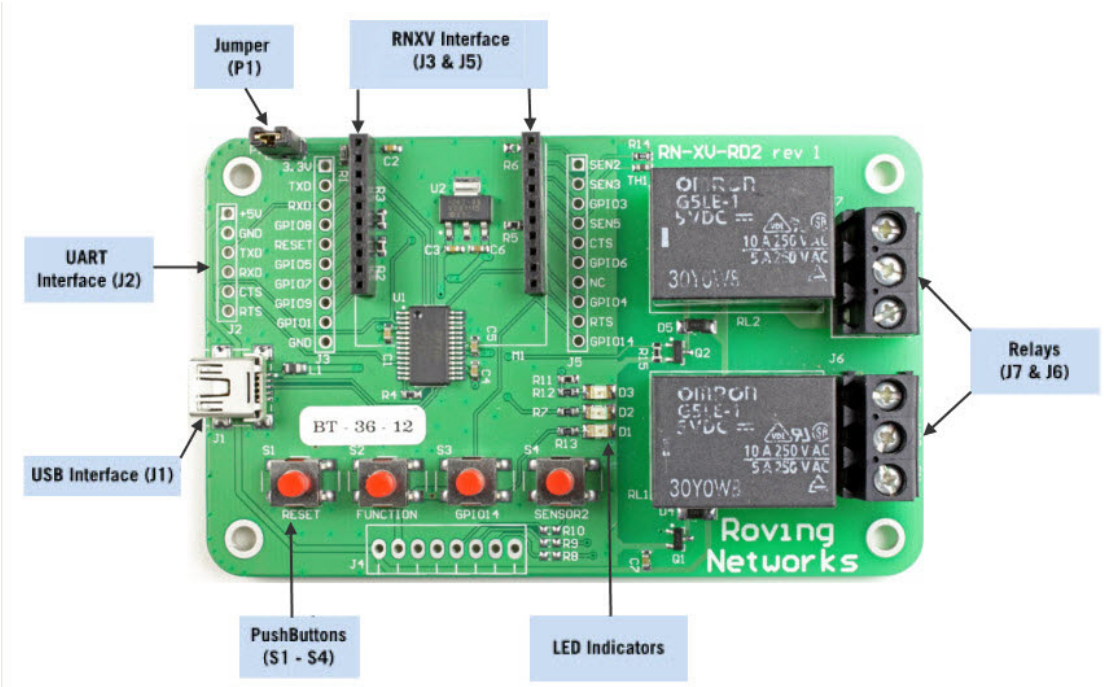
RNXV Dual Relay Evaluation Board with USB cable

Note: The RNXV modules such as RN171XV, RN41XV or RN42XV are sold separately and are not part of the standard RN-XV-RD2 Dual Relay Evaluation Kit.

1.4 RNXV DUAL RELAY EVALUATION BOARD CONTENTS

This section describes the hardware for RN-XV-RD2 Evaluation board, which enables user to evaluate the RNXV modules. The RNXV modules, which are sold separately, is mounted on the evaluation board and contains the RNXV Wi-Fi or Bluetooth. Figure 1-2 shows the RN-XV-RD2 components.

FIGURE 1-2: RN-XV-RD2 EVALUATION BOARD



UART Interface (J2)

RX - input to evaluation board
TX - output from evaluation board

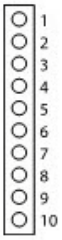
Pin	Description
1	VBUS (5 V)
2	GND
3	RXD
4	TXD
5	RTS
6	CTS

RNXV Interface (J3)

RX - input to evaluation board
TX - output from evaluation board

Pin	Description
1	3.3 VDC output
2	TXD
3	RXD
4	GPIO8
5	RESET
6	GPIO5
7	GPIO7
8	GPIO9
9	GPIO1
10	GND

RNXV Interface (J5)



RX - input to evaluation board
TX - output from evaluation board

Pin	Description
1	Sensor 2 (3.3-V tolerant)
2	Sensor 3 (3.3-V tolerant)
3	GPIO3
4	Sensor 5 (3.3-V tolerant)
5	CTS
6	GPIO6
7	Unused
8	GPIO4
9	RTS
10	GPIO14

Table 1-2 provides detail on the evaluation board LED indicators.

TABLE 1-2: RN-XV-RD2 EVALUATION BOARD LED INDICATORS

Condition	Red LED	Yellow LED	Green LED
On solid	—	—	Connected over TCP
Fast blink	Not Associated	Rx/Tx data transfer	No IP address
Slow blink	Associated, no Internet	—	IP address OK
Off	Associated, Internet OK	—	—

Table 1-3 provides detail on the evaluation board components.

TABLE 1-3: RN-XV-RD2 EVALUATION BOARD COMPONENTS

Component	Description
Connection Socket for the RNXV	The RN-XV module's pins slide into the socket.
Three Status LEDs	These LEDs mimic the LEDs on the RNXV.
Four Push Button Switches	These switches are hard-wired to the RNXV module and provide reset, ad hoc/WPS mode, access to sensor 2, and access to GPSW (GPIO04). The switches are not used with Bluetooth module.
Two 10-amp, 250-V Relays	The board has two relays with connectors (J7 and J6) that can be connected to a variety of electronics or appliances. After programming the module, the connected electronics can be operated remotely over Wi-Fi or Bluetooth.
Built-in Temperature Sensor	The board includes a temperature sensor (SEN5) that enables he module to wake or sleep depending on the ambient temperature.
External Temperature Probe Connector	An external temperature probe can be attached to the board using the connector at SEN3.
USB Cable	A USB cable connected to the board enables direct connection from the board to the computer, e.g., for programming the module over the UART.
10 GPIO pins	The board contains access to 10 GPIO pins via the 3.3V headers at J3 and J5.
Voltage Regulator	The voltage regulator controls the voltage levels on the board.

Table 1-4 gives detail on the hardware availability with module interface.

TABLE 1-4: RN-XV-RD2 EVALUATION KIT HARDWARE AVAILABILITY W/ MODULE INTERFACE

Hardware	Description	RN-XV-RD2 with RN171XV	RN-XV-RD2 with RN41/42XV
Evaluation Board	Contains connectors for Wi-Fi/Bluetooth modules.	For RN171XV module	For RN41XV and RN42XV module
Power Up	Interface for powering up the evaluation boards.	USB	USB
LEDs	To indicate status and for debugging.	Available	Available
Push Buttons	RESET and WPS (Wi-Fi Protected Setup) mode.	Available	No
10-Pin Sensor Interface	Connectors for analog sensor interface supported based on the modules used.	Available	No
Communication Interface	UART and USB	Available	Available
USB Connector On-board	Provides power to the evaluation board and supports communication (COM Port).	Available	Available
Antenna Connections	Supported by RNXV modules based on the module selected.	NA	NA

1.5 RNXV DUAL RELAY EVALUATION BOARD RELATED DEMO APPLICATIONS

Resources related to RN-XV-RD2 can be downloaded from the Microchip web site http://www.microchip.com/RN-XV-RD2.

Note: RN171 module firmware on the RN171XV can be upgraded to the latest version through FTP update.

For additional information on FTP update and commands, refer to "*WiFly Command Reference, Advanced Features and Applications User's Guide*" from the Microchip web site http://www.microchip.com.

For more information on Bluetooth module links, refer to "*Bluetooth Command Reference and Advanced Information User's Guide*" from the Microchip web site http://www.microchip.com.

NOTES:

Chapter 2. Getting Started

2.1 INTRODUCTION

This chapter describes the hardware and software setup for RNXV Dual Relay Evaluation Board, which enable users to evaluate the RNXV 802.11 b/g (Wi-Fi) or RNXV 802.15.1 (Bluetooth) based modules. The RNXV modules, which are sold separately, mounts on the evaluation board connector slot and contains the RN171 Wi-Fi module and RN41/42 Bluetooth modules. The board connects to a PC or embedded controllers via the standard USB cable serial port interface. The board has two relays capable of switching up to 240 volts. The evaluation board also provides two push button switches to control (Wi-Fi Protected Setup) WPS mode and to reset the module without any software configuration. The board has connectors to drop in the RNXV, as well as headers that enable wires access to the RNXV signals.

This chapter discusses the following topics:

- Hardware Requirements
- Software/Utility Requirements
- Modules Configuration

2.2 HARDWARE REQUIREMENTS

The RN-XV-RD2 requires an RN171XV or RN41XV/RN42XV board along with a USB cable as its hardware setup for connection with computer/laptop and to run the demo applications.

To setup the hardware, perform the following steps:

1. Mount the RNXV module onto the socket at M1 on the RN-XV-RD2 evaluation board. If the header is not keyed, the user must orient the module as shown in Figure 2-1. The RNXV provides power to the evaluation board.
2. Connect the USB cable to a USB port on host computer and the other end to the RN-XV-RD2 board. Connect the other side of the USB cable to the evaluation board at J2.
3. Download and install the FTDI drivers from the Microchip web site "http://ww1.microchip.com/downloads/en/DeviceDoc/FTDI-Drivers.zip" FTDI Chipset Drivers.
4. Once the FTDI Drivers are installed, the COM port is automatically assigned based on the active connection.
5. Ensure a jumper is used to connect/shot pins on J1.

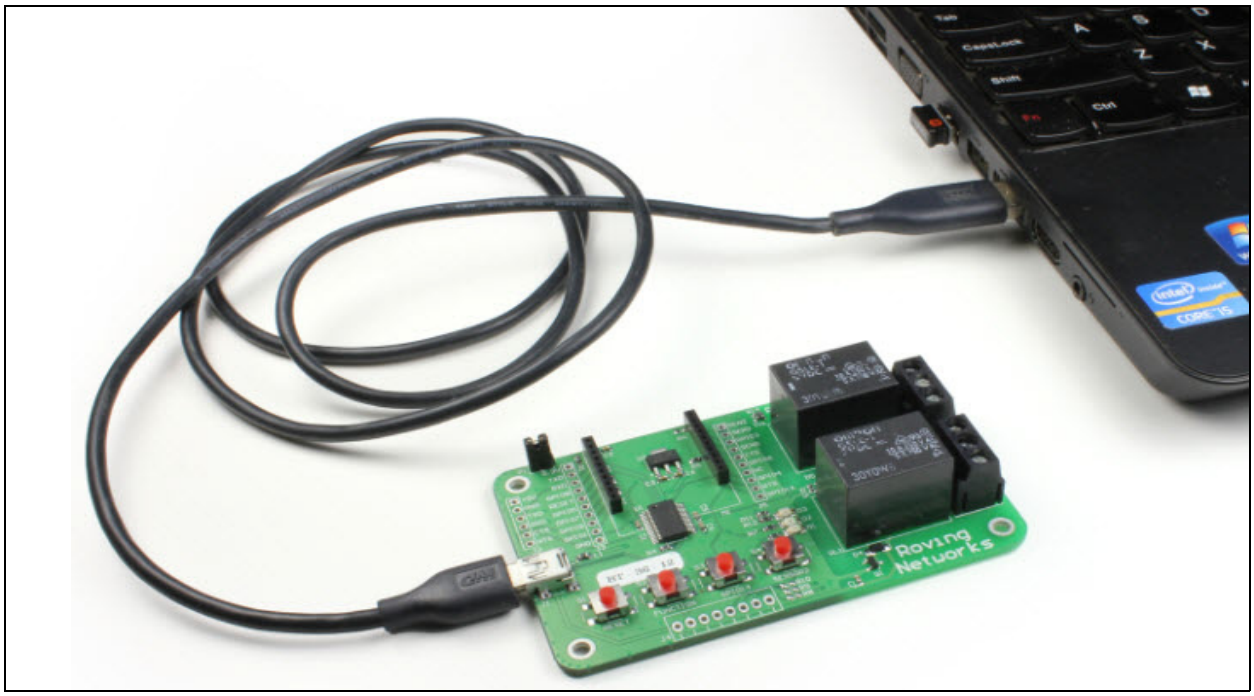
Note: If the jumper is removed for J1, these pins can be used to probe voltage levels on the board. However, if J1 pins are without a jumper, the board does not function.

The RN-XV supports several antenna options. The RN-XV-W, which is recommended to be used for this evaluation, is shipped with a wire antenna. Therefore, there is no need to install a separate antenna for the evaluation described in this document.

Note:	RN171XVW is a standard configuration, industrial Temperature (-40 to +85 C) 802.15.4 replacement solution with 1/4 inch wire antenna.

Figure 2-1 shows the completed RN-XV-RD2 evaluation board hardware setup with Host Computer. Any RN171XV or RN41XV/RN42XV boards can be mounted on the Module Connector M1.

FIGURE 2-1: HARDWARE SETUP WITH HOST COMPUTER



2.3 SOFTWARE/UTILITY REQUIREMENTS

The following software tools/utilities are required to run the demo applications:

- Terminal Emulator Application such as TeraTerm (for Windows OS) or CoolTerm (for MAC OS) - The Terminal Emulator program is used to send the configuration commands to the module over a UART interface. The emulator also displays information transmitted from the module.
- RN-XV-RD2 board uses the FTDI chip set. Windows automatically installs the drivers for the USB-serial cable. If the drivers are not automatically installed, download and install the FTDI drivers from the Microchip web site at http://ww1.microchip.com/downloads/en/DeviceDoc/FTDI-Drivers.zip FTDI Chipset Drivers.
- Once the FTDI drivers are installed, the COM port is automatically assigned based on the active connection.

2.4 MODULES CONFIGURATION

RN171XV CONFIGURATION

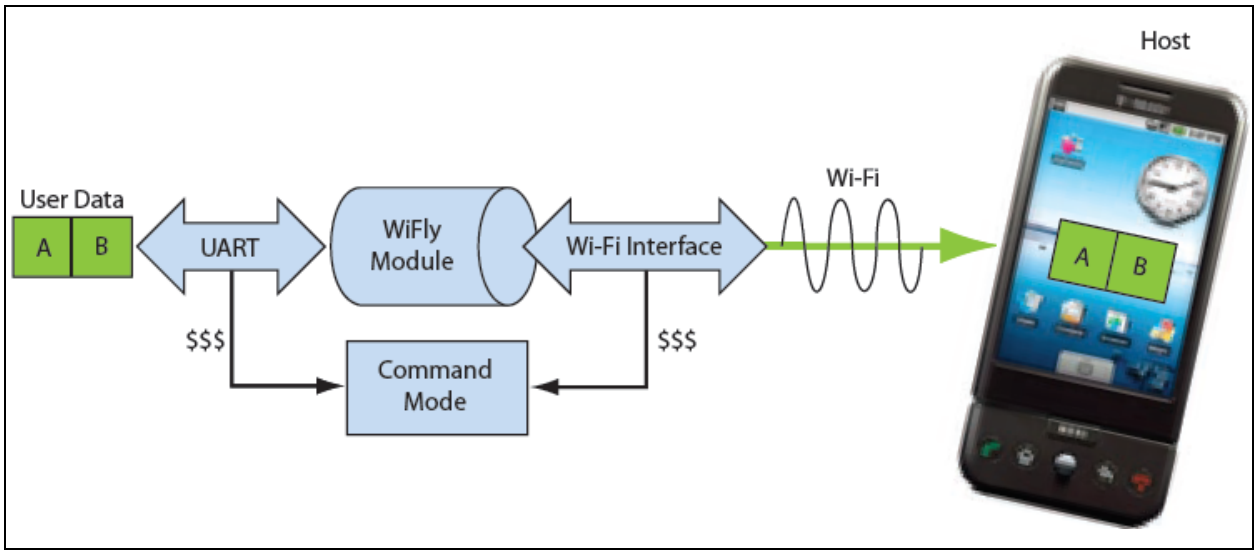
RN171XV is mounted on RNXV Evaluation Kit. The RN171 operates in two modes:

- Data mode (default)
- Command mode

2.4.1 Data Mode

In Data mode, the RN171 module is essentially a data pipe. When the module receives data over Wi-Fi, it strips the TCP/IP headers and trailers, and passes the user data to the UART. When data is written to the UART, the module constructs the TCP/IP packet and sends it out over Wi-Fi. Thus, the entire process of sending/receiving data to the host is transparent to the end application/user microcontroller.

FIGURE 2-2: APPLICATION INTERFACE FOR DATA AND COMMAND MODES



2.4.2 Command Mode

By default, the RN171 module is in Data mode. Sending an escape sequence $$$ causes the module to enter the Command mode. Once in Command mode, the module can be configured using simple ASCII commands. To exit Command mode and return to the Data mode, type `exit <cr>`. Figure 2-2 shows an application interface for Data and Command modes.

Basic configuration requires the wireless network access point's name (SSID) and the authentication password. The RN171 module can associate with only one network at a time. It is recommended to begin evaluation by configuring the RN171 module using an open access point to simplify the setup.

The following two methods are used to configure the RN171 module:

1. Over the UART, that is connected to a computer/laptop or to a microcontroller
2. Through Wi-Fi using Ad hoc networking

Terminal emulator utility is required to type the commands and to monitor the activity/transactions.

2.4.3 Configuration Using a USB Cable

The evaluation board uses a USB cable to enable the host computer to communicate with the RN171 module on the evaluation board. The procedures in this section describe how to use a terminal emulator to go into Configuration mode, send commands to find networks, associate with an access point, and save configuration.

2.4.3.1 CONFIGURE THE MODULE USING A TERMINAL EMULATOR

Either the TeraTerm (for Windows OS) or CoolTerm (for Mac OS-X), terminal emulator utility can be used. Also legacy evaluation boards use a USB-to-serial cable for connecting the evaluation board with the computer/laptop. When using the RN171 evaluation board, use the COM port to which the USB-to-serial cable is connected.

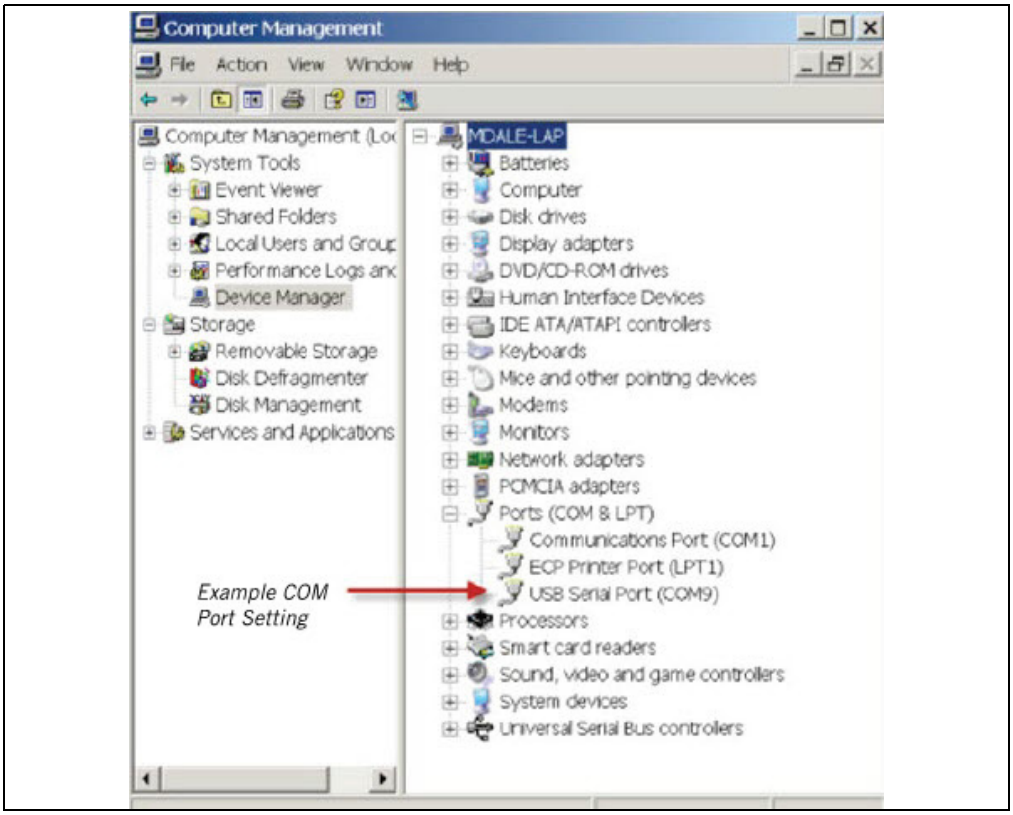
The following are the steps to communicate with the module using a terminal emulator:

1. Determine the COM port that is assigned to the USB cable (the port is COM9 in the example shown in Figure 2-3).
2. Open the available terminal emulation program and specify the COM port.
3. When using TeraTerm, go to Serial option and select the COM port number from the drop-down menu.
4. The serial port with the required settings are as follows:
   - Baud: 9600
   - Data bits: 8
   - Parity: None
   - Stop bits: 1
   - Flow control: None
5. Type the commands through the terminal emulator program and to the assigned program.

Note: COM port number can be found as follows:

- For Windows OS: Go to the Windows Device Manager, from System Tools. In the Device Manager, browse and expand the selection for serial ports (COM & LPT). Use TeraTerm for other configuration settings and monitoring. This is illustrated in Figure 2-3.
- For MAC OS: When using CoolTerm, view and select the port from the same terminal emulator application.

FIGURE 2-3: FINDING THE COM PORT NUMBER IN WINDOWS



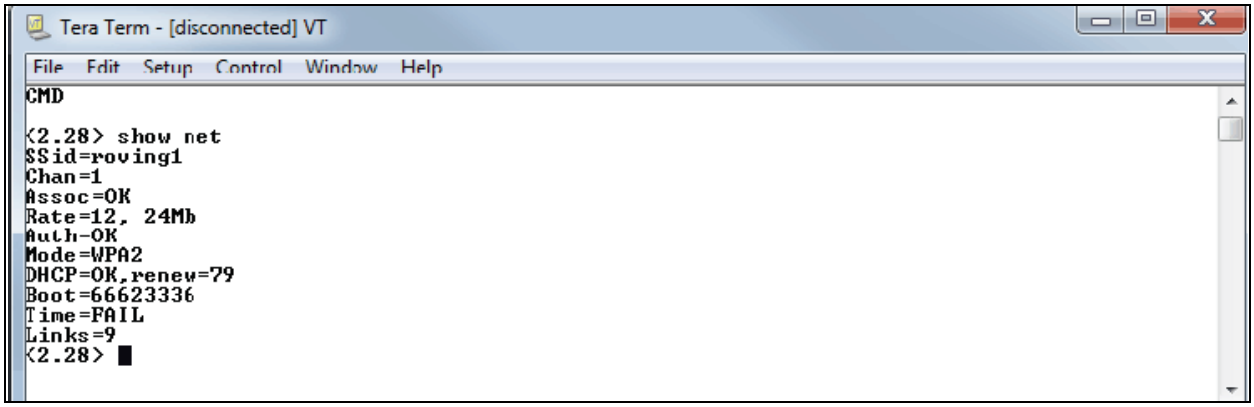
2.4.3.2 ENTER COMMAND MODE

The following are the steps to enter the Command mode in a terminal emulator:

1. Type `$$$` on the keyboard sequentially with no additional characters before or after each `$` sign. The module replies with `CMD` (on terminal emulator) to indicate that it is in Command mode.
2. Type `show net <cr>` to display the current network settings (Figure 2-4 shows the current network settings for version 2.28).

Note:	When a command is completed, the terminal displays a prompt using the format <X.XX>, where X.XX indicates the module's firmware version.

FIGURE 2-4: CURRENT NETWORK SETTINGS



The RN171 module supports a variety of command keywords. The "*WiFly Command Reference, Advanced Features and Applications User's Guide*" from the Microchip web site http://www.microchip.com provides a complete command reference.

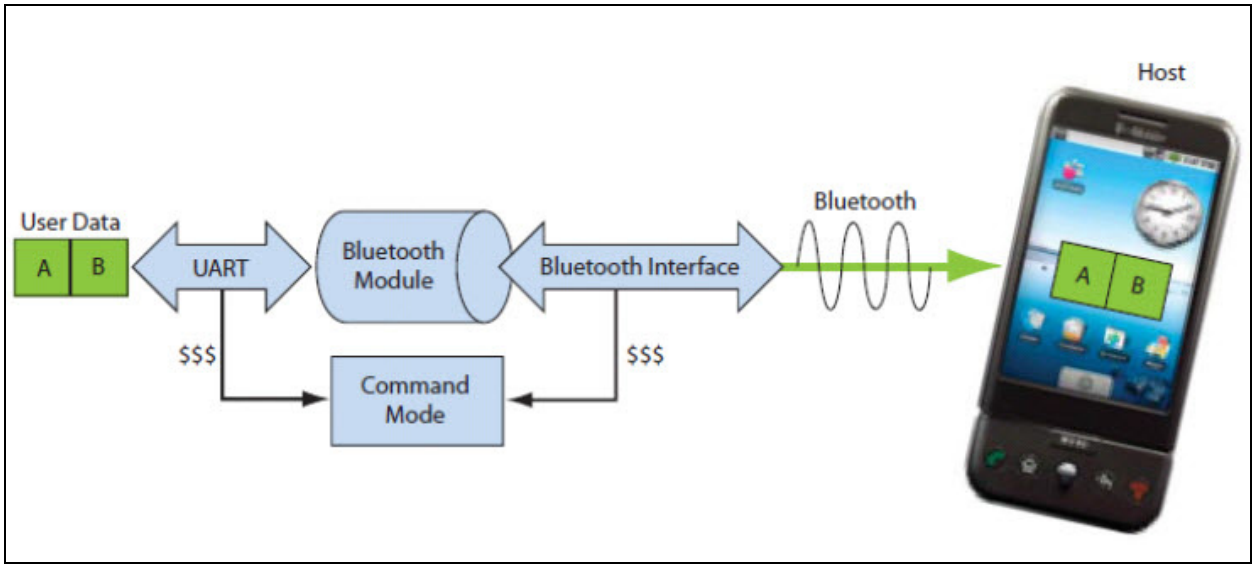
RN41/42XV CONFIGURATION

RN41/42XV with RN41/42 module base is mounted on RNXV Evaluation Kit. The RN41/42 also operates in two modes:

- Data mode (default)
- Command mode

While in Data mode, the module operates as a data pipe. When the module receives data, it strips the Bluetooth headers and trailers and passes the user data to the UART port. When data is written to the UART port, the module constructs the Bluetooth packet and sends it out over the Bluetooth wireless connection. Thus, the entire process of sending/receiving data to the host is transparent to the end microcontroller. The Figure 2-5 illustrates the operational modes.

FIGURE 2-5: DATA & COMMAND MODES



The default configuration for the Bluetooth module is:

- Bluetooth slave mode
- Bluetooth pin code 1234
- Serial port 115,200 Kbps baud rate, 8 bits, no parity, 1 stop bit
- Serial port flow control disabled
- Low-power mode off

Configuration is done by putting the module in the Command mode and sending ASCII commands over the UART port or the Bluetooth link. Reboot the module for settings to take effect. The changed configuration parameters persist until next change happens or until a factory reset is performed.

There are two ways to configure the Bluetooth module:

- Local configuration using computer's serial port
- Via Bluetooth

Terminal emulator utility is required to type the commands and to monitor the activity/ transactions.

2.4.4 Configuring the Module over the UART Port

Connect the module to any computer/laptop. Connection can be done using the RS-232 DB9 port or via a USB cable. When RN-XV-RD2 evaluation board is used as RN41/42XV base board, connection is done using a USB cable.

With the Bluetooth module connected and powered on, run a terminal emulator and open the COM port to which the cable is connected. The terminal emulator's communication settings must be the default serial port settings:

- Baud rate 115,200 kbps
- 8 bits
- No parity
- 1 stop bit
- Hardware flow control disabled

Note: Use local configuration at any time when the module does NOT have a Bluetooth connection, as well as under certain conditions. If the module is in Configuration mode and a connection occurs, the module exits Configuration mode and data passes back and forth from the remote module.

Once a connection is made, Command mode can be entered only if the boot-up configuration timer has not expired (60 seconds). To remain in Configuration mode, set the configuration timer to 225.

2.4.5 Remove Configuration Using Bluetooth

It is often useful to configure the module remotely over a Bluetooth connection. Before performing remote configuration using Bluetooth, first pair the Bluetooth module with any computer. For computer/laptop with Bluetooth capability and running Windows, click **Bluetooth devices** in the system tray at the bottom right on your computer screen. Select **Add a Bluetooth device** and follow the on-screen instructions. For Mac OS-X, click the Bluetooth icon, select **Setup Bluetooth device**, and follow the on-screen instructions. Once a connection is made, the module enters the command mode if the boot-up configuration timer has not expired (60 seconds). To remain in Configuration mode, set the configuration timer to 255.

When the configuration is finished, reset the module or send the "**---**" command, which causes the module to exit Configuration mode and enables data to pass normally.

Note: Configuration mode (local or remote) is NEVER enabled when the module is in auto-mode and is connected over Bluetooth.

2.4.6 Enter Command Mode

To enter Command mode, launch a terminal emulator and specify the module's default settings. Table 2-1 shows the serial port settings.

TABLE 2-1: SERIAL PORT SETTINGS

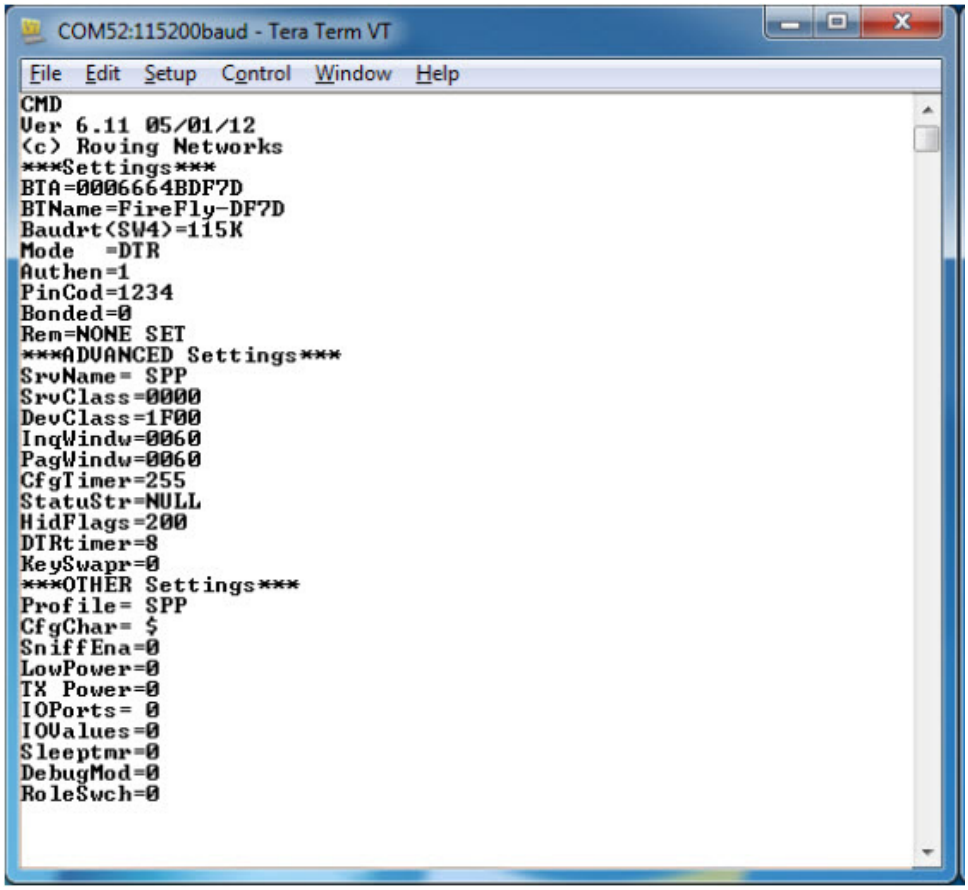
Setting	Value
Port	COM port to which module is attached
Baud rate	115200
Data rate	8 bits
Patiry	None
Stop bits	1
Flow control	None

Type $$$ into the terminal emulator to enter command mode.

The module returns the string CMD, which indicates that the connection and terminal settings are correct. While in Command mode, the module accepts ASCII bytes as commands. When a valid command is entered, the module returns AOK. It returns ERR for an invalid command and ? for unrecognized commands. Type h <cr> to see a list of commands.

A quick check to confirm that user has entered the Command mode is to type the X <cr> command after entering Command mode. This command shows summary of the module's current settings, such as the Bluetooth name, device class and serial port settings. Figure 2-6 illustrates the view of current settings.

FIGURE 2-6: VIEW CURRENT SETTINGS



To return to Data mode, type --- <cr> or reset the module and re-connect.

The RN41/42 modules support a variety of command keywords. The "*Bluetooth Data Module Command Reference & Advanced Information User's Guide*" from the Microchip web site http://www.microchip.com/bluetooth provides a complete list of command reference.

Chapter 3. Application Interface Concerns

3.1 INTRODUCTION

This section provides the design concerns related to powering the evaluation board, sensor interface settings, mode settings and restoring factory settings for RN171XV and RN41/42XV modules mounted on RNXV Evaluation Board.

3.2 RN171XV INTERFACE CONCERNS

3.2.1 Powering the Module

The RN131/RN171 Evaluation Board is powered using the USB cable or through the battery pack, which holds two AAA batteries. However, RN131 Evaluation Board can also be powered using normal wiring.

Note: The RN171 module can also be powered through the USB cable while a battery pack is installed.

3.2.2 Sensor Interfaces

The input voltage on the sensor inputs must not exceed 1.2V. The Analog-to-Digital Converter (ADC) saturates at 400 mV. It is recommended to use the sensor power output to drive any analog devices that are attached to the sensor pins.

Note: Sensor pins 2 and 3 have a resistor network in front of sensors 4 and 5, respectively. Hence, these pins are driven with up to 3.3V DC.

3.2.3 GPIO9 Functions

The AP push button is connected to GPIO9. Depending on the state of GPIO9, the module enters into three different modes: AP mode, Factory Reset and WPS mode.

3.2.3.1 AP MODE

To put the module into AP mode, GPIO9 must be high when the module powers up or wakes from a sleep state. Press the AP mode button to drive GPIO9 high, and then press the RESET button to reset the module. The module is in default AP mode, which creates a default access point network with the default parameters as listed in Table 3-1.

Note: This default mode overwrites any software settings.

TABLE 3-1: DEFAULT AP MODE SETTINGS

Setting	AP Mode Default
SSID	WiFlyAP-XX, where XX is the last two bytes of the module's MAC address
Channel	1
DHCP Server	Enabled
IP Address	1.2.3.4

Setting	AP Mode Default
Netmask	255.255.255.0
Gateway	1.2.3.4

Once the module boots, other Wi-Fi-enabled devices (such as,Computers, iPhones, iPads, Android tablets, etc.) are able to find the module when access points are scanned.

3.2.3.2 FACTORY RESET

In Factory Reset mode, the module is restored to the factory defaults.

Perform the following steps to restore the defaults:

1. Put the module into default AP mode as described in **AP Mode**.
2. Press the **AP Mode** push button 5 times (with 1 or more seconds between presses).

This feature is useful in case the module is not configured properly and is no longer responding.

3.2.4 Reset

The RESET push button reboots the module.

3.3 RN41/42XV INTERFACE CONCERNS

The following sections provide information on designing with the RN41XV and RN42XV module, including radio interference, factory reset, connection status, etc.

3.3.1 Powering the Module

Apply ONLY 3.3 V ± 10% regulated power to pin 1 (VDD) and pin 10 (ground). The module does not have an on-board voltage regulator and MUST be powered from a regulated 3.3 V power supply.

Note: P1 connected can be used for current measurements. If P1 is removed, a multimeter can be used to measure the voltage drop across a series resistor mounted on the supply. For more details, refer to **Appendix A "RN-XV-RD2 Evaluation Board Schematic"**.

3.3.2 Reset Circuit

The RN41XV and RN42XV modules contain a 1k Ω pull-up to VCC, and the reset polarity is active low. The module's reset pin has an optional power-on-reset circuit with a delay, which must only be required if the input power supply has a very slow ramp or tends to bounce or have instability on power-up. Often a microcontroller or embedded CPU I/O is available to generate the reset once power is stable. If not, designers can use one of the many low-cost power supervisor chips currently available, such as the MCP809 and MCP102/121.

3.3.3 Factory Reset Using GPIO4

It is recommended that designers connect GPIO4 (pin 8) to a switch, jumper, or resistor so it can be accessed. This pin can be used to reset the module to its factory default settings, which is critical in situations where the module has been misconfigured. To reset the module to the factory defaults, GPIO4 must be high on power-up and then toggle low-to-high twice (simultaneously) with one second interval between the transitions.

3.3.4 Connection Status

The RN41XV and RN42XV modules have an on-board green LED to indicate the connection status. The connection status LED is located in the lower right corner of the module.

TABLE 3-2: CONNECTION STATUS LED

Setting	AP Mode Default
Blink at 1 Hz	The module is discoverable and waiting for a connection.
Blink at 10 Hz	The module is in command mode.
Solid	The module is connected to another device over Bluetooth.

3.4 EXAMPLES OF RELAY

The following examples control the relay functionality. Two GPIO pins on the RN171XV module control the relays. Turn the relays on/off by driving the pins high/low using software commands. The relays can be used for a variety of wireless appications, such as controlling equipment (light bulbs, fans, etc.).

3.4.1 Example: Relay 1

```
set system mask 0x21f2 l        // Turn the relay on
set system output 0x0002

set system mask 0x21f2 l        // Turn the relay off
set system output 0
```

3.4.2 Example: Relay 2

```
set system mask 0x21f2 l        // Turn the relay on
set system output 0x0100

set system mask 0x21f2 l        // Turn the relay off
set system output 0
```

NOTES:

Appendix A. RN-XV-RD2 Evaluation Board Schematic and PCB Details

A.1 INTRODUCTION

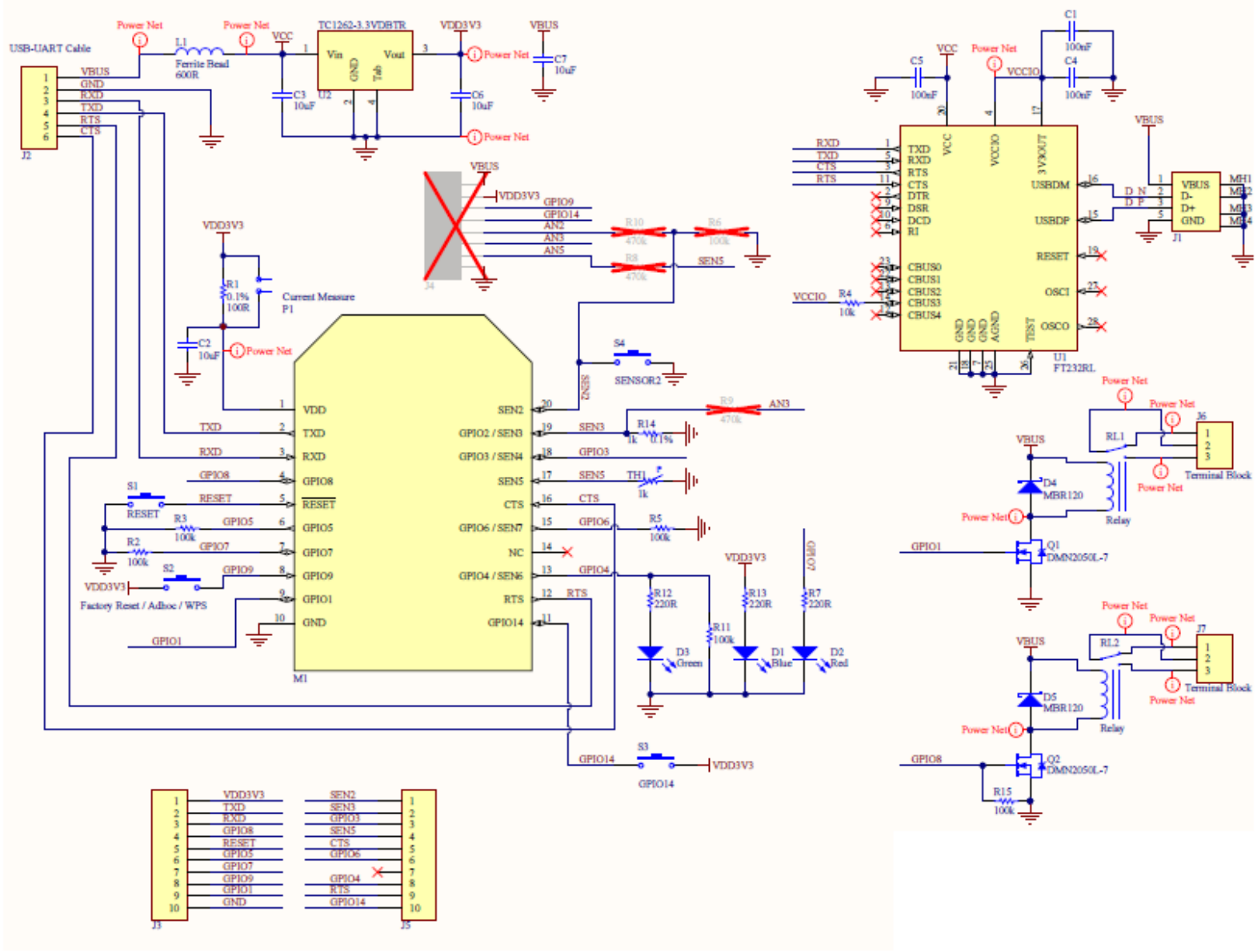
This appendix provides the RN-XV-RD2 Evaluation Board schematic, PCB layout and Bill of Materials (BOM).

- RN-XV-RD2 Evaluation Board Schematic
- RN-XV-RD2 Evaluation Board PCB Layout
- RN-XV-RD2 Dual Relay Evaluation Board Bill of Materials

A.2 RN-XV-RD2 EVALUATION BOARD SCHEMATIC

Figure A-1 shows the Evaluation Board schematic.

FIGURE A-1: RN-XV-RD2 EVALUATION BOARD SCHEMATIC



A.3 RN-XV-RD2 EVALUATION BOARD PCB LAYOUT

The RN-XV-RD2 Evaluation Board is a 2-layer, FR4, 0.062 inch, plated through hole PCB construction. Figure A-2 through Figure A-6 show tha PCB constructions and Assembly Drawings.

FIGURE A-2: RV-XV-RD2 EVALUATION BOARD TOP SILKSCREEN

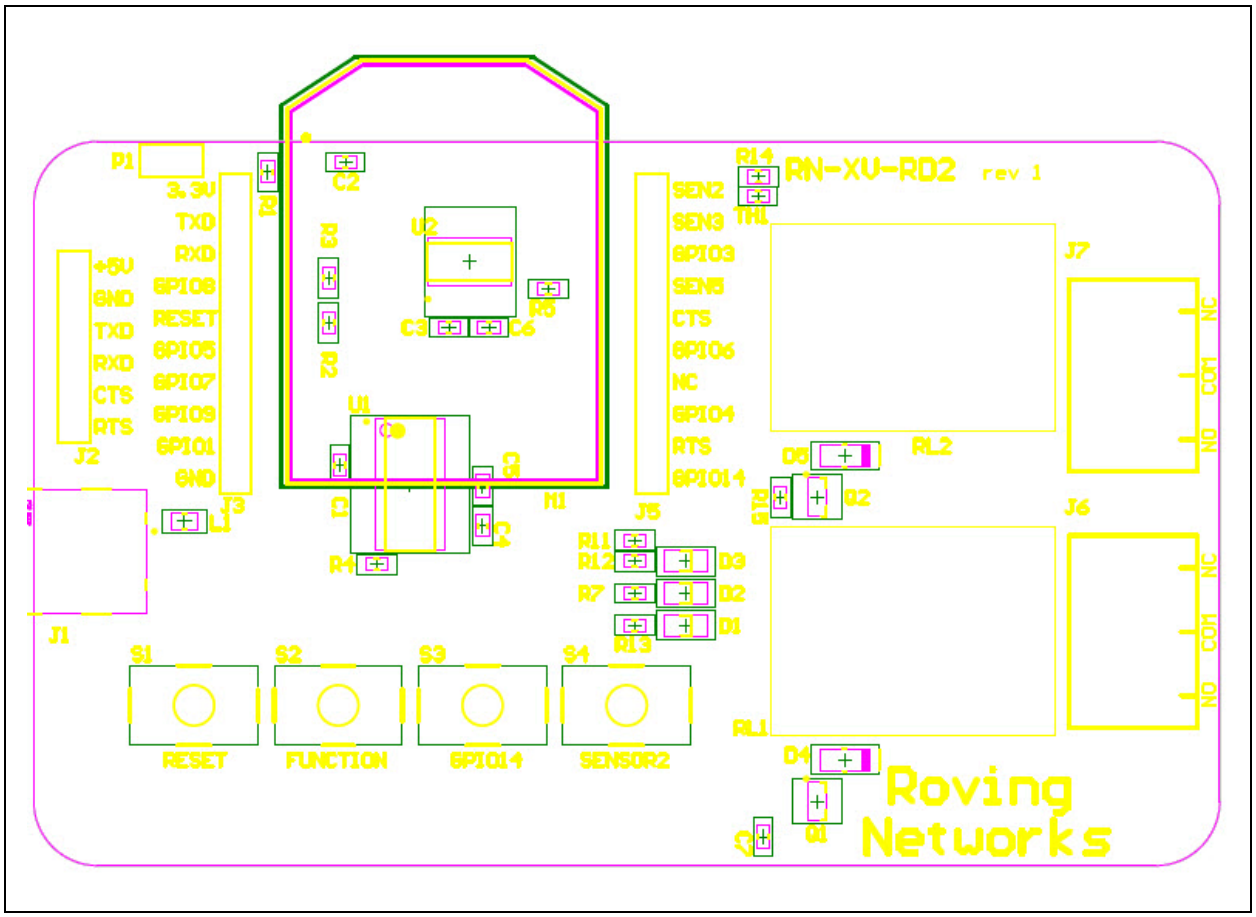


FIGURE A-3: RN-XV-RD2 EVALUATION BOARD BOTTOM SILKSCREEN

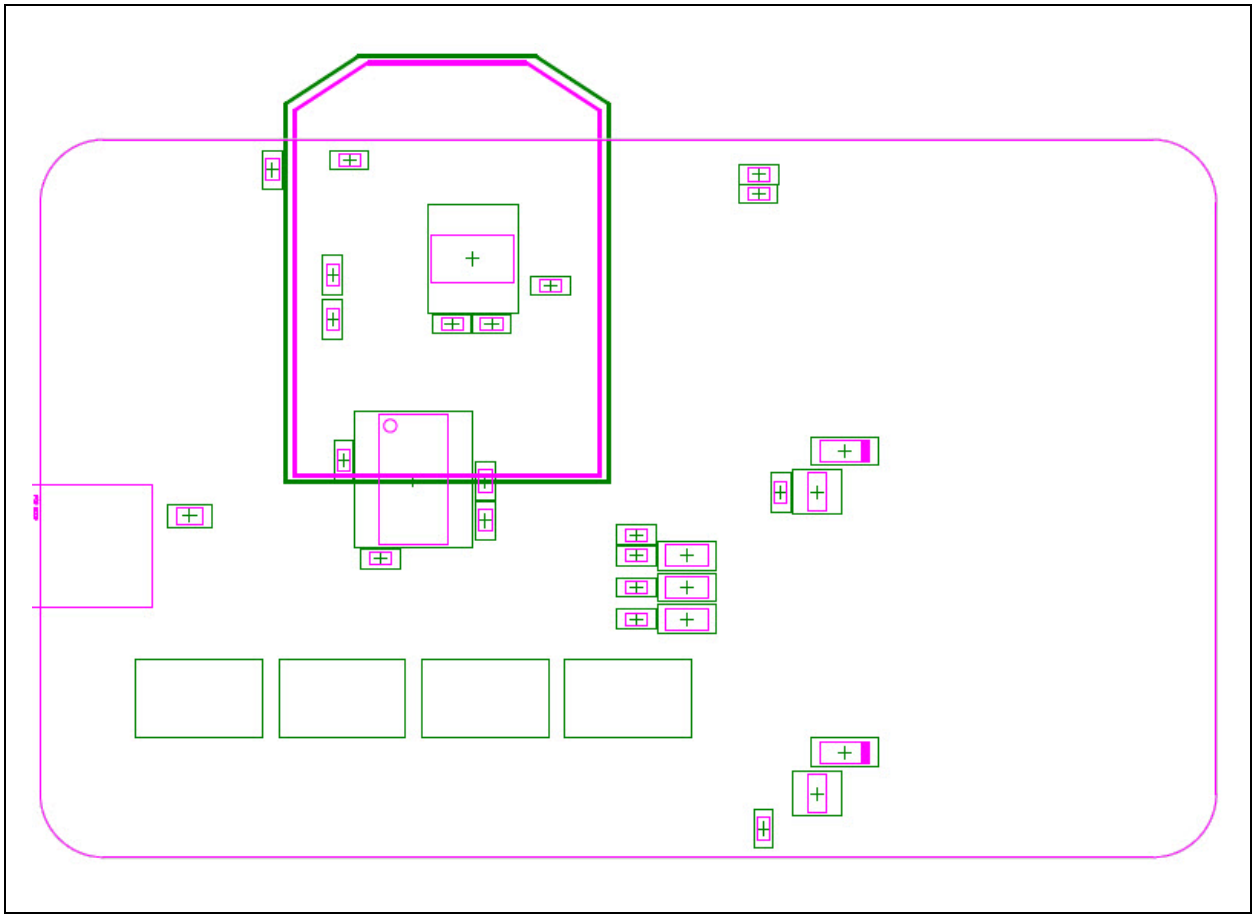


FIGURE A-4: RN-XV-RD2 EVALUATION BOARD TOP COPPER

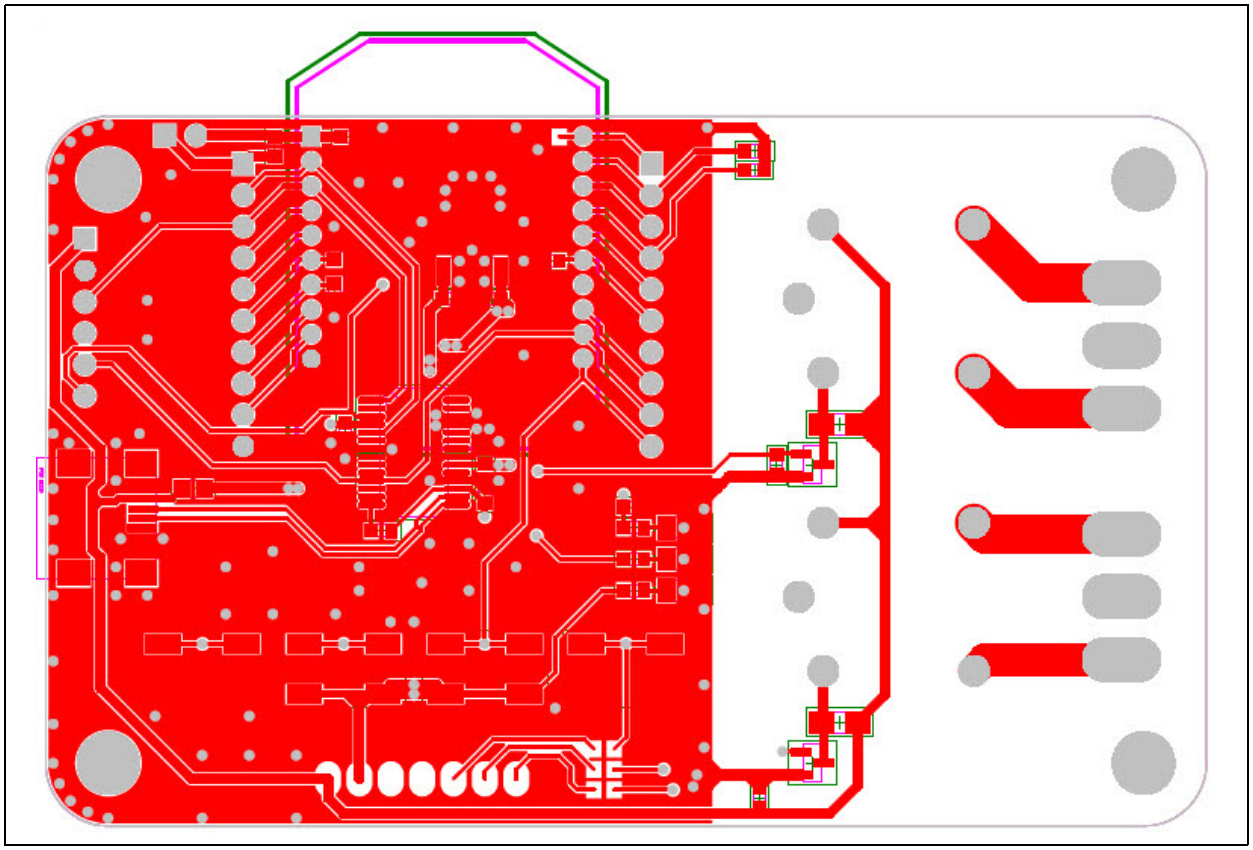


FIGURE A-5: RN-XV-RD2 EVALUATION BOARD BOTTOM COPPER

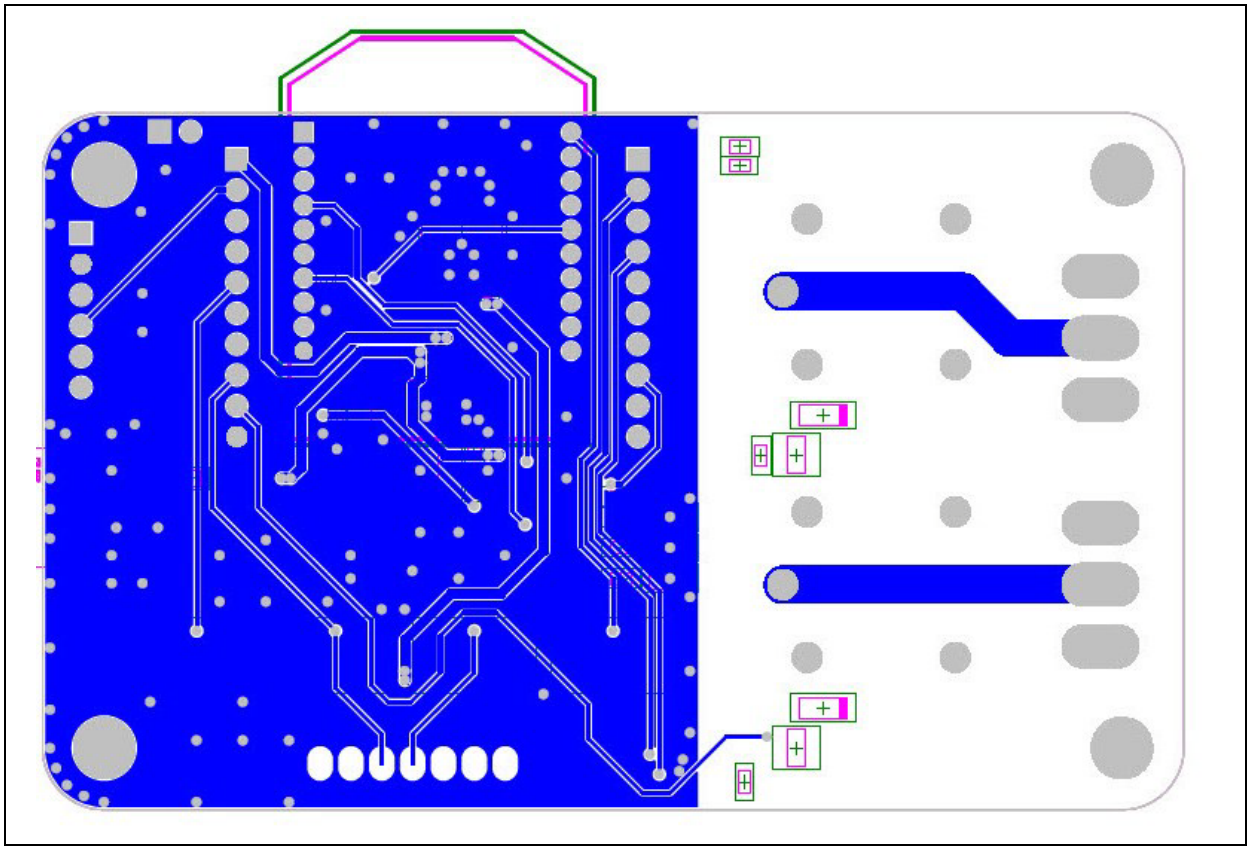
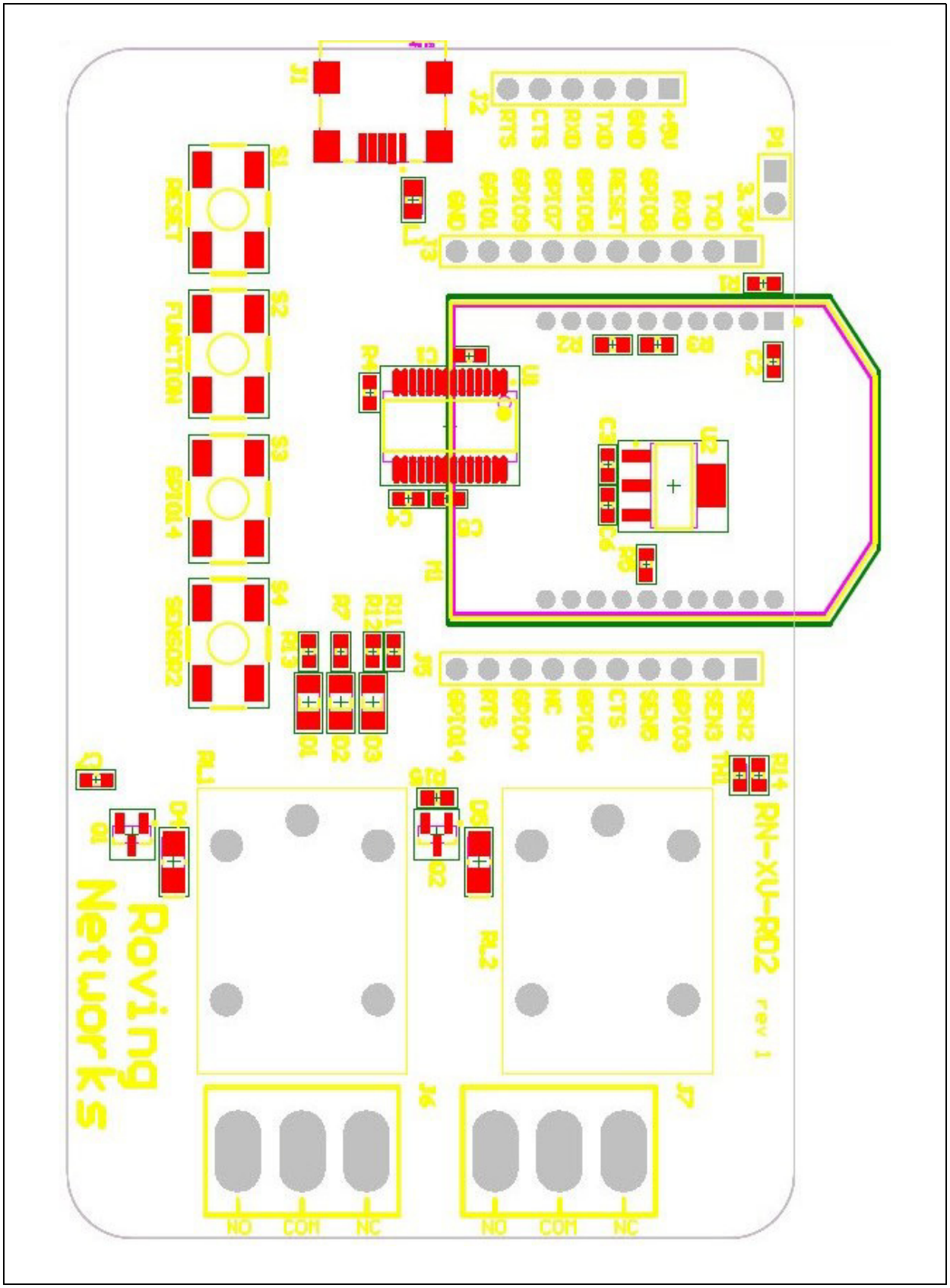


FIGURE A-6: RN-XV-RD2 EVALUATION BOARD TOP ASSEMBLY



A.4 RN-XV-RD2 DUAL RELAY EVALUATION BOARD BILL OF MATERIALS

TABLE A-1: RN-XV-RD2 DUAL RELAY EVALUATION BOARD BILL OF MATERIALS (BOM)

#	Reference	Value	Description	Vendor	Vendor P/N
1	C1, C4, C5	100nF	CAP CERAMIC, 1UF 50V Y5V 0603	Yageo	CC0603ZRY5V9BB104
2	C2, C3, C6, C7	10uF	CAP CERAMIC 10UF 6.3V X5R 0603	Murata Electronics North America	GRM188R60J106ME47D
3	D1	Blue	LED BLUE CLEAR 1206 SMD	Lite-On Inc	LTST-C150TBKT
4	D2	Red	LED RED CLEAR 1206 SMD	Lite-On Inc	LTST-C150CKT
5	D3	Green	LED GREEN CLEAR 1206 SMD	Lite-On Inc	LTST-C150KGKT
6	D4, D5	MBR120	Schottky diode, 1A, 20V, SOD-123F	ON Semiconductor	MBR120ESFT1G
7	J1	—	CONN USB RCPT MINI B 5PS R/A SMD	JAE Electronics	DX2R005HN2E700
8	J6, J7		Terminal block, 5.08mm pitch, w2b, 3 positions	Weidmuller	1716030000
9	L1	600R	FERRITE CHIP 600 OHM 500MA 0805	TDK Corporation	MMZ2012Y601B
10	M1	—	RN-X Module - 2 x 10 pin female 2mm header	Microchip	RN-XV Module
11	P1	—	Jumper 0.1" 2 pin	—	—
12	Q1, Q2	DMN2050L	MOSFET N-CH 20V 5.9A SOT23-3	Diodes Inc	DMN2050L-7
13	R1	100R	metal film, 0.1%, 0.1W, 0603	Panasonic - ECG	ERA-3AEB101V
14	R2, R3, R5, R11, R15	100k	RES 100K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ104V
15	R4	10k	thick film, 5%, 0.1W, 0603	Panasonic - ECG	ERJ-3GEYJ103V
16	R7, R12, R13	220R	RES 220 OHM 1/10W 5% 0603 SMD	Vishay/Dale	CRCW0603220RJNEA
17	R14	1k	metal film, 0.1%, 0.1W, 0603	Panasonic - ECG	ERA-3AEB102V
18	RL1, RL2	SPDT	mechanical relay SPDT, 10A, 250VAC / 125VDC 5V/80mA coil	Omron Electronics Inc - EMC Div	G5LE-1 DC5
19	S1, S2, S3, S4	SPST	Tactile & Jog Switches 6x6 260gf RED SMT	Mountain Switch	101-TS6923T2605-EV
20	TH1	1k	THERMISTOR 1K OHM NTC 0603 SMD	Murata Electronics North America	NCP18XQ102J03RB
21	U1	FT232RL	IC USB TO SERIAL UART 28-SSOP	FTDI	FT232RL
22	U2	TC1262-3.3V	Linear Voltage Regulator	Microchip	TC1262-3.3VDBTR

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