



Icron Technologies Corporation

FCC Title 47 Ch 1 Part 2.1033 (b) (4)

Brief Description of the WiRanger Circuit Functions and Operation

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1. Introduction

1.1. Purpose

This document has been written as part of the FCC certification requirements for Icron's WiRanger, Cable-Free USB Hub product.

1.2. Scope

Pursuant to FCC Title 47 Ch 1 Part 2.1033 (b) (4) [10-1-06 Edition], this document provides a brief description of the WiRanger's basic operation and circuit functions. A description of the ground system and antenna is also included.

2. WiRanger Basic Operation

The WiRanger allows standard USB devices to communicate with standard USB 1.1 or USB 2.0 host computers wirelessly. The WiRanger consists of two separate units: a Local EXtender (LEX) that connects to a USB host computer via a standard USB cable and a Remote EXtender (REX) that connects to USB devices. The LEX unit and the REX unit send USB communications between the connected PC and devices wirelessly using IEEE 802.11g radios. From a USB protocol perspective and hence the perspective of the connected PC and USB devices, the WiRanger acts like a regular USB 2.0 hub.

Figure 1 below shows the overall system diagram for the WiRanger. The Icron LEX FPGA sends USB data embedded inside Ethernet frames to the LEX Atheros AR2317 802.11 radio chip, for transmission across the wireless link. The REX Atheros radio chip receives these Ethernet frames and transfers them to the REX FPGA, which extracts the USB packets and transfers them to the USB 2.0 Hub that can communicate to attached USB devices. The system functions the same in the device to host, REX to LEX direction.

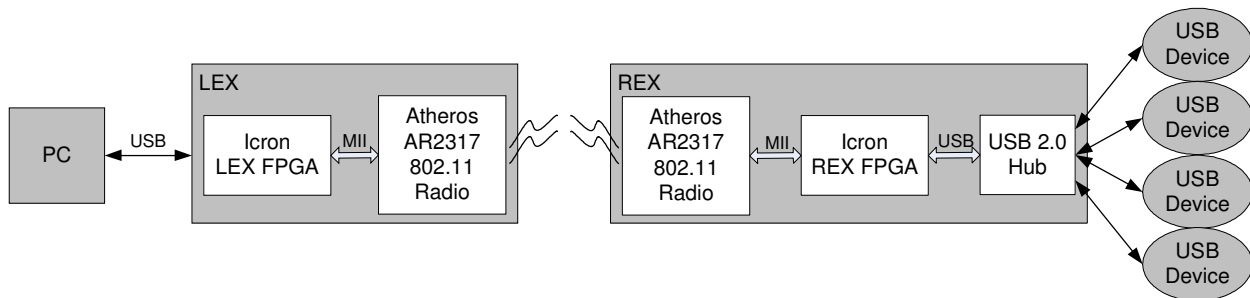


Figure 1: System Diagram and Expanded System Diagram

3. WiRanger Circuit Description

3.1. LEX Circuit Description

The USB host and LEX unit communicate using the USB 2.0 protocol. The USB host computer connects to the LEX using a standard USB cable connection to the USB type-B connector. USB Data is sent from the host, through the connector to the ULPI Transceiver as a 480Mhz differential pair, D+/D-.

The ULPI Transceiver converts the serial USB data into 8bit wide parallel data at 60Mhz and sends it to the FPGA.

After special processing in the FPGA the USB data is encapsulated in Ethernet frames and forwarded over the MII to the 802.11g radio.

The radio then sends these Ethernet frames to the REX.

The reverse occurs when receiving data from the USB device to the Host PC.

3.2. REX Circuit Description

The radio data is delivered via MII to the FPGA

After special processing in the FPGA the extracted USB data is sent to the ULPI Transceiver on 8bit wide parallel data at 60Mhz.

The ULPI Transceiver converts the parallel USB data to serial and sends it on a 480Mhz differential pair, D+/D-, to the USB 2.0 Hub

The USB Hub is connected to four USB type-A Device ports and will communicate to attached USB devices using the USB 2.0 protocol.

The reverse occurs when sending Device data to the Host PC.

3.3. Ground System and Antenna

The WiRanger uses a total of two 2.4GHz antennas, one each on the LEX unit and the REX unit. They are connected to RP-SMA connectors mounted on the PCB's. The antennas have a 50Ω nominal impedance and a maximum gain of 2.0dBi at 2.4GHz.

Both the LEX unit and the REX unit are powered by low voltage class II supplies that are not grounded on AC side. Local PCB ground is connected to the antenna connector directly.

4. Appendix A

4.1. Abbreviations

PC Personal Computer

USB Universal Serial Bus

ExtremeUSB Icron's USB extension protocol

LEX Local Extender

REX Remote Extender

MII Media Independent Interface

4.2. Revision History

Version	Date	Author	Reason for Change
A01	2007-02-12	Daniel Ternes	Creation
A01	2007-02-14	Daniel Ternes	Update graphic and text for submission.