BT800 Series HID Proxy
BT800/BT820

Application Note  v1.4

INTRODUCTION

Laird’s BT800 series USB HCI devices support BLE HID proxy mode, a profile designed by Cambridge Silicon Radio that allows Bluetooth Low Energy HID devices to function on operating systems without the Bluetooth driver loaded. This functionality is present in the BT800, 810, and 820.

Both Classic Bluetooth and Bluetooth Low Energy have a similar problem with regards to the traditional HID profile. Until the host machine loads the Bluetooth driver, HID devices (such as a keyboard or mouse) cannot function. This makes certain tasks, like modifying the system BIOS, impossible with a Bluetooth mouse or keyboard. This is shown in Figure 1.

Note: In the BT820, HID Proxy mode works with “Just Works” devices and will not pair with BT devices that require a pincode or passkey.

Figure 1: Regular HID profile with Bluetooth Classic (left) and Bluetooth Smart (right)

The BLE HID Proxy profile allows the BT800 Series device to process all the Bluetooth activity on its own and present itself to the host as a USB device with regular HID data traveling over USB. This onboard processing means a BLE HID device may communicate over USB to any host that supports USB input devices, even if the host is not running the Bluetooth stack. Bluetooth operations occur transparent to the host (Figure 2).
This application note illustrates how to enable this BLE HID proxy function by modifying a few keys in the Bluetooth Persistent Store. The function is not enabled in production.

**Note:** Due to the proprietary nature of the third party software (CSR BlueSuite) used for BLE HID proxy mode, we only support BLE HID proxy mode for OEMs and NOT for individual customers.
REQUIREMENTS

- BT800 development board or BT820 USB dongle
- Windows PC

**Note:** Windows 8 is used in this guide. Windows 7 and XP can be used for the first time modification.

- CSR BlueSuite
- CSR USB driver or CSR USB-SPI adaptor for BT800 development kit.

**Notes:**

1. CSR BlueSuite is made available only to OEMs under a Laird NDA. OEMs should contact LT-wirelessinfo@lairdtech.com to obtain the NDA. After BlueSuite is installed, PStools can be found under the CSR folder.

2. CSR USB driver is provided along with the CSR BlueSuite. The CSR USB-SPI adaptor is available at: http://parts.digikey.com/1/parts/1406287-converter-usbspi-dev-sys-1808-1a.html

3. Due to the proprietary nature of the third party software (CSR BlueSuite) used for BLE HID proxy mode, we only support BLE HID proxy mode for OEMs and NOT for individual customers.

ENABLING THE BLE HID PROXY FUNCTION

Changing the VID and PID

**Note:** This step (changing the VID and PID) is only required for the BT820 USB dongle. Please refer to the “Modifying VID and PID for the BT820” application note for information on this step.

Installing CSR USB Driver

When the BT800 development board is first plugged in the PC USB port, Windows installs the driver automatically. It is recognized as the “Generic Bluetooth Radio” in the Windows device manager.

![Generic Bluetooth Radio in Device Manager](image)

Complete the following steps to install the CSR USB driver:

1. Right-click on **Generic Bluetooth Radio**, then click **Update Driver Software**.
2. Select the **Driver** tab and click **Update Driver**.

![Generic Bluetooth Radio Properties](image)

*Figure 5: Update Driver button in Properties panel*

3. Click **Browse my computer for driver software**.
4. Click **Let me pick from a list of device drivers on my computer**.
5. Click **Have Disk**.

![Have Disk button](image)

*Figure 6: Have Disk button*

6. Navigate to where the CSR driver is located on your computer, and select `CSRBlueCoreUSB.inf`. Proceed through the windows until software installation is complete.
Figure 7: CSR USB Driver installation
The BT800 development board is now recognized as *CSR BlueCore Bluetooth* in Windows device manager. It can be found by expanding “Universal Serial Bus controllers”.

![CSR BlueCore Bluetooth in Device Manager](image)

You can skip to Open PSTools if you are not planning to use the SPI adaptor.

**CSR USB-SPI Adaptor**

An RJ45 cable comes with the adaptor. Cut the RJ45 cable in half. Plug in the RJ45 jack into the adaptor and connect the open end to the development board.

![CSR USB SPI adaptor](image)

**Table 1** details RJ45 pins and their corresponding SPI signals.

<table>
<thead>
<tr>
<th>Signal</th>
<th>RJ45 Connector Pin</th>
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<tbody>
<tr>
<td>SPI_CS8</td>
<td>1</td>
</tr>
<tr>
<td>SPI_MOSI</td>
<td>5</td>
</tr>
<tr>
<td>SPI_CLK</td>
<td>7</td>
</tr>
<tr>
<td>SPI_MISO</td>
<td>3</td>
</tr>
<tr>
<td>GND</td>
<td>8</td>
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</table>
Open PStools

After invoking PStools, you must select either USB transport or SPI transport to access the PSkeys.

On the BT800 DVK board, there is a 10-pin header for SPI and WLAN Coexistence and a SPI/PCM switch. Be sure to put SPI/PCM switch on the SPI position before plugging the development board to your PC if an SPI interface will be used for opening PStools.

In PStools, select either USB or SPI transport as shown in Figure 12 and Figure 13.

PStools first reads all the PSkeys from the module. This process takes about ten seconds and then the screen in Figure 14 appears with Bluetooth address highlighted on the list and the MAC address shown on the right.

Note: The Bluetooth address of your module will be different than the one displayed in Figure 12 because this is a unique address. Do not attempt to change it or you might put the module in nonoperational condition.
Modifying the pskeys for BLE HID Proxy Mode

There are several pskeys to be modified. To simplify the process, customers can merge the `HCIandHIDKeys.psr`. To do this, follow these steps:

1. In the menu bar, select **File > Merge**.

2. Select the `HCIandHIDKeys.psr` file and click **Open**.
Enabling HID Mode

The HCI and HID mode keys have been written to the module, but HID mode has not yet been selected. You can merge the `EnableHID.psr` file to select HID. However, it is very important to understand that the module must be in HCI mode before Pskeys can be accessed again with pstools if further changes are to be made.

After the `EnableHID.psr` file is merged, close the pstools and reinsert the BT800 development board or BT820 dongle into the PC.

**WARNING:** Omitting “HCIandHIDKeys.psr” will render the BT8XX non-operational.

The device is now a recognized USB Composite Device.
Installing the Switcher Service

There is a service called VFPRadioSupportService provided by CSR. By enabling this service, Windows 8 is able to “switch” the HID device into HCI mode temporarily. Follow these steps to install the service:

1. Copy these two files (VFPRadioSupportService.exe and VFPRadioSupportService_PS.dll) into the C:\Windows\System32 directory. Note that administrative privileges are probably required.
2. Open a command prompt with Admin rights and navigate to the C:\Windows\System32 directory.
3. Enter `sc create VFPRadioSupportService binPath="C:\Windows\System32\VFPRadioSupportService.exe` to create the service.
4. Plug in the HIDenabled BT8xx device.
5. Open Device Manager, right click USB Composite Device, and select Update Driver.
6. Navigate to where CsrRadios_HID.inf is located and select it.
7. Click Open.

The BT8XX device is now recognized as Generic Bluetooth Radio.
8. By updating the driver with the CSR USB driver again as shown in previous section, it is possible to access the pskeys again.

Enabling the HCI Mode

You can merge EnableHCI.psr to select HCI mode. The BT8Xxx is recognized as Generic Bluetooth Radio even after the switcher service has been stopped.
WORKING WITH A BLE HID DEVICE

Connecting to a BLE Mice

To begin, you’ll need a Windows installation USB thumb drive. Insert the drive into your device, and select “BOOT from USB” in your PC’s boot screen (Figure 29).
Once the Windows setup screen is shown, insert the BT820 dongle which is already configured in BLE HID proxy mode. Press the “pairing button” on the BLE mouse (Figure 30). In this example, we’re using the ELECOM M-BT11BB.

After few seconds, the BT820 connects to the mouse automatically. No host BT/BLE stack is involved in the process (Figure 31).
Clearing the pairing entry

Once a connection has taken place, the pairing is saved. The BT820 will always try to connect to the same BLE device it has last connected to. The pairing entry needs to be cleared before it will connect to a new BLE device.

The pairing can be removed with HID “SET_FEATURE_REQ” command over USB – “0x06 0x0 0x0 0x0 0x0 0x0 0x0 0x0”. For testing purposes, there is an exe file to remove the pairing. If the switcher service has been installed and is running, the service must be stopped with “sc stop vfpradiosupport service” in command prompt (Figure 32). You must have administrative permissions.

Figure 32: Stop vfpradiosupportservice if the BT800 is not seen as a USB composite device
Clear HID Pairings

Figure 33: Clear the pairing in BT800 BLE HID proxy mode

BLE HID proxy mode pairing requirement

The BLE HID device must allow the “Just Works” as I/O CAP. It is not possible for the BT800/BT820 to provide any I/O capability other than the “Just Works” option. Some market available BLE keyboards require I/O CAP “Display” option, and it will reject the pairing if such security level is not met. Below is the sniffer trace showing the BLE keyboard and BT800 rejecting the pairing.

Figure 34: A BLE keyboard rejects the pairing because of insufficient authentication.

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
<th>Approved By</th>
</tr>
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<tbody>
<tr>
<td>1.0</td>
<td>18 Feb 2014</td>
<td>Initial Release</td>
<td>Jonathan Kaye</td>
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<tr>
<td>1.1</td>
<td>26 Mar. 2014</td>
<td>Minor Edits</td>
<td>Jonathan Kaye</td>
</tr>
<tr>
<td>1.2</td>
<td>11 Nov 2015</td>
<td>Expanded introduction on HID vs BLE HID Proxy</td>
<td>Jonathan Kaye</td>
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<tr>
<td>1.3</td>
<td>1 Dec 2016</td>
<td>Addition of example</td>
<td>Raymond Au</td>
</tr>
<tr>
<td>1.4</td>
<td>15 Aug 2017</td>
<td>Added clarifying note that BT820 HID Proxy only works with “Just Works” devices</td>
<td>Jonathan Kaye</td>
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