

1 Introduction

This application note details a method of adding wireless USB capability to a device using LucidPort's L800 Wireless USB Controller. A Wireless USB peripheral connects to any Wireless USB enabled PC (Wireless USB Host). Existing (wired USB) drivers work directly with the wireless USB enabled peripheral. Using a native peripheral controller like the L800 yields the highest performance at the lowest cost.



Figure 1: A Wireless USB Host (PC) connected to Natively Wireless Peripherals

2 Hardware

A Wireless USB design requires the addition of two main components, the L800 Wireless USB Controller (contact LucidPort for detailed chip information) and a WiMedia UWB PHY.

With an asynchronous parallel interface similar a SRAM's, the L800 connects with the embedded CPU's memory bus. The CPU accesses and controls the L800 (and the USB transfer data) through standard memory reads and writes. Likewise, the L800 connects to and directs the UWB PHY through an industry standard interface (WiMedia MPIO).

2.1 Integration on the System Board

In most cases, designers will place the L800 and UWB PHY on the main system board. The L800 is used to connect to either wired or Wireless USB (or both at the same time.) Firmware running on the peripheral's CPU regulates both connections. As the L800 manages most USB functions automatically, the CPU role is mostly just reading and writing transfer data.

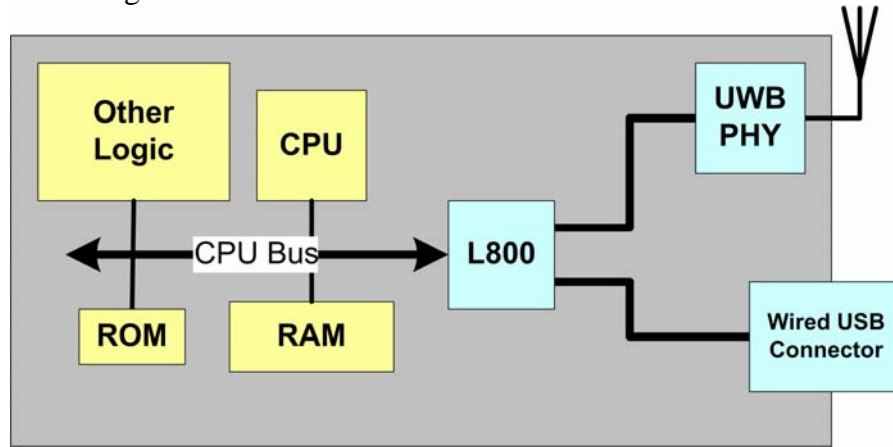


Figure 2: Adding the L800 to a design

2.2 A Separate PHY Module

Alternatively, a separate UWB PHY module can be used. This has several advantages.

1. The PHY modules are independently tested.
2. The more expensive and difficult to layout components are on a separate board.
3. PHYs can be easily replaced to conform with different regulations in different countries (different band groups).
4. Having a choice of industry-standard PHYs permits the selection of different price/performance levels. This also avoids single vendor lock-in.

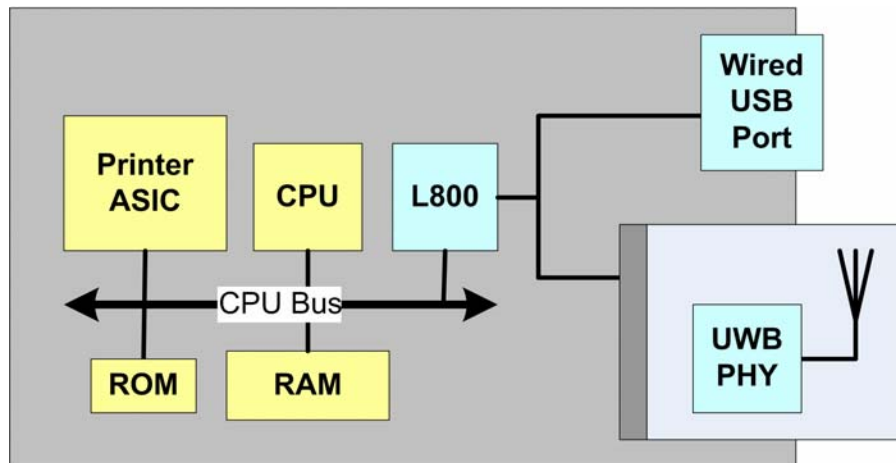


Figure 3: A design using a separate PHY module

2.3 Wireless USB Option

As the L800 has both wired and Wireless USB interfaces, it is possible to use the same design in both Wireless USB and wired USB products. With only the L800 on the system board, the peripheral connects using a standard (wired) USB 2.0 Hi-Speed peripheral interface. From the user's perspective, this is just a standard wired USB device.

Without changing firmware, Wireless USB functionality can be added by connecting a UWB PHY module to the L800. By placing a standard connector on the PHY module, Wireless USB becomes a build-to-order option. For the user, the device now supports both wireless and wired USB connections.

3 Software

3.1 Wireless USB enabled PC

No changes are required on the Wireless USB enabled PC (the user's PC). Existing peripheral (wired USB) drivers work directly with the wireless USB enabled peripheral.

3.2 Peripheral Firmware

3.2.1 System Driver

A System Driver takes direction from the USB host to controls the actual peripheral hardware (e.g. printer head). With two interfaces, instructions to the peripheral can now come from either a wired or wireless USB host. Modify the System Driver to arbitrate between the two hosts. One option is for the user to determine the connection by setting a parameter or switch. Another method would be for the System Driver to queue up requests that come in simultaneously.

3.2.2 Wired USB Client Driver

The Wired USB Client Driver in the peripheral determines how the PC controls it through wired USB. The Client Driver implements the protocol for printer, camera, or other USB functions.

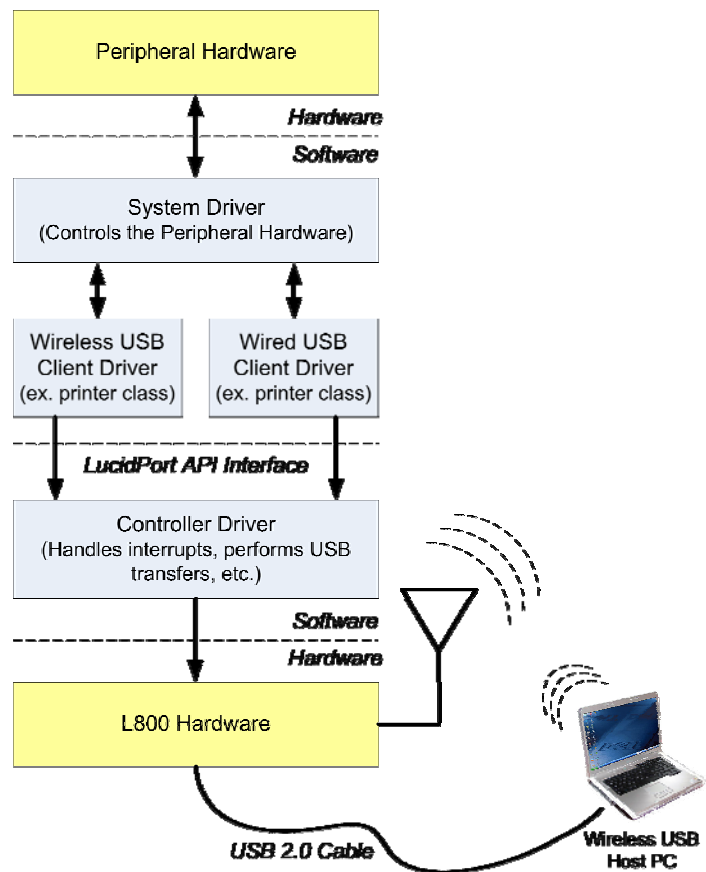


Figure 4: Peripheral Firmware Stack

The USB-IF requires that Wireless USB devices with wired USB peripheral ports support cable association. Therefore, the Wired USB Client Driver needs to be modified to support cable association. This is a minor modification and LucidPort provides examples with source code.

3.2.3 Wireless USB Client Driver

The Wireless USB Client Driver in the peripheral determines how the PC controls it through Wireless USB. The Client Driver implements the protocol for printer, camera, or other supported tasks.

This is almost identical to the Wired USB Client Driver. Minor modifications are required, including provisions for association, extra descriptors, and connection context management. LucidPort provides examples showing the required changes for USB printer, scanner, and mass storage classes. Source code is provided.

3.2.4 Controller Driver

LucidPort's controller driver is presented as a set of APIs used by the wired and wireless USB client drivers. These APIs abstract the USB protocol and the control of the L800 hardware to simple functional calls and data structures. They have been tested with the Linux, Windows, and WinCE systems and can be easily ported to other operating systems. Source code is provided.

4 LucidPort's Tools

1. L800 RDK board with detailed development guides, schematics, and bill of materials
2. Wired and Wireless USB Client Driver Examples for USB Printer, Scanner, Mass Storage, and Video classes (with source code)
3. LucidPort APIs (with source code) for the Linux, Windows, and WinCE operating systems

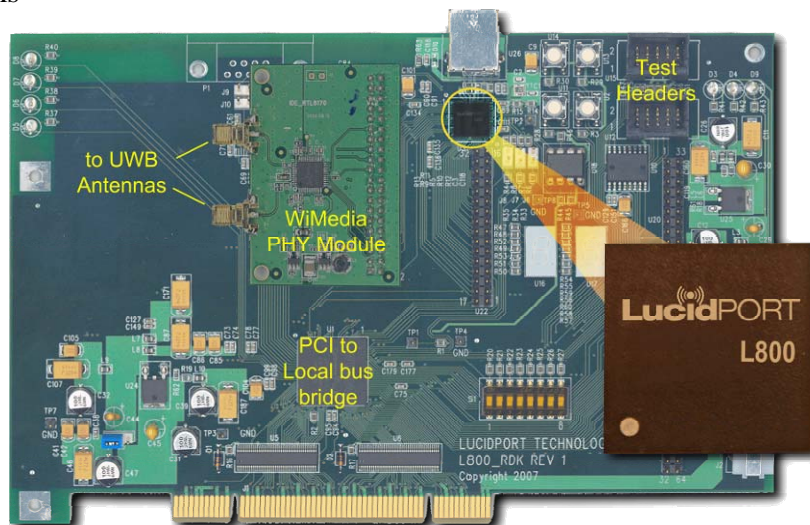


Figure 5: L800 Reference Development Kit (RDK)

5 Development Steps

1. Integrate LucidPort's APIs
2. Modify the peripheral's Wired USB Client Drivers to make the Wireless USB Client Driver
3. Modify the peripheral's Wired USB Client Drivers for cable association
4. Modify the System Driver to arbitrate between wired and Wireless USB hosts.

6 End-User Experience

6.1 Installation and Setup

Step 1:

The user associates the Wireless USB device with his Wireless USB enabled PC. The L800 supports both cable and numeric association. Association can be a part of the install process (step 2 below).

Step 2:

If the Wireless USB enabled PC does not already have the existing peripheral software/ driver, the user must install this using a CD or internet download. Installation and setup is now complete.

6.2 Usage

The user directs the natively wireless peripheral with his Wireless USB enabled PC just as one normally would with a wired USB based peripheral. If for some reason the wireless connection is severed, Windows would report that it is disconnected. The user can eliminate the obstruction or interference and the peripheral will reconnect automatically.

7 Regulatory Issues

1. The L800 utilizes ultrawideband technology. This transmits in the 3 to 5 GHz range – bands 1 to 3 of the WiMedia protocol. (Actual frequency usage is determined by the Wireless USB host, not the L800.) This may be regulated in your area. Check local laws before using.
2. Due to its encryption technology, the L800 is subject to US export controls. It may not be used or exported to (or to a national or resident of) Afghanistan, Cuba, Iran, Iraq, Libya, North Korea, Sudan, Syria, or any country to which the United States has embargoed goods or any organization or company on the United States Commerce Department's "Denied Parties List".

8 Further Information

Contact LucidPort for updates, technical support, and alternative design techniques at support@lucidport.com.