

Tested and Report Prepared By:

ITC Engineering Services
9959 Calaveras Road, Box 543
Sunol, CA 94586-0543
Tel: 925-862-2944
Email: docs@itcemc.com

Fax: 925-862-9013
Web: www.itcemc.com

FCC ID PDVRFLAN



RF-LAN Module

Description of Operation v1.01

December 05, 2002

Operational Overview

The purpose of the RF-LAN Module is to provide communication over the air to another similar unit or an RF-LAN Hub. The RF-LAN Module will be installed into different types of host electronic measurement, control, and data acquisition equipment, such as electric meters. After installation at the factory into a host device the Module and Antenna are fully enclosed and not accessible externally.

The module has to be installed by a trained professional only and only at the factory.

The following describes the general operation of the RF-LAN Module:

- The Module operates in ISM band (902 – 928 MHz) using the Frequency Hopping method.
- The Module can be installed in devices that provide a 5VDC power supply.
- Communication with the host device is accomplished through a 9600 baud serial interface.
- The Module adjusts output RF power according to reception of an acknowledgment signal.
- The Module can communicate with a similar Module located in other devices, such as a Gateway, and with low power RF transceivers located nearby inside devices like Water or Gas Meters.

Hardware Description

The main building blocks of the RF-LAN Module are the microcontroller, the RF transceiver, and the 1-Watt RF power amplifier, as shown in the following Figure 1: Block Diagram of RF-LAN Module.

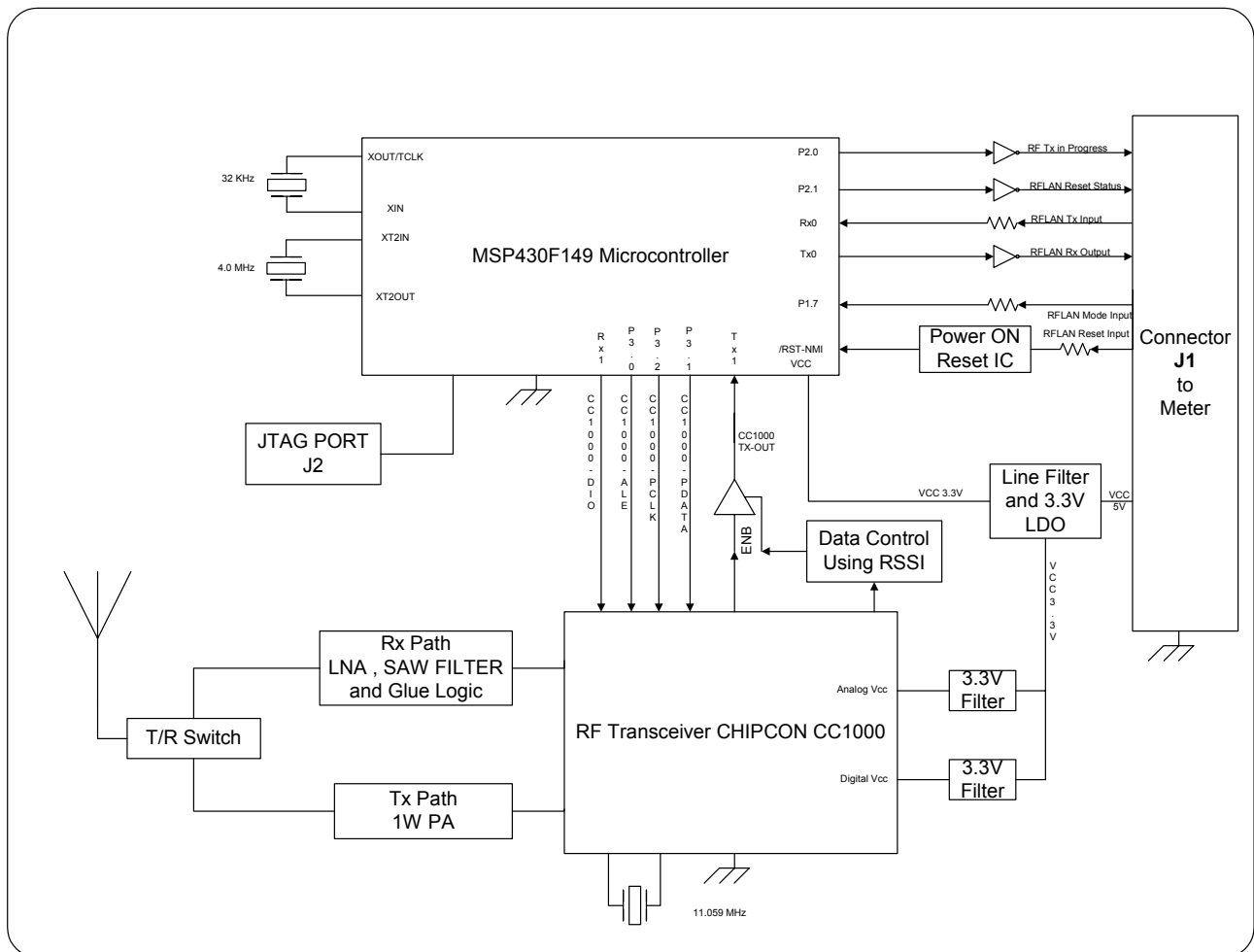


Figure 1: Block Diagram of RF-LAN Module

The MSP430 controller is the heart of the circuit, which interfaces with:

- The host device via the J1 connector.
- The CC1000 chip to send and receive data over the air.

The firmware program resides in the internal flash of MSP430. MSP430 has two crystals, Y1 is 32.768 KHz and Y2 is 4.0MHz. Y1 is basically used to work with a JTAG emulator for debug purposes, Y2 is used for normal operation. When the RF LAN Module is connected to a host device, the host device controls the way the RF LAN Module will work through the serial port, J1.5 (Reset), and J1.6 (Command/Data).

MSP430 controls all of the functions on the RF-LAN Module, it talks to the host device via Serial port 0. The mode of RF-LAN is set by the signal level at J1.6. When the signal level is high it is in command mode, when the signal level is low it is in data mode. MSP430 appropriately handles the data by polling the J1.6.

MSP430 talks to the CC1000 via port bits and sends/receives RF data using serial port 1. MSP430 initializes CC1000 by toggling port bits (simulated synchronous serial bus), P3.2 (PCLK), P3.1 (PDATA IO), and P3.0 (PALE), as provided by the CC1000 data sheets.

The CC1000 is a single chip RF transceiver, used for wireless application in the ISM band 300-1000MHz frequency ranges. The analog and digital supply to CC1000 is well filtered by using a PI filter to suppress noise. An 11.059 MHz crystal is connected to CC1000 as a reference for the data rate and for other internal functions.

On the receive path, the RF input signal from the antenna goes through a saw filter, an LNA, and a 50-ohm impedance matching network, before feeding the RF input of CC1000. Great care is taken to design the traces on these paths to match for 50-ohm traces in order to reduce loss.

On the transmit path, the RF2131 IC is connected to the RF output of CC1000 to provide a 1-Watt RF power output. The MSP430 controller does the on-off control of the PA.

The RF transmit and receive paths are connected to the antenna via a T/R switch. MSP430 controls which signal to pass by controlling the T/R switch, using port bits.

When CC1000 is programmed in receive mode, the data to the MSP430 is allowed only when RSSI (Receiver Signal Strength Indicate) is better than -105 DBm, using RSSI signal and glue logic.

MAX825SEUK (U5) provides the power on reset to the RF-LAN Module.

Software Description

At power-on, MSP430 initializes all port pins and initializes the CC1000. MSP430 sets the mode of operations by looking at J1 connector mode input (J1.6). The host device initializes all the RF-LAN registers at power-on in command mode.

When J1.6 is in data mode, MSP430 initializes the CC1000 in Rx mode. When a valid data packet is received, MSP430 checks for the valid CRC. If valid, it checks to see if it is addressed to this RF-LAN Module. If addressed correctly, the data packet is sent to the host device.

In data mode, data received on the serial port is buffered and packetized with the header, initialized with the CC1000 in the transmit mode, setting the T/R switch to the transmit path, and sends the data to the CC1000 to transmit the data over the air. Once the data is sent, the CC1000 is switched to the receive mode, waiting for the acknowledge packet for the data just sent. The frequency-hopping algorithm is implemented to send/receive data on various frequency channels. The frequency-hopping tables are residing in the flash of MSP430.