# RSL10 USB Dongle User Guide

When developing Bluetooth low energy applications, you often need to establish a connection between a peripheral that is being developed and a central device that can help verify and diagnose the behavior of the peripheral.

To serve this purpose, ON Semiconductor developed the combination of the RSL10 USB Dongle and the Bluetooth® Low Energy Explorer. The Dongle is plugged into a computer that has the Bluetooth Low Energy Explorer software installed. The Dongle can then act as a generic central device with which a software developer can do anything that a typical central application would do, such as advertising scanning, establish a connection, and list services and characteristics.

## 1. RSL10 USB DONGLE

### 1.1 Key Features

- Bluetooth v.5.0, single (Bluetooth low energy) mode compliant
  - Supports Master and Slave Modes
  - Supports up to four connections
- Integrated Bluetooth low energy stack
- Radio performance
  - Transmit power: +6 dBm to -17 dBm
  - Receiver sensitivity: -94 dBm
- Host interfaces
  - USB (virtual COM port emulation)
- Bluetooth Low Energy Explorer software to diagnose Bluetooth low energy connections during application development
- Bluetooth 5, CE, FCC, IC and Japan certified

### 1.2 Electrical Characteristics

NOTE: The ratings in Table 1 are absolute maximum ratings beyond which the module can be permanently damaged. These are not maximum operating conditions. The maximum recommended operating conditions are in Table 2.

**Table 1. Absolute Maximum Ratings**

| Rating | Min | Max | Unit |
|---|---|---|---|
| Storage Temperature | -40 | +85 | °C |
| VBUS | -0.3 | 6.5 | V |

**Table 2. Recommended Operating Conditions**

| Rating | Min | Max | Unit |
|---|---|---|---|
| Operating Temperature Range | -40 | +85 | °C |
| VBUS | 3.6 | 5.5 | V |

### 1.3 Certifications

#### 1.3.1 Bluetooth

The RSL10 USB Dongle is Bluetooth qualified and listed as an End Product.

#### 1.3.2 FCC

FCC ID: 2APD9-RSL10USB1

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

#### 1.3.3 ISED

IC: 23763-RSL10USB1

HVIN: RSL10V1.02

This device complies with Industry Canada’s licence-exempt RSSs. Operation is subject to the following two conditions: (1) This device may not cause interference; and (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

CAN ICES-3 (B)/NMB-3(B) – This Class B Digital Apparatus Complies with Canadian ICES-003.

Cet Appareil numerique de la classe (B) est conforme a la norme NMB-003 du Canada.

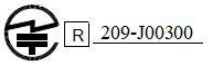
**WARNING:** RF Exposure Compliance

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 1 cm from all persons and must not be co-located or operating in conjunction with any other product antenna or transmitter.

L'antenne utilisée pour le produit doit être installée de manière à assurer une distance de séparation d'au moins 1 cm de toutes les personnes et ne doit pas être installée en même temps ou fonctionner en conjonction avec une autre antenne ou émetteur de produit.

### 1.3.4 Japan

The RSL10 USB Dongle has the Japanese certification number R209-J00300:




## 2. Bluetooth Low Energy Explorer Software

### 2.1 Introduction

Bluetooth Low Energy Explorer is a desktop application that runs on Windows®, developed to work with the RSL10 USB Dongle. The application allows developers to quickly become familiar with developing, testing, and evaluating Bluetooth low energy devices. Bluetooth Low Energy Explorer lets you scan for your device, read advertising data, connect, and discover services. You can then pair and bond to your device, read and write to characteristics, subscribe to notifications, and receive characteristics updates. The application also features a logging section, which displays the details of processes in the underlying structure, allowing for easier troubleshooting.

List of software features:

1. Scanning and reading advertising data
2. Connecting, pairing, and bonding
3. Service and characteristic discovery
4. Reading and writing of characteristics
5. Support for notifications and indications
6. Listing paired/bonded devices
7. Radio transmission power selection
8. Local device firmware updates
9. An external script for updating the dongle firmware

### 2.2 Before Using Bluetooth Low Energy Explorer

1. Install the Bluetooth Low Energy Explorer software.
2. Plug the RSL10 USB Dongle into a USB port. You might be prompted to install device driver software. You can either:
   - Follow the link in the error dialog to obtain the driver from the web.
   - Find the driver in *ON Semiconductor /Driver /CP210x_windows_Drivers.zip* where you installed the Bluetooth Low Energy Explorer. Unzip and install the appropriate *.exe* file.
3. Open the windows Device Manager and check which com port has been assigned (see Figure 1).

Now you can start Bluetooth Low Energy Explorer.

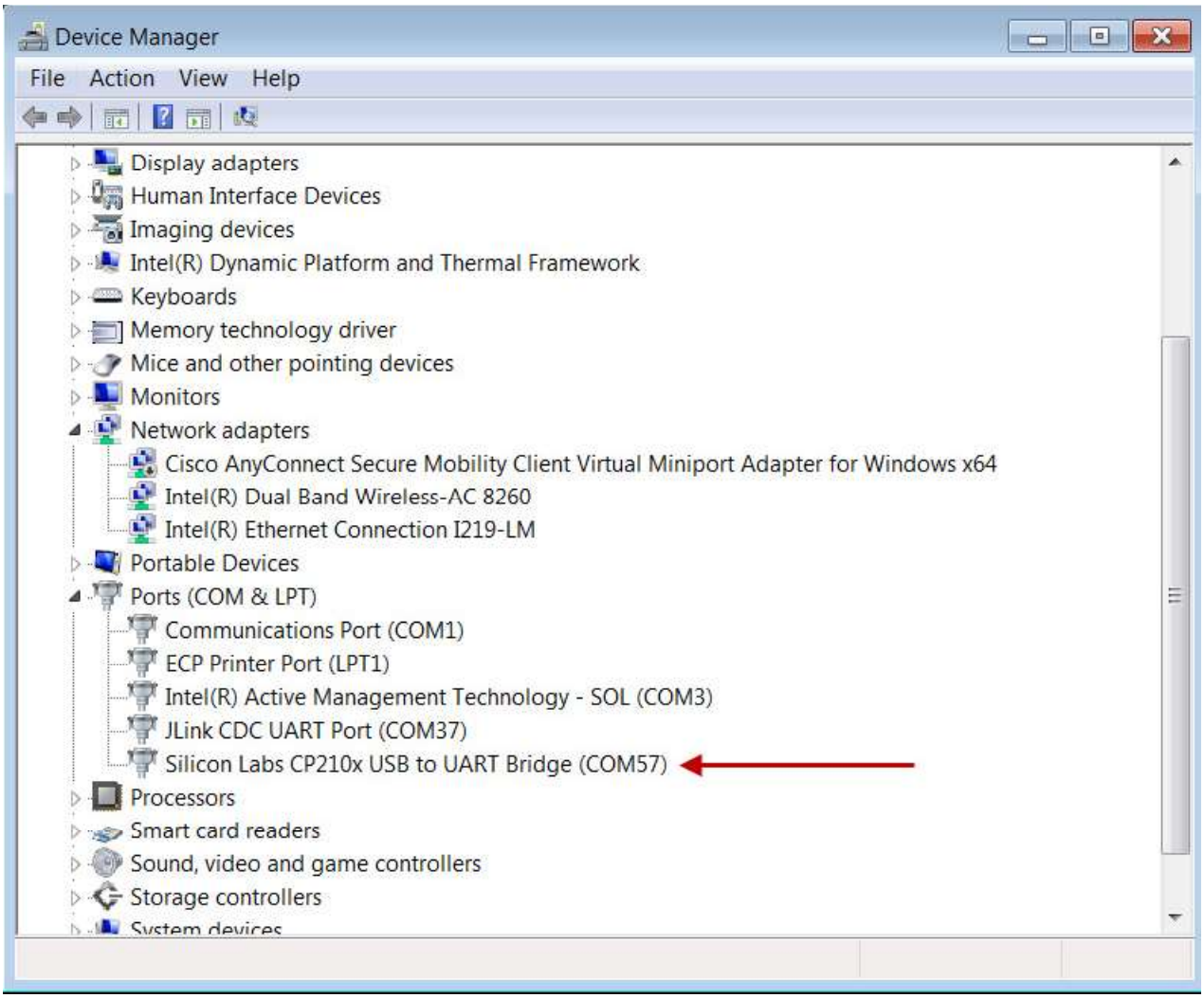



**Figure 1. Assigned COM Port**

### 2.3 Using Bluetooth Low Energy Explorer

In the Start Menu, browse to:

- **All Programs** > **ON Semiconductor** > > **Bluetooth Low Energy Explorer**
- If you are running Windows 10: **ON Semiconductor** > **RSL10 dongle** > **Bluetooth Low Energy Explorer.exe**

Select the Com Port which has been assigned during installation (see Figure 2, and Section 2.2, “Before Using Bluetooth Low Energy Explorer” on page 3).

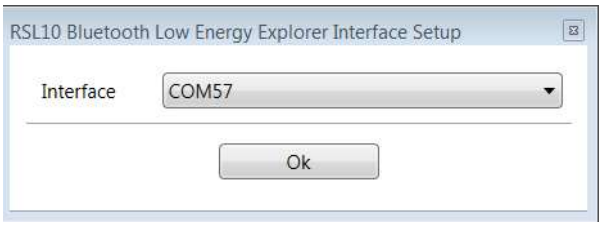



**Figure 2. Select COM Port**

The Bluetooth Low Energy Explorer window is split into three main areas with an occasional fourth area, as shown in Figure 3:

1. List of visible Bluetooth low energy technology devices
2. Details of the selected device
3. Log information
4. The User action area on the right of the screen, is visible only when needed, such as for bonding data. You enter passkeys in this area when they are required.

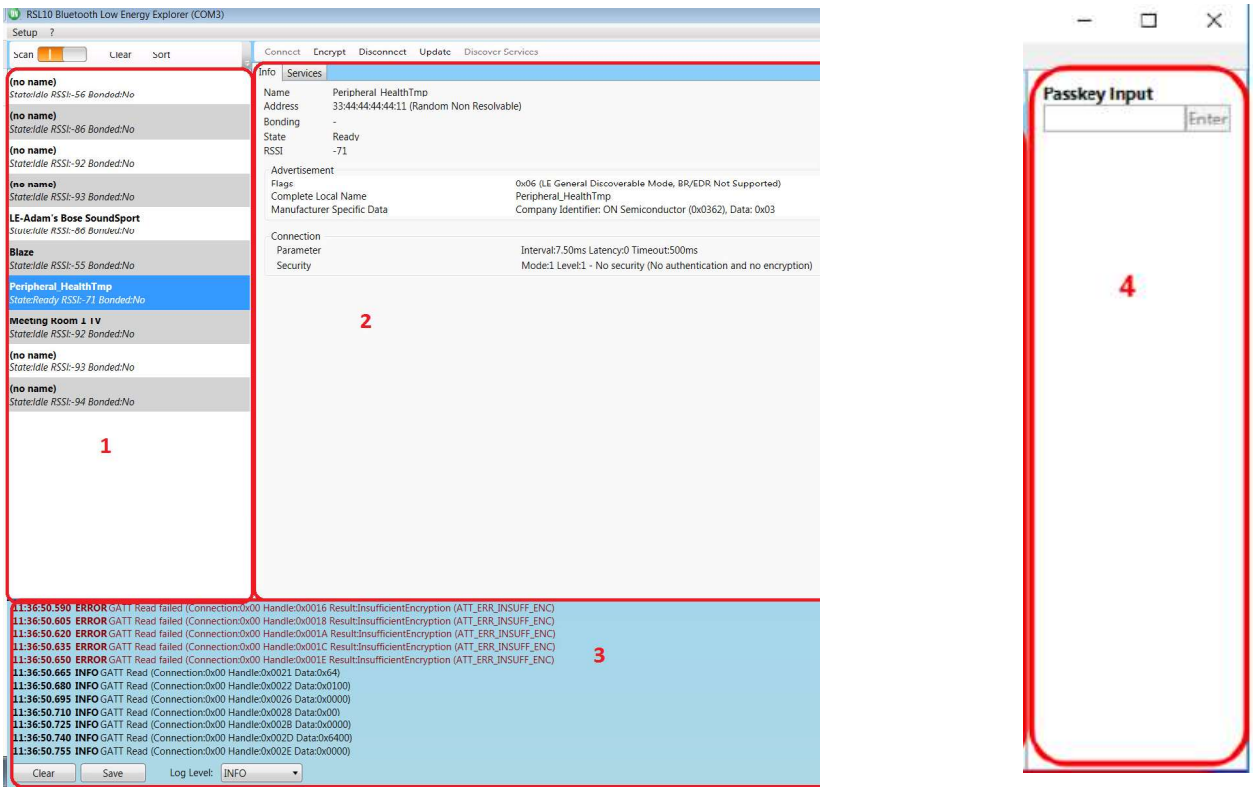



**Figure 3. Bluetooth Low Energy Explorer Window Areas**

### 2.3.1 Establishing Connection and Discovering Services

General working procedure (see Figure 4, above):

1. Start Scanning by toggling the switch.
2. Select your device.
3. Make a connection to the device.
4. When you want to discover or update services, click the **Discover Services** button.
5. Switch to the new tab **Services.**
6. Depending on the services and characteristics offered by the connected device, values can be read and/or modified.

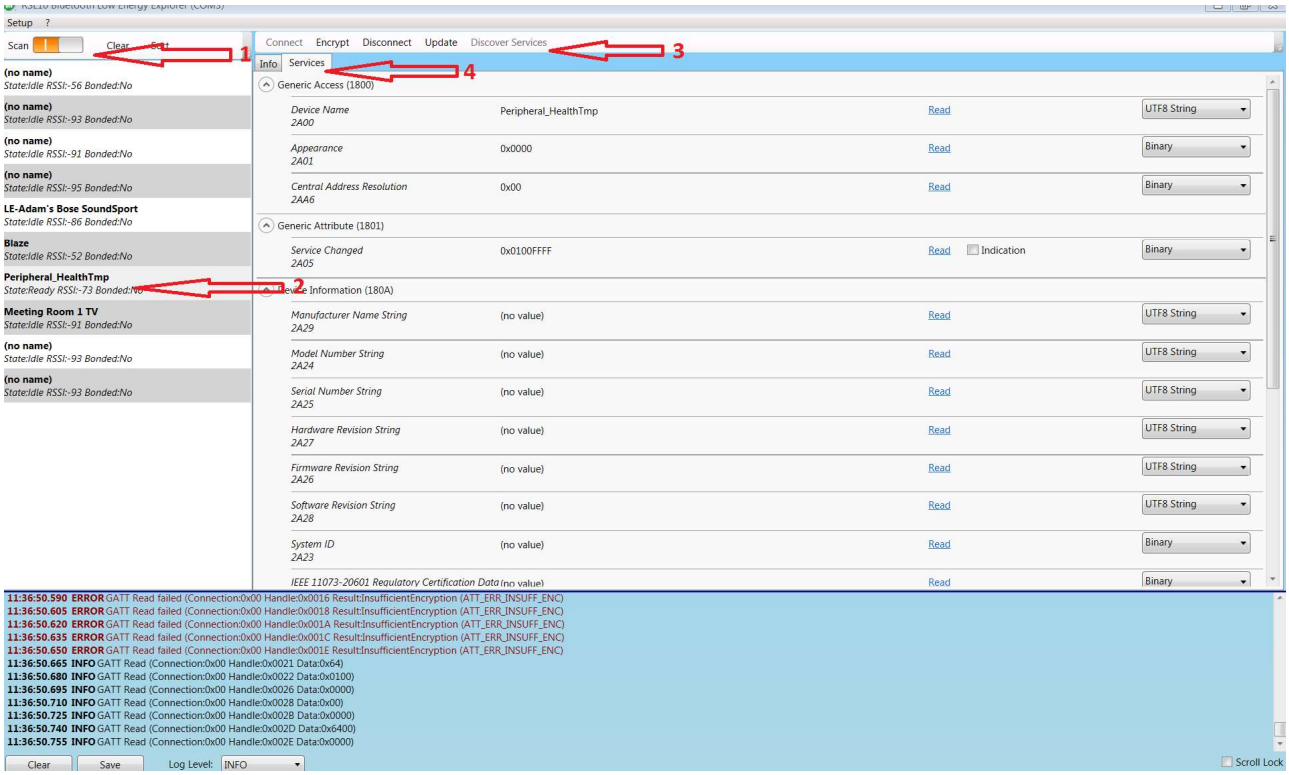



**Figure 4. Establish Connection**

### 2.3.2 The Services Tab

The content of the **Services** tab depends on the services and characteristics offered by the connected device.

All characteristics sub-procedures are implemented; Figure 5 is an example of how some of the sub-procedures (depending on the device) might be displayed in the **Services** tab:

- Clicking **Read** reads the characteristics value.
- Clicking **Write** writes a change to the characteristics value.
- The characteristics writing properties Write Request or Write Without Response are displayed if either or both are supported.
- Some services offer a continuous update. Ticking the notification or indication box sets the characteristic in the service to be continuously updated.

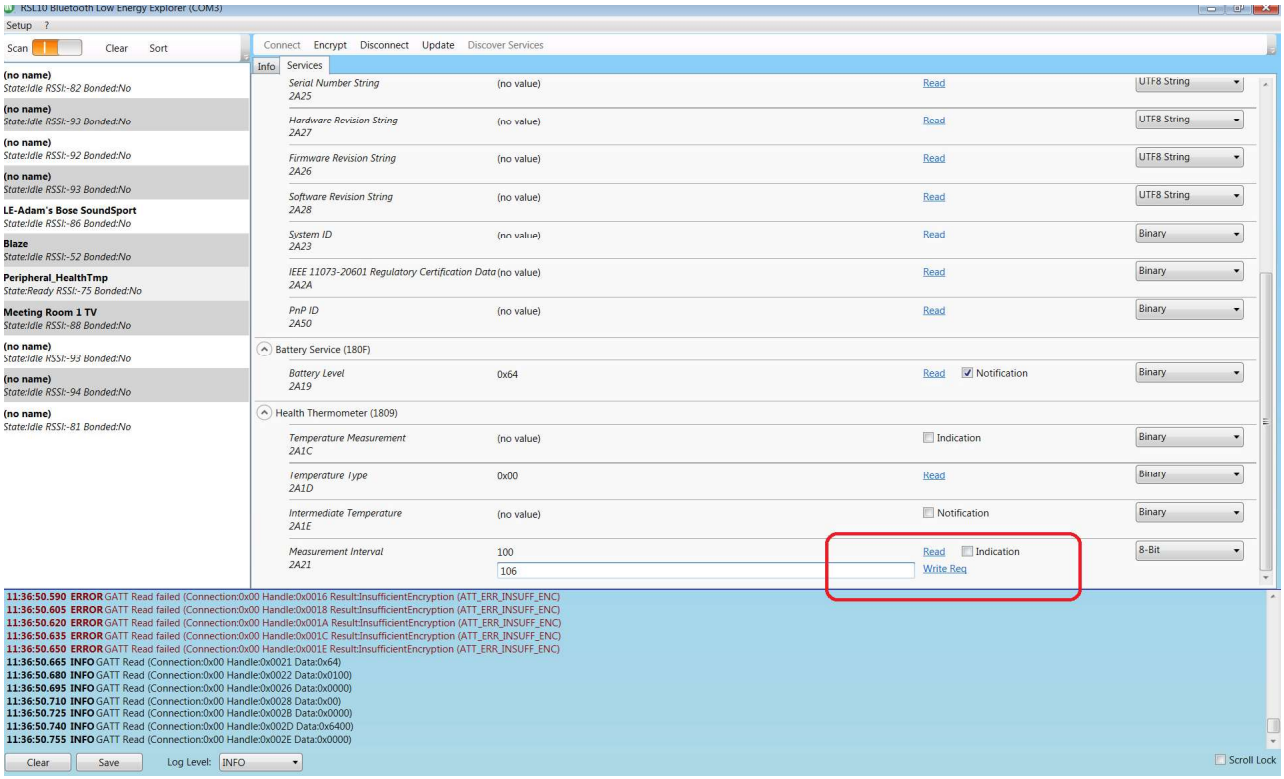



**Figure 5. Services Tab of a Connected Device**

NOTE: Some parameters are only accessible over an encrypted connection (see Section 2.4, “Enable Encrypted Connection”).

## 2.4 Enable Encrypted Connection

So far the connection has not been encrypted. To access all parameters, the connection needs to be changed to an encrypted connection.

1. The supported encryption settings can be selected in **Setup Menu** > **Security**, as shown in Figure 6. The Security Manager abbreviations are defined in Table 3 on page 8.

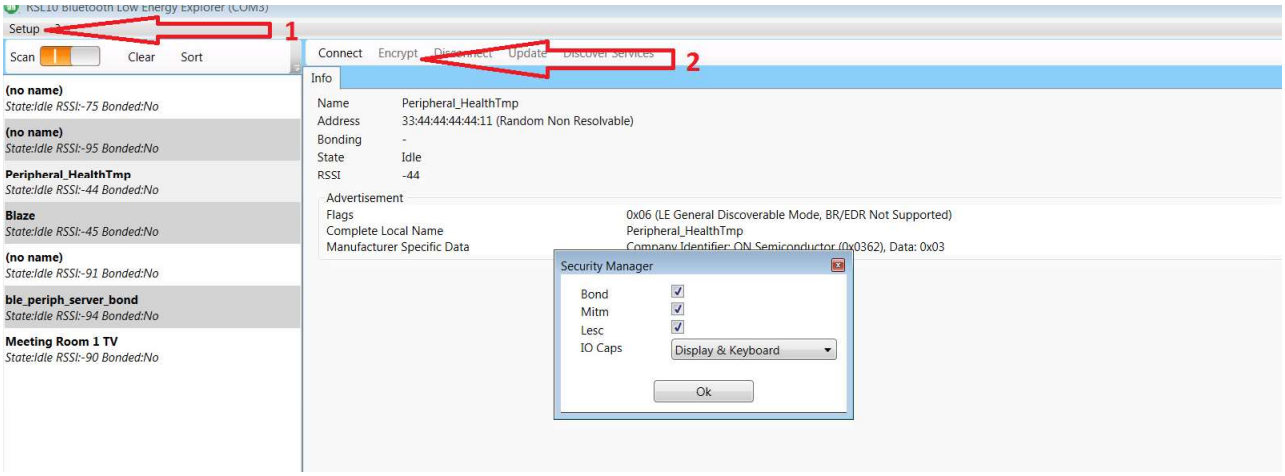



**Figure 6. Setting the Security Options**

**Table 3. Security Manager Abbreviation Meanings**

| Abbreviation | Definition |
|---|---|
| Bond | Bonding |
| Mitm | Man in the Middle |
| Lesc | LE Security Connections |

2. To change the connection to an encrypted one without saving bond information, press the **Encrypt** button as shown in Figure 7.
3. To have an encrypted connection and saved pairing information, press **Bond/Pair** as shown in **Figure 7**.
4. If a passkey is needed, it is displayed, or can be entered in the user action area (see Section 2.3, “Using Bluetooth Low Energy Explorer” on page 4, and Figure 3 on page 5).

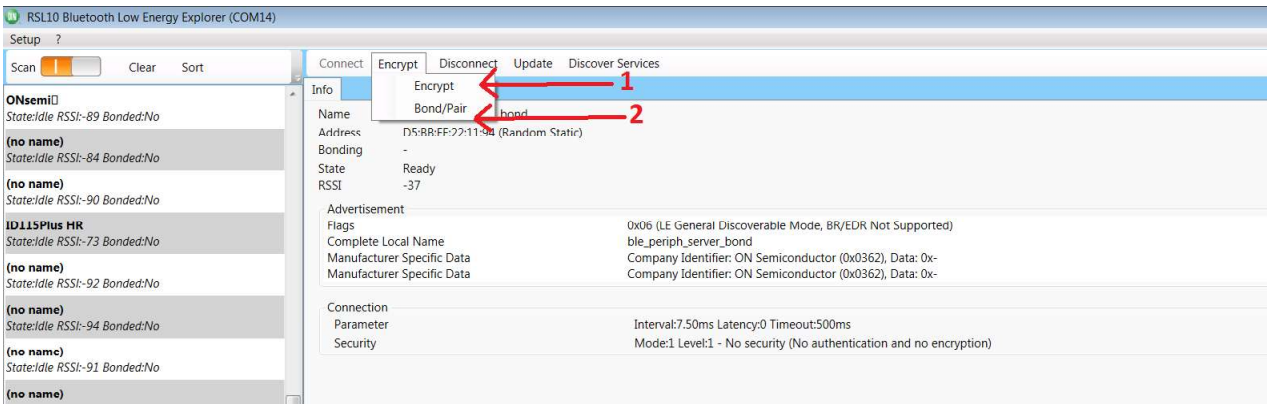



**Figure 7. Menu for an Encrypted Connection**

### 2.5 Initial Connection Settings

Figure 8 shows where you can set the initial connection settings before connecting. Once they are set, they become the default connection parameter settings for any device that you want to connect to.

To open the Connection Parameter window, press **Setup > Connection**. The numbered areas in Figure 8 are as follows:

1. Initial connection parameter settings before connecting to the device. For a description of the parameter settings, see Figure 9.
2. Minimum Connection Event Length in milliseconds
3. Maximum Connection Event Length in milliseconds
4. Scan Window in milliseconds
5. Scan Interval in milliseconds

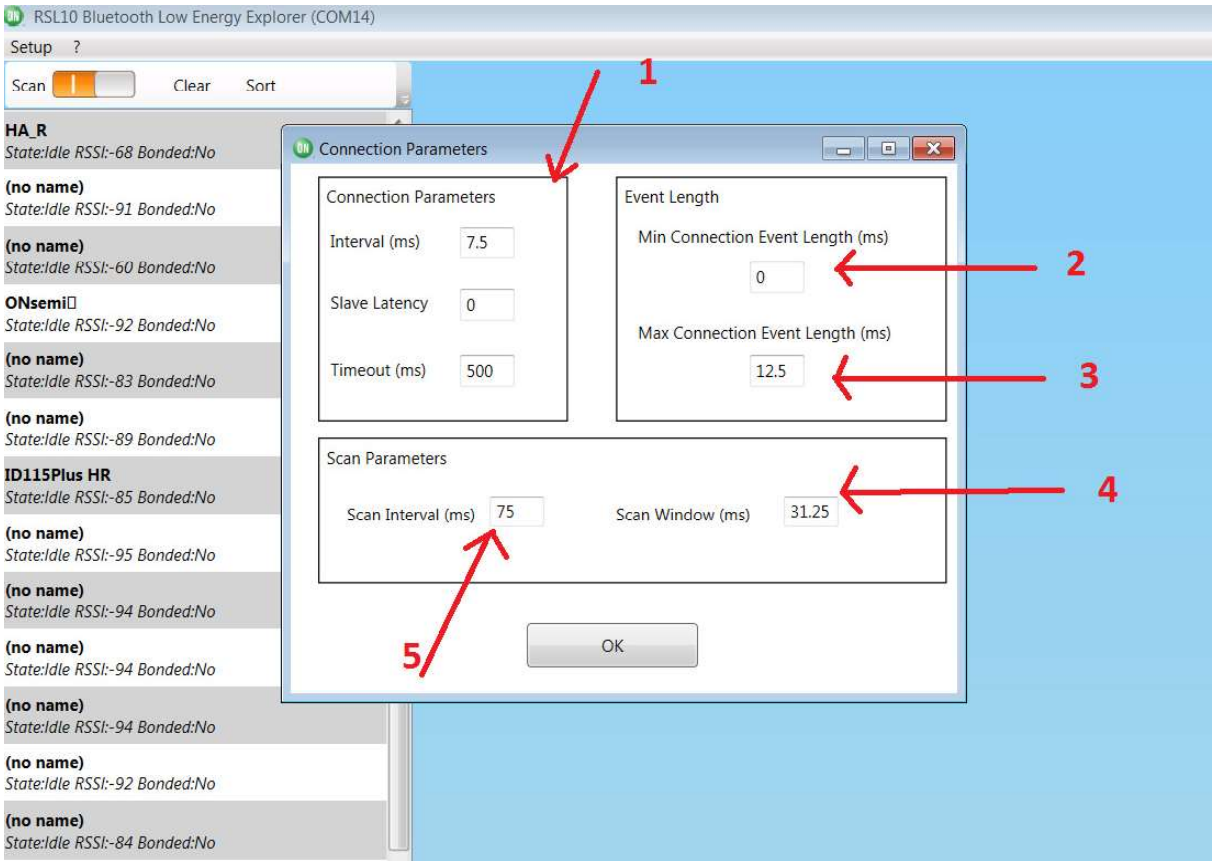



**Figure 8. General Connection Settings**

Alternatively, you can update the connection parameters while connected, using the **Update** button in the Services tab, which is shown in Figure 9.

In Figure 9:

- **Interval** is the connection interval in multiples of 1.25 ms units

- **Slave Latency** is the number of connection events
- **Timeout** is in multiples of 10 ms units.

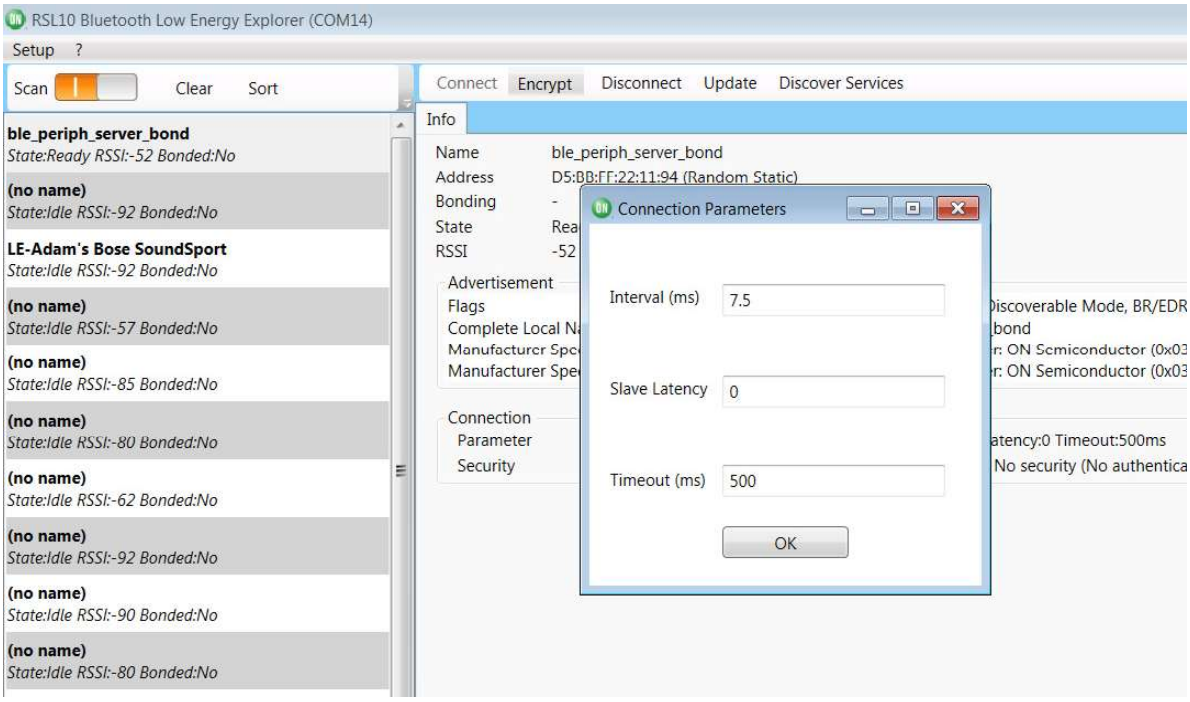



**Figure 9. Connection Parameter Window Update**

### 2.6 Bond Manager

The Bond Manager is accessible in the main menu under **Settings** > **Bonds**:

In the **Bond Manager** window, all currently active bonds are displayed. There is also the option to delete them. (See Figure 10.)

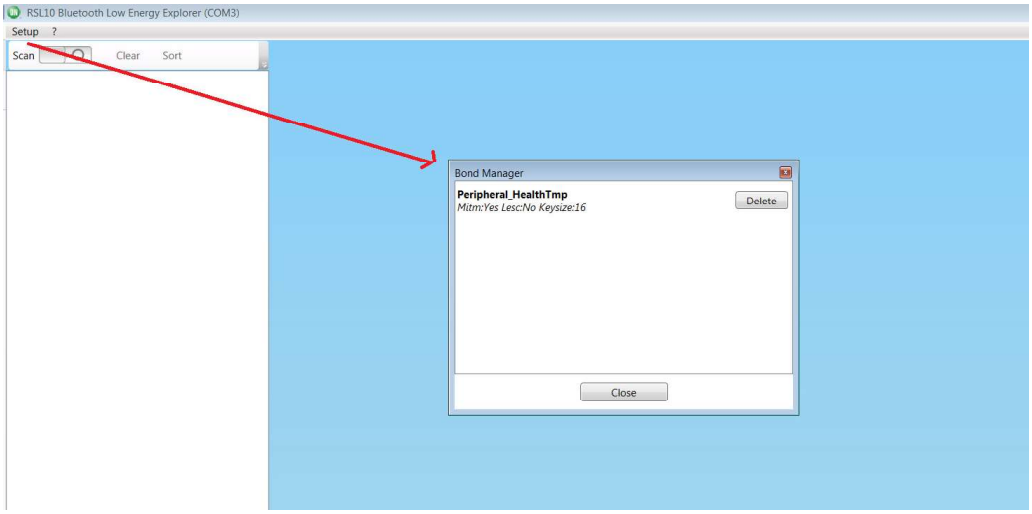



**Figure 10. Bond Manager**

### 2.7 TX Power Update

TX power (Transmission power) in dBm ranges from +6 dBm to -17 dBm.

NOTE: If you are using a new RSL10 USB Dongle, you have to update the firmware on the dongle to get access to this feature.

To open the TX Power window, press **Setup > TX Power**, and a window like Figure 11 appears.

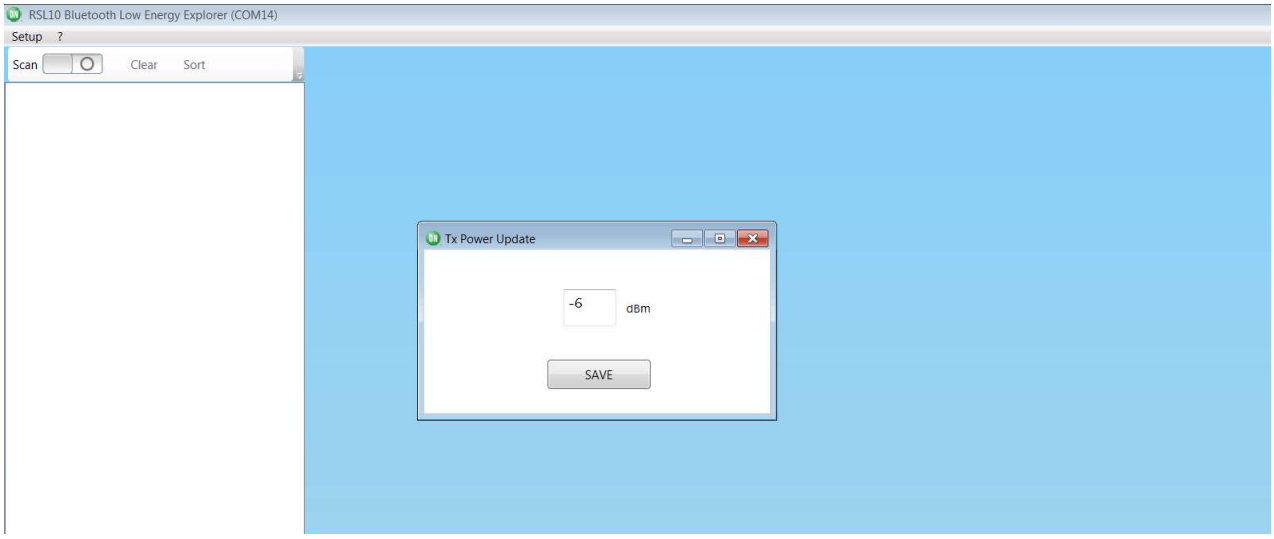



**Figure 11. TX Power Update Window**

## 2.8 Dongle Information

The Bluetooth Low Energy Explorer version, and Dongle version and ID, can always be accessed in the **About** dialog (see Figure 12).

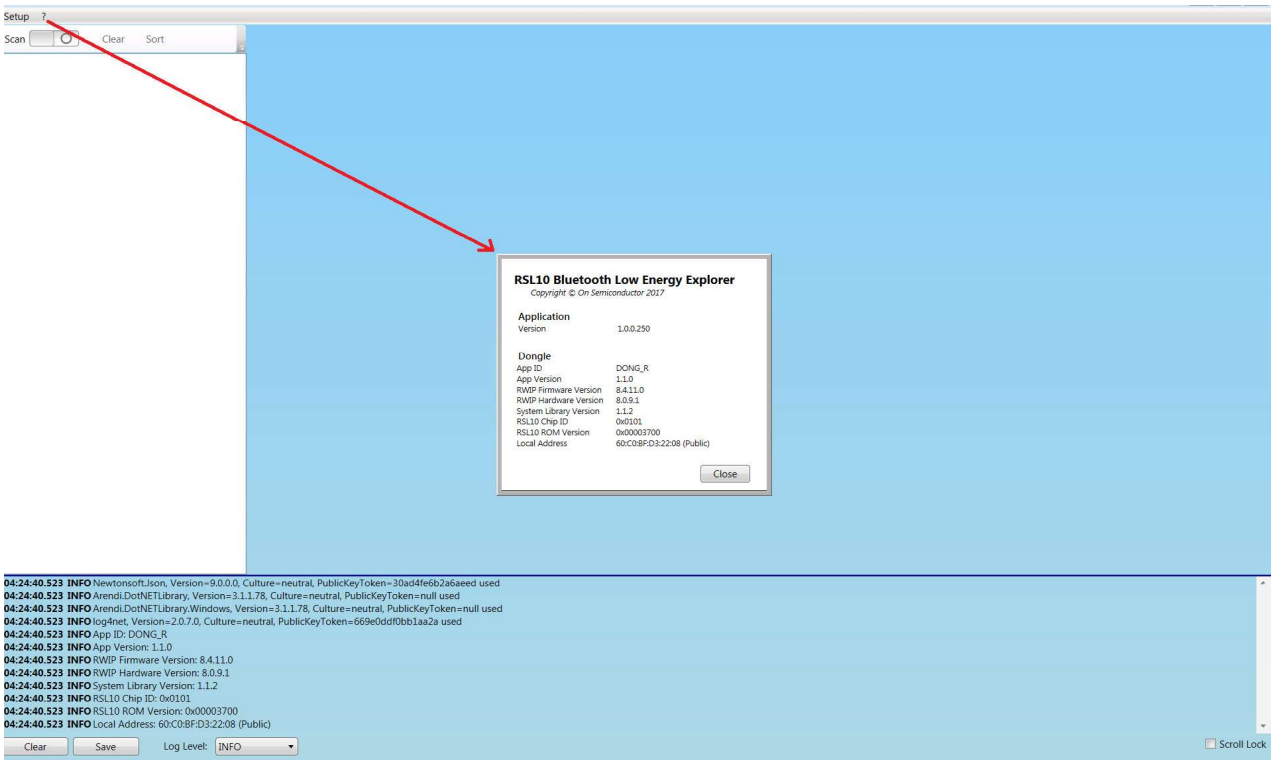



**Figure 12. Version and ID Info**

## 2.9 Dongle Updater

For updating the firmware on the dongle itself, a dedicated Python script is available called *updater.py*, which is in the *Firmware* subfolder of the Bluetooth Low Energy Explorer installation.

The script has the following prerequisites:

- Installed Python, version 2.7.x or ≥ 3.4
- Installed module *pyserial*, version ≥ 3.2
- *CP210xRuntime.dll* in the same directory as *updater.py*
- SiliconLabs VCP driver version ≥ 6.7.3

The help command for the update protocol is as follows:

```
> updater.py -h
```

This command gives the following output:

```
usage: updater.py [-h] [-v] [--force] PORT FILE
```

```
Updates the RSL10 USB Dongle with a firmware image file.

positional arguments:
PORT     COM port number of RSL10 USB Dongle
FILE     image file (.bin) to download

optional arguments:
-h, --help     show this help message and exit
-v, --version  show program's version number and exit
--force        force overwrite of the bootloader
```

The following is an example of using the command with the `PORT` positional argument to update the firmware (the *DongleFW.bin* file is in the *Firmware* subfolder of the Bluetooth Low Energy Explorer installation):

```
> updater.py <PORT> DongleFW.bin
```

This command gives the following output and programs the new firmware into the USB Dongle:

```
Image      : DONG_R ver=1.0.1
Application: DONG_R ver=1.0.0
Bootloader : BOOT_R ver=1.0.0
********************************************************************************
***************
```

It shows the version information of the image file, the currently installed application, and the installed bootloader. For every transmitted flash sector of image data, an asterisk (*) is printed.

### 2.10 Dongle Hardware

The dongle has a dual color LED, which is used to represent different functions as shown in Table 4, below:

**Table 4. LED Colors and Functions**

| Function | LED Color |
|---|---|
| When using the DongleFW | a short flash during start up, and then off |
| When the dongle is in the bootloader | constant red |

## PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT:**
Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
**Phone**: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
**Fax**: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
**Email**: orderlit@onsemi.com

**N. American Technical Support**: 800-282-9855 Toll Free USA/Canada
**Europe, Middle East and Africa Technical Support**: Phone: 421 33 790 2910

**ON Semiconductor Website: www.onsemi.com**

**Order Literature**: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative

**M-20847-002**