Discontinued

DR-TRC104-2400-DK Development Kit

User's Guide

General Overview

The TRC104 Development Kit is available as part number: DR-TRC104-2400-DK

The TRC104 Development kits allow for complete evaluation and application development of Murata's 2.4 GHz TRC104 transceiver IC. A communication link or a Range Test can be executed with the Data Terminal to evaluate system performance.

Kit Includes:

- 2 USB 2.0 Cables
- 2 Universal Wall Plug Power Supplies
- 2 "AA" Battery Packs
- 4 "AA" Batteries
- RF Design Assistant (RFDA) 4.0 Software
- 2 SMA Antennas, 2.4 GHz
- 2 DR-TRC104-2400 Development Boards
- 1 CD Containing:
    - C Source Code for Development Kit Firmware
    - TRC104 Data Sheets and User Guides
    - RFDA 4.0 Utility Software

Key Features:

- Firmware Development with Renasas IDE (sold separately)
- Comprehensive Evaluation of RFIC's
- Individual TRC104 Parameter Configuration
- 57.6 kbps Serial Communication Setup
- Example Code
- RFDA 4.0 Software
- 2-way Communication Link (ComLink)
- Range Test
- Up to 1 Mbps Data Rate
- Data Terminal Program
- Diagnostic LED's
- "Out of the box" Operation
- 32-Byte Packet Handling

Overview

The TRC104 development board is designed to allow the evaluation of critical functions of the transmitter and receiver and to facilitate the development of custom firmware. All functions of the transmitter and receiver may be enabled using the RFDA software. A two-way communication link is possible through the RFDA software by bringing up the Data Terminal program. A Range Test is available with use of one of the included battery packs for roaming capability.

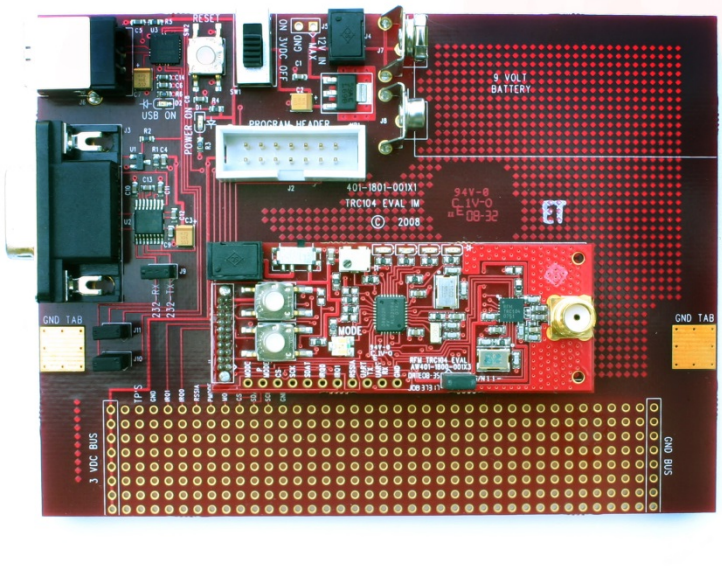

Figure 1 - TRC104 Development Board

Test Points

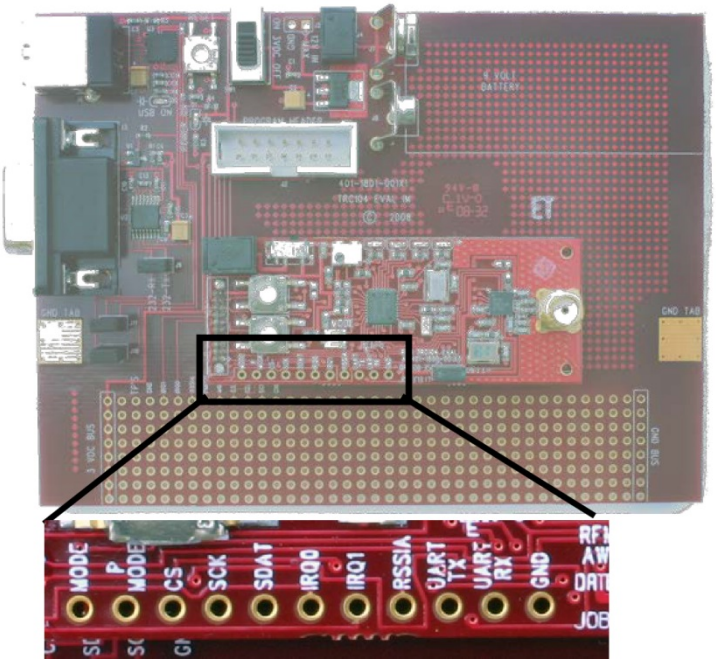

Figure 2 - Test Point access

Referring to Figure 2, test points are provided to monitor signals in real time from the TRC104. The following test points are provided:

MODE - Mode control pin, see data sheet description
PMODE - Mode control pin, see data sheet description
CS - SPI Read/Write chip select
SCLK - SPI Clock
SDAT - SPI Data to/from TRC104
IRQ0 - INT interrupt from the TRC104
IRQ1 - DRSSI threshold Interrupt from the TRC104
RSSIA - Analog RSSI signal from the TRC104
UART TX - RS232 data sent TO the RFDA
UART RX - RS232 data received FROM the RFDA
GND - Ground connection for probe

Microcontroller Programming Header

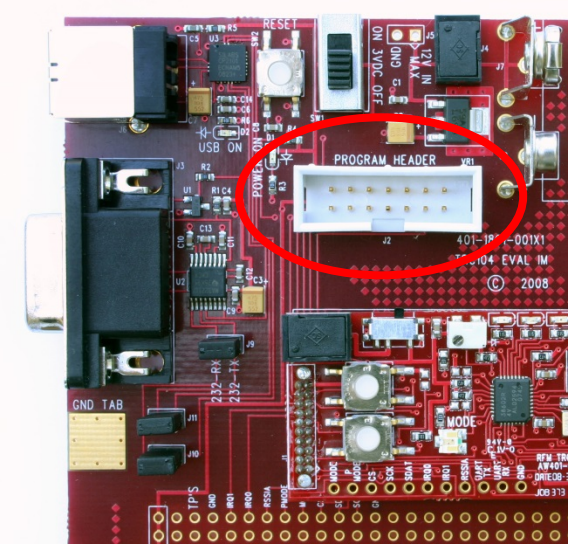

Figure 3 - TRC104 Development Board with Renasas Programmer

The dual row, 14-pin header is used to program the Renasas microcontroller IC. This is available if the user wishes to develop their code for the TRC104 and use the TRC104 development board as a bench trial. The development board can be used as a development platform or as an development tool for IC performance. Refer to Figure 3.

Development Board Operation

Antennas

Two dipole antennas are included that provide excellent performance in the desired band of operation. The antennas are a critical part of the performance of the communication link, thus, a dipole antenna provides the best performance.

Power Supply

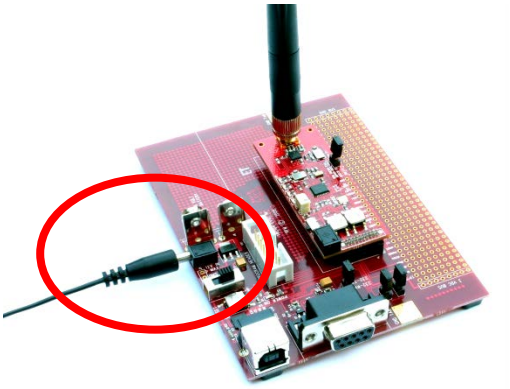

Figure 4 - AC Power Supply Connection

The development kit includes two universal AC power supplies that may be used to power the development boards from a wall outlet. The AC power supplies are shipped with a set of snap-on adaptors that support most AC standards used in the world. Refer to the kit photograph on the cover and Figure 4.

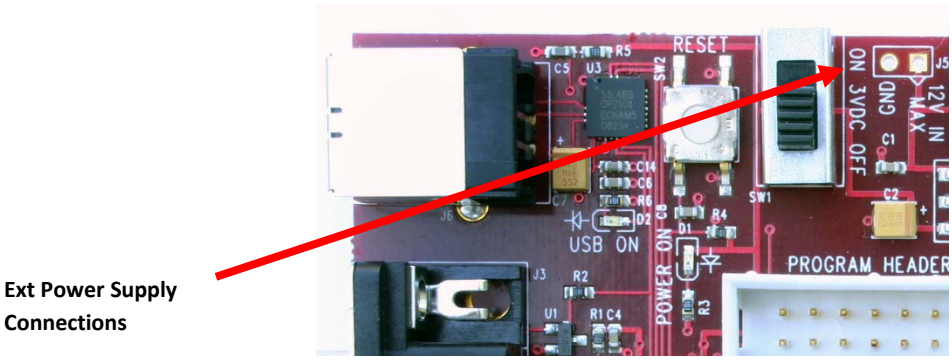

Figure 5 - External Power Supply Connection

Two pins are provided for connection of an external power supply up to 12 V maximum. Note the polarity of the connections before connecting any power source. An on-board voltage regulator reduces the external power input to 3.3 V for use by the rest of the board. Refer to Figure 5.

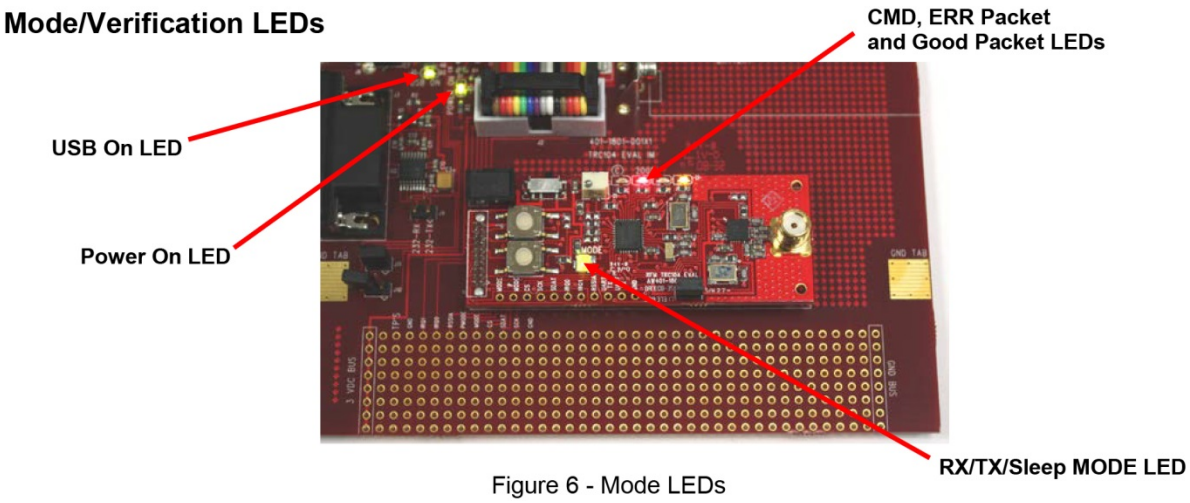

Figure 6 - Mode LEDs

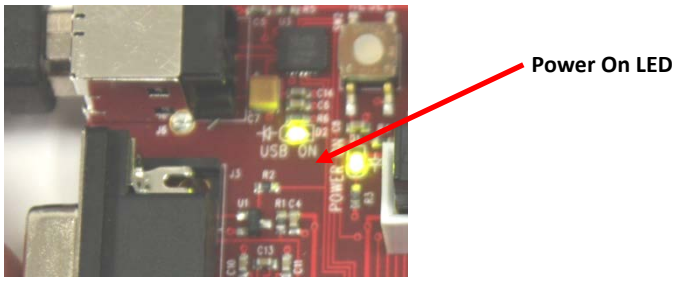

Figure 6 - Power ON LED

On power-up the Green “Power On” LED will illuminate indicating the board is powered and working. Refer to Figure 7.

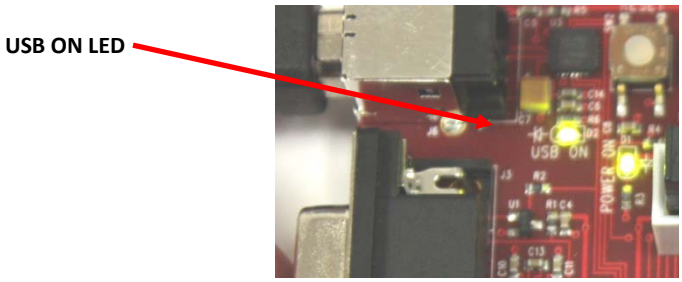

Figure 7 - USB ON LED

If a USB cable is plugged into the USB port the Green “USB ON” LED will turn on when it has established a communication link with the PC. Refer to Figure 8.

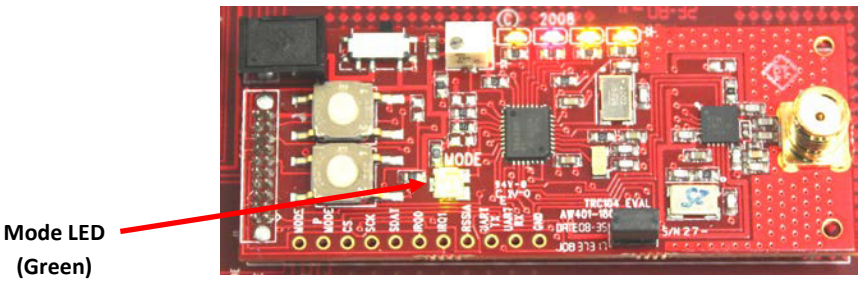

Figure 8 - Continuous Receive Mode LED

On power up, after the LED’s have performed the startup sequence, the Mode LED illuminates green and the board is configured for (Continuous) Receive Mode. In this mode the user can apply a modulated RF signal into the SMA connector and observe the demodulated signal on an oscilloscope by applying a probe to the DAT test point (see Figure 2). Refer to Figure 9.

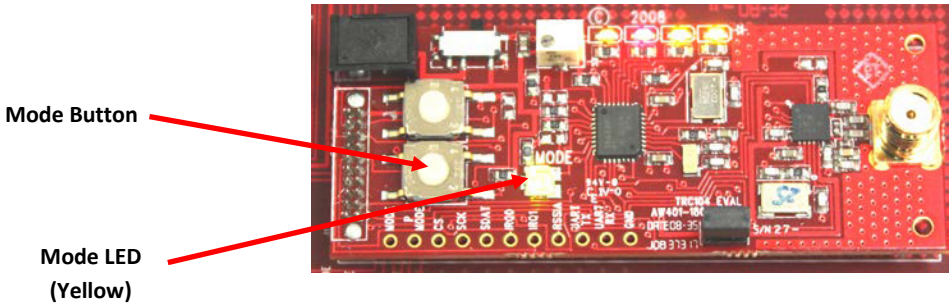

Figure 9 - Transmit (Continuous) Mode LED

Referring to Figure 10, pressing the MODE button once will configure the board for Transmit (Continuous) Mode and the Mode LED will change color from Green to Yellow. In this mode the user can apply a modulated signal to the DAT test point and observe modulation on a spectrum analyzer.

Pressing the Mode Button once again will configure the board for Sleep Mode and the Mode LED will turn off. In this mode the user can remove Jumper J1 and apply an ammeter to the pins to measure sleep current. Refer to Figure 11 and Figure 16.

PC Serial Communication

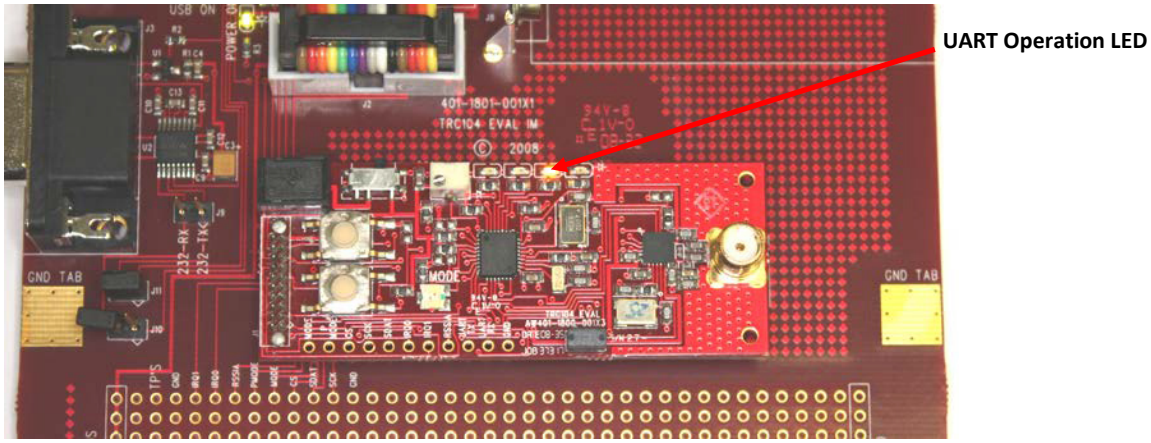

Figure 10 - UART Operation LED

When a UART operation is performed either to or from the TRC104, the yellow UART LED will flash indicating a successful operation. Refer to Figure 11.

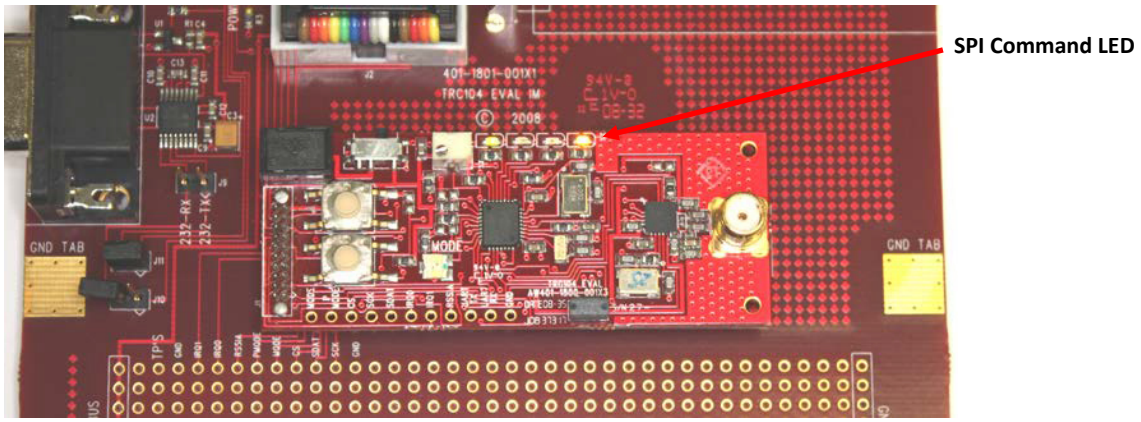

Figure 11 - SPI Command LED

When a command is sent to the TRC104, the yellow CMD LED will flash indicating a successful command send. Refer to Figure 12.

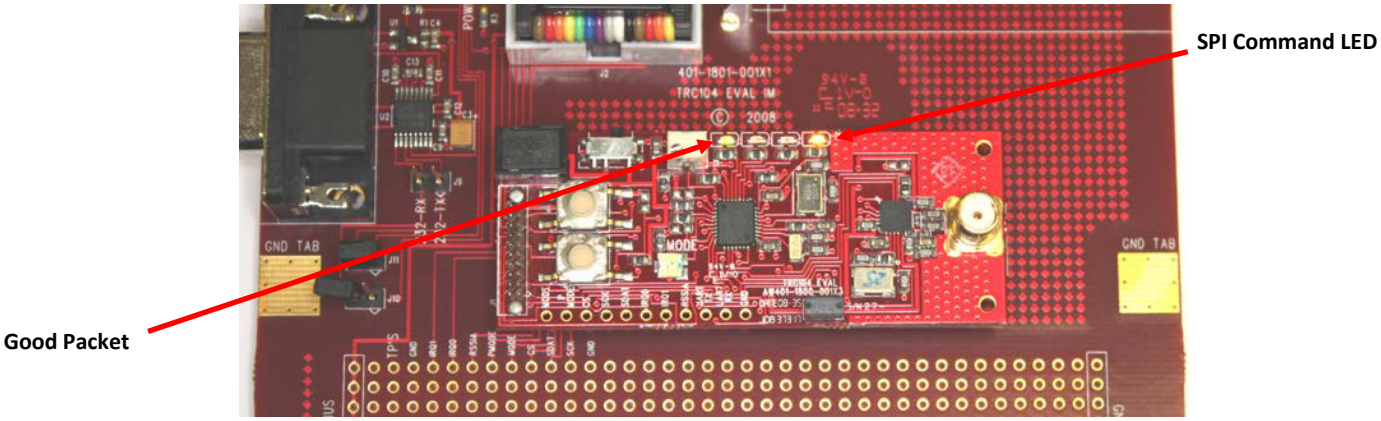

Figure 12 - Good Packet LED

The LED's also indicate the success or failure of a communication packet when using the Data Terminal/Range Test associated with the RFDA software. When a packet is sent and received successfully a green LED will flash on both boards to indicate successful reception and acknowledgement. Refer to Figure 13.

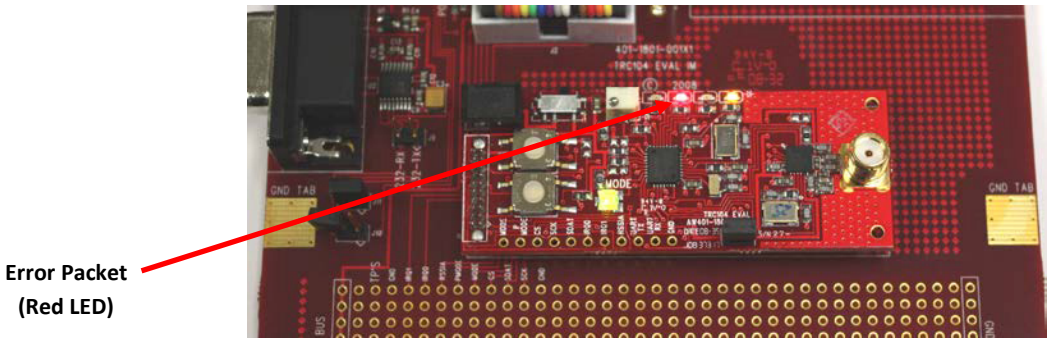

Figure 13 - Error Packet LED

If the packet received contains a checksum error then a red LED will flash on both boards indicating a packet error. When using the Range Test function, several RED LED flashes usually will indicate that the edge of the maximum receiving range is being reached and packet errors are increasing. Refer to Figure 14.

RS232 Port

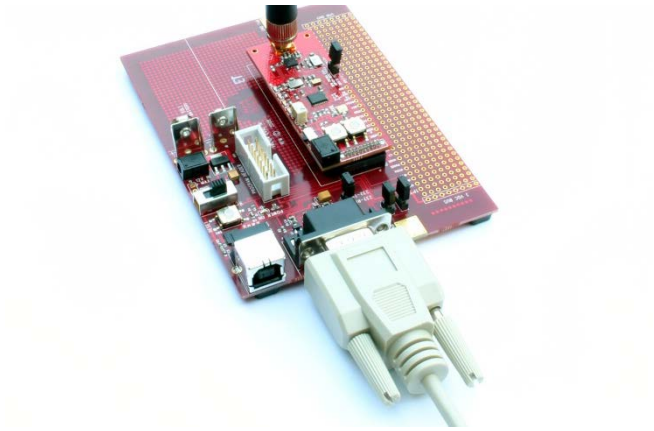

Figure 14 - RS-232 Serial DB-9 Connector

The development board has the option of communicating via USB or standard DB-9 serial communication cable. The kit includes 2 USB 2.0 cables. If using a DB-9 cable make certain it is a DB9 Male to Female straight thru cable configuration and NOT a null modem configuration. There is no flow control so DTS, CTS, RTS, etc., signals are not used. Refer to Figure 15.

When using the DB9 for serial communication, Jumper J10 and J11 MUST be removed to disable USB serial connection and enable the DB9 serial connection. See Figure 16.

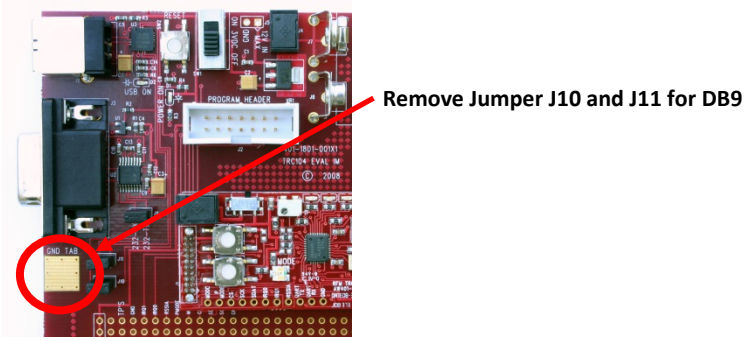

Figure 15. DB9 Serial Comm Jumper Configuration

Current Monitor (J1)

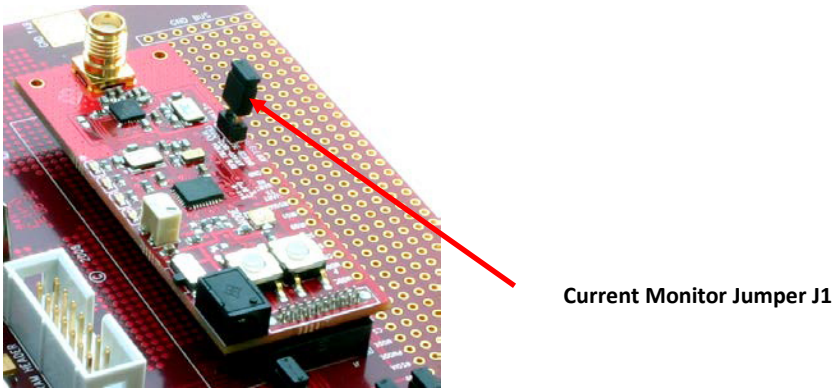

Figure 16 - TRC104 Current Monitor Jumper J1

J1 allows current to flow to the TRC104 (only). This enables the current consumption of the TRC104 to be monitored without the additive effect of the microcontroller and other on-board device current usage. For normal operation the jumper at J1 must be installed. To monitor the current usage of the TRC104, simply remove the jumper and apply an ammeter between the two pins BEFORE POWER UP. If jumper J1 is removed while powered, applying the ammeter will cause the TRC104 to power up in an undefined mode. Refer to Figure 17.

Transmit Power Adjust

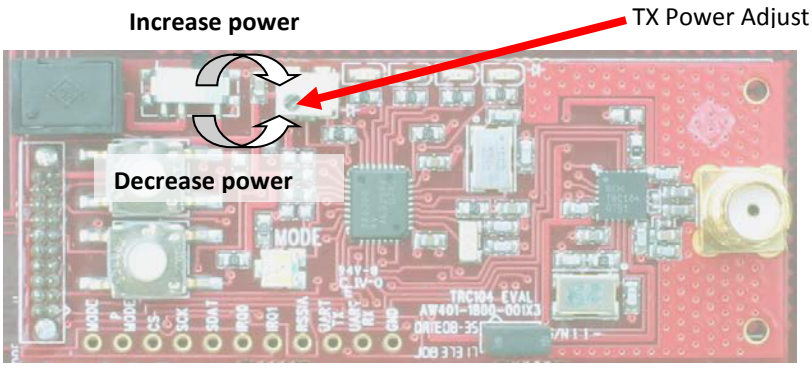

Figure 18 - TX Power Adjustment

The potentiometer (POT) is used to adjust the transmit power. To increase the output power, rotate the slot clockwise with a small tuning tool. To decrease the power, rotate the slot counter clockwise. Refer to Figure 19.

The transmit power is divided into 6 levels (See TRC104 datasheet TXCFG register). Rotating the POT adjusts the voltage level on the internal A-to-D converter (ADC) of the microprocessor. The ADC continuously samples the POT for a change and updates the TX power register if the level has changed. Each time the microprocessor updates the TX register the CMD LED will flash indicating an SPI write.

Communication Link

A two-way communication link is available by configuring the boards and using the Terminal program in the RFDA software. The boards are configured for Receive Buffered Mode with Packet Handling enabled. Both the Range Test and ComLink use this mode. When the boards are configured for either mode, data is transferred using the internal Transmit and Receive FIFOs. Automatic CRC generation (TX) and checking (RX) is also enabled.

Communication Link Packet Structure

The packet structure for the ComLink and Range Test use the variable length packet mode as defined below and referenced in Section 8.2 of the TRC104 datasheet. Refer to Figure 20.

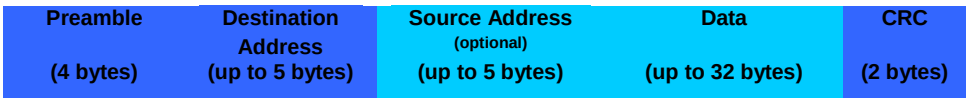

Figure 21 - Packet Mode Structure

The default configuration for the board in ComLink Mode is as follows:

Freq 2480 MHz (channel 80)
Modulation = GFSK
LNA Gain = max
CRC Enabled
Discard Packet on CRC error
Buffered Mode Enabled
3 byte Address = 0x0AA00A
FIFO depth = 32 bytes (0x1F)
TX Power = Max (+0dBm)
Data Rate = 1Mbps

Table 1 - Default Configuration

Range Test Setup

A range test can be performed by easily configuring both DR boards with the Range button. First determine which board will be the “Receiving” board and which will be the “Transmitting” board. To configure the “Receiving” board for Range Test receive, press the Range button once. The Range LED will illuminate Yellow. To initiate the Range Test on the “Transmitting” board, press and hold the Range button for at least 1 second. The transmitting board will automatically begin the range test.

The transmitting board sends the range test packet with an automatically generated CRC, configures for Receive Mode, and waits for an acknowledgement ACK back from the receiving board. The receiving board receives and checks the packet CRC for errors. If there are no errors the receiving board flashes the Green LED and transmits an acknowledgement ACK. The transmitting board, upon receiving an acknowledgement, checks the packet CRC and flashes the Green LED indicating a good acknowledgement. If the transmitting board does not receive an acknowledgement after 10 ms, or receives an error packet (CRC does not match), the board flashes the red ERR LED and repeats the process.

The development kit includes AA battery packs that may be used to facilitate roaming in order to test the link performance of a given application area. Simply plug in a battery pack, turn on the board, configure for Range Test receive, and initiate the transmitting board.

ComLink Terminal Mode Setup

A message of up to 128 bytes may be sent by simply typing the message into the terminal window of the RFDA software and pressing the ‘Enter’ key.

To configure the boards for terminal mode, press the Range button twice on each board. The Range LED will flash two times to indicate terminal mode configuration. Connect the development kit board to the PC using the included USB serial cable. Run the RFDA software and select the TRC104 from the drop-down menu at the top. Click on ‘Data Terminal’. Set-up the other development board in the same manner. When the message is transmitted the receiving board will check the CRC and, if verified, will flash the Green LED and display the received packet. If a CRC error occurs the Red LED will flash.

When configured for terminal mode, the TRC104 operates with the same configuration as the Range Test Mode. The configuration is summarized in Table 1.

Battery Packs

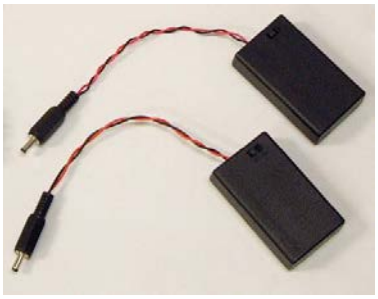

Figure 22 - AA Battery Packs with Integrated Switch

The kit includes four “AA” batteries and two ”AA” battery packs that hold 2 “AA” batteries each to be used with each individual evaluation board separate from the development board. This is useful for situations where mobility is important during evaluation and testing. Refer to Figure 23. The kit also includes two 9 V batteries that may be used to operate the development board. Figure 24 illustrates the location of the 9V connections.

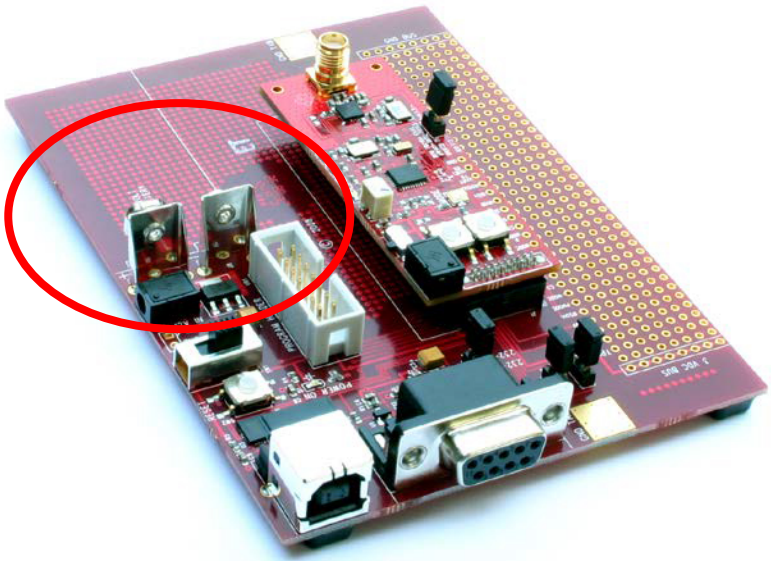

Figure 25 - Development Board with 9V Battery Connections

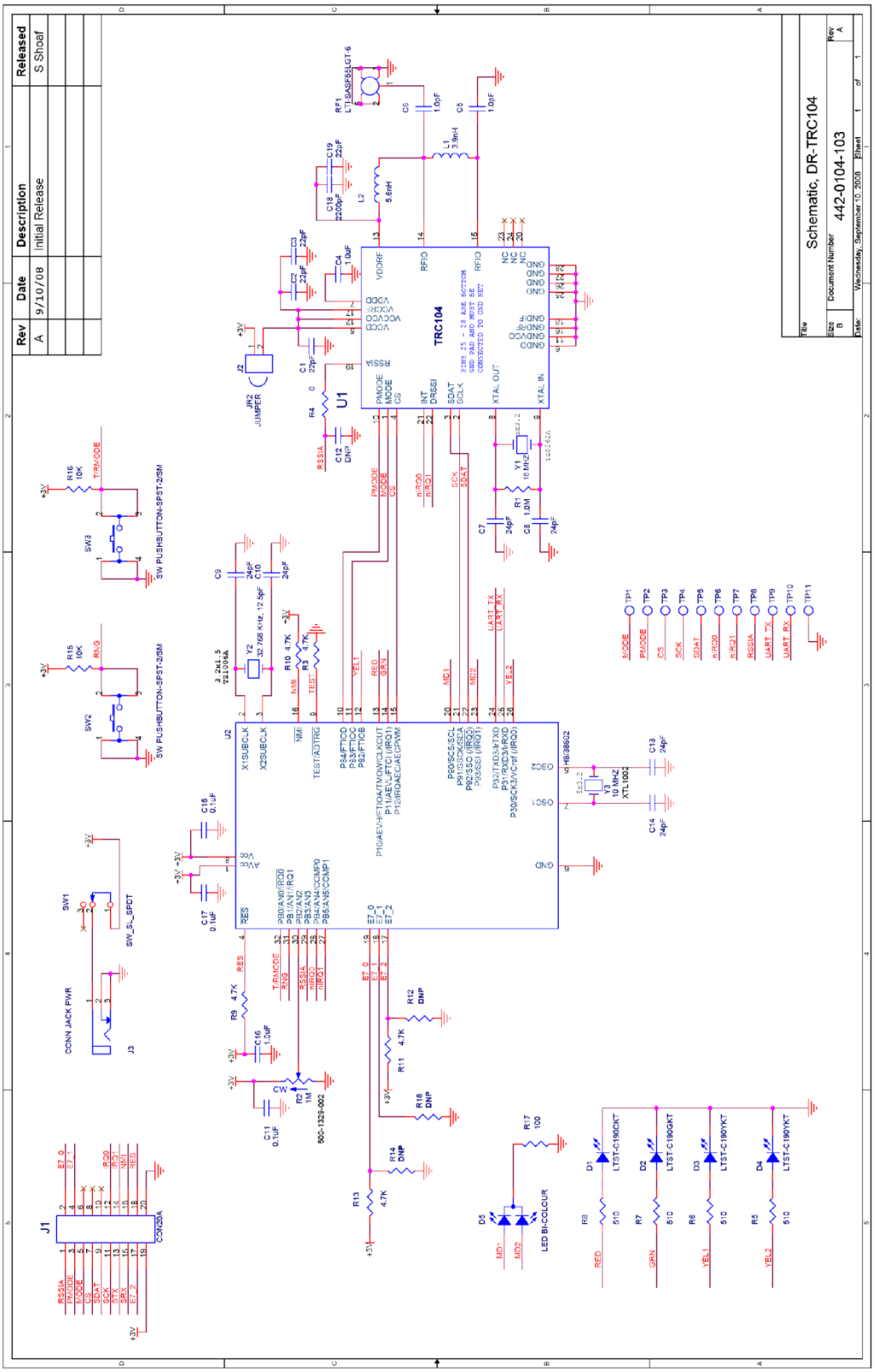

Figure 22 - DR-TRC104 Schematic

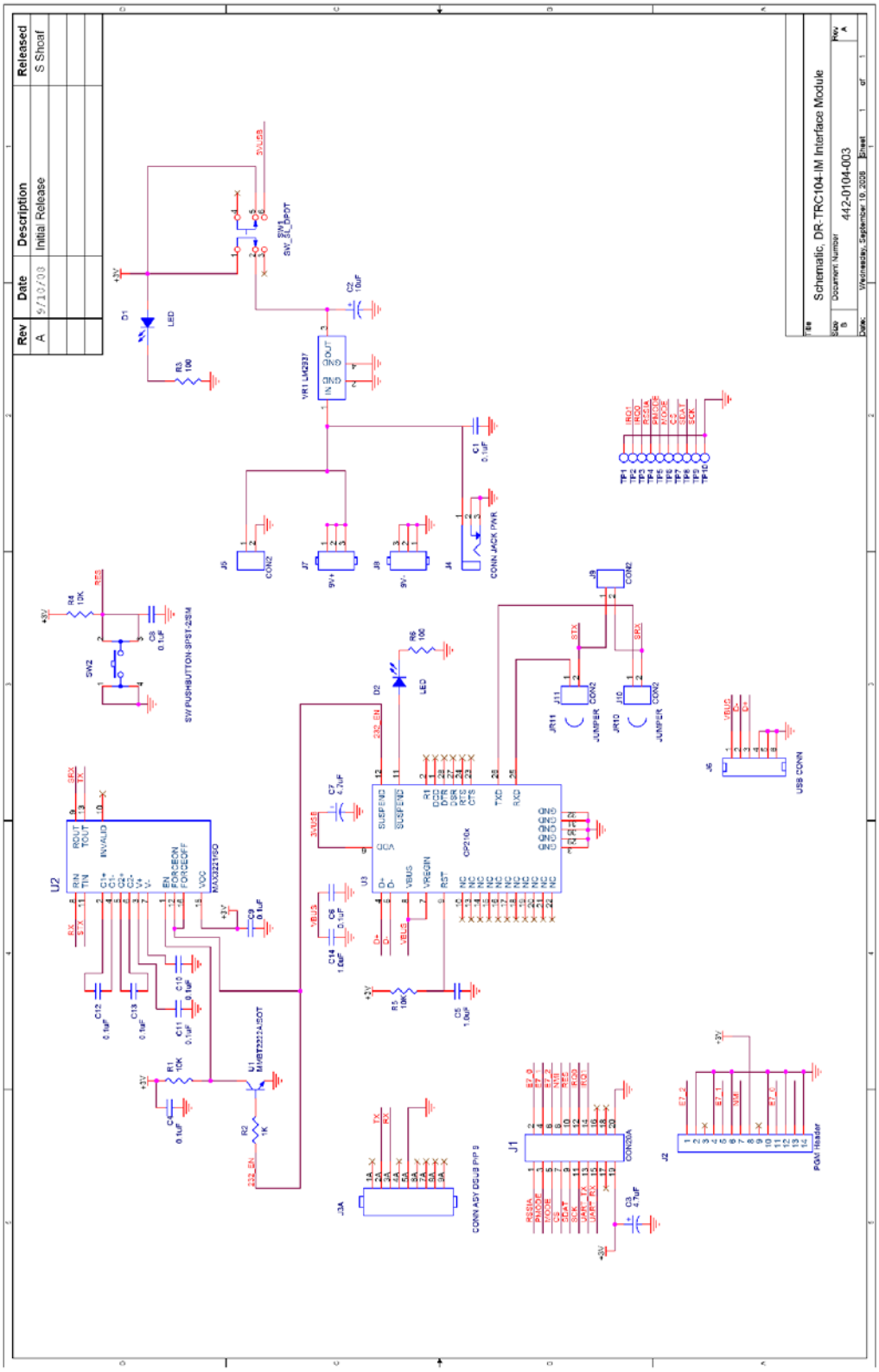

Figure 23 - Interface Module Schematic