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AN214871

Establishing Bluetooth Low Energy (BLE) Connections and Conducting Throughput Testing using BlueTool™

Associated Part Family: CYW20734

This document provides procedures that describe how to establish BLE connections and conduct throughput measurements using the Cypress BlueTool™ software utility. The document shows software engineers how to use BlueTool™ software to prepare two CYW20734-equipped devices for Bluetooth throughput testing.

Contents

1 About This Document 1
1.1 Cypress part numbering scheme 1
1.2 Acronyms and Abbreviations 1
1.3 References 2
2 IoT Resources 2
3 About BlueTool 2
4 System Requirements 3
4.1 Host System Requirements 3
4.2 Software Requirements 3
5 System Connections 3
6 Launching BlueTool 3
7 Configuring BlueTool for LE Connections and Throughput Testing 4
7.1 Setting Up the HCI Control Transport 4
7.2 Low Energy Control for Advertising 6
7.3 Starting an LE Connection 9
7.4 Creating an LE Connection 10
7.5 Setting Up Devices for Throughput Testing 12
Document History Page 15
Worldwide Sales and Design Support 16

1 About This Document

1.1 Cypress part numbering scheme

Cypress is converting the acquired IoT part numbers from Broadcom to the Cypress part numbering scheme. Due to this conversion, there is no change in form, fit, or function as a result of offering the device with Cypress part number marking. The table provides Cypress ordering part number that matches an existing IoT part number.

Table 1. Mapping Table for Part Number between Broadcom and Cypress

Broadcom Part Number	Cypress Part Number
BCM20734	CYW20734

1.2 Acronyms and Abbreviations

In most cases, acronyms and abbreviations are defined upon first use. For a more complete list of acronyms and other terms used in Cypress documents, go to: http://www.cypress.com/glossary.

1.3 References

The references in this section may be used in conjunction with this document.

Document Name	Document Number	Source
Cypress Documents		
[1] *BTSP User's Guide*	–	Bundled with the BlueTool software package
[2] *Software for Exercising, Testing, Scripting, Debugging, and Programming Devices*	BlueTool-QSG1xx-R	Cypress Developer Community
Other Documents		
[3] *ActivePerl Documentation*	–	ActiveState Docs @ http://docs.activestate.com
[4] *General information on Perl*	–	http://www.perl.org http://www.activestate.com http://perl.oreilly.com

2 IoT Resources

Cypress provides a wealth of data at http://www.cypress.com/internet-things-iot to help you to select the right IoT device for your design, and quickly and effectively integrate the device into your design. Cypress provides customer access to a wide range of information, including technical documentation, schematic diagrams, product bill of materials, PCB layout information, and software updates. Customers can acquire technical documentation and software from the Cypress Support Community website (http://community.cypress.com/).

3 About BlueTool

BlueTool is a proprietary Cypress software tool for exercising, testing, scripting, debugging, and programming devices that use Cypress Bluetooth chips. BlueTool runs on a standard PC running the Microsoft® Windows® operating system. BlueTool interfaces with the Cypress Bluetooth chips at the HCI protocol layer. The HCI UART is supported.

4 System Requirements

4.1 Host System Requirements

A personal computer running the Microsoft® Windows® operating system is required to use BlueTool. Cypress recommends running Windows XP. However, other versions of Windows are supported.

Note: BlueTool is frequently updated, resulting in operational and other changes to the graphical user interface. Consequently, this document only contains basic instructions on using BlueTool. These instructions should remain the same for all BlueTool releases. If discrepancies exist between this document and the version of BlueTool you are using, contact your Cypress technical representative or visit Cypress's Developer Community for Hardware Requirements

The following hardware is required to use BlueTool:

- Two USB cables.
- Two Cypress Bluetooth CYW20734-based devices.
- Two UART-to-USB adapter boards.

Note: Contact your Cypress sales representative for the UART-to-USB adapter boards.

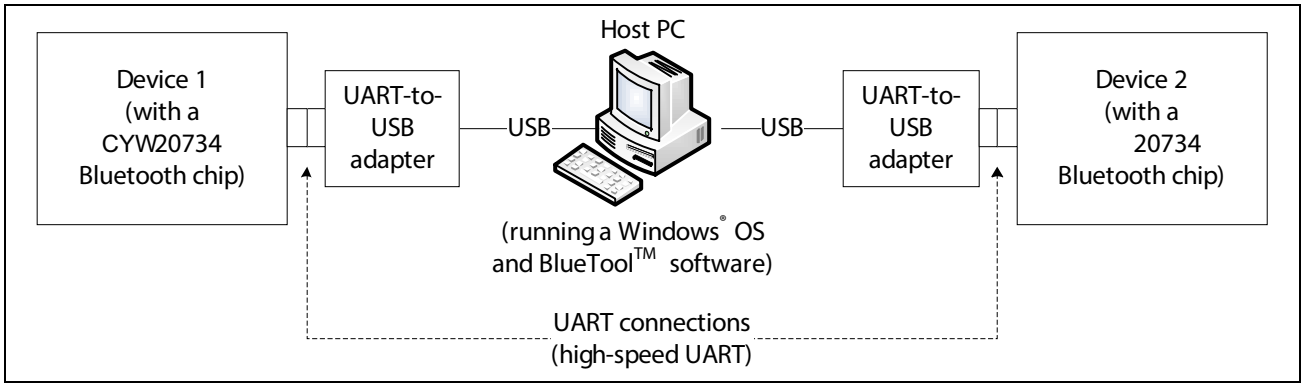
4.2 Software Requirements

BlueTool provides support for Perl®scripting. If this feature is being used to automate throughput testing, then a Win32® version of ActivePerl (5.8.4 or higher) must be installed on the host computer. Earlier versions of ActivePerl are not supported.

Note: ActivePerl is available from ActiveState at www.activestate.com.

5 System Connections

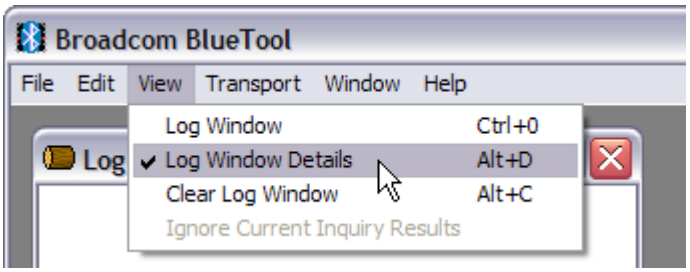
Figure 1. System Setup



6 Launching BlueTool

Complete these steps to launch BlueTool and display the log window:

1. Click **Start>All Programs>Cypress BlueTool>BlueTool** to open the BlueTool application.
2. In BlueTool, click **View>Log Window** to display the log window.
3. Click **View>Log Window Details** to enable the log window to display detailed log information.



7 Configuring BlueTool for LE Connections and Throughput Testing

This section contains instructions on configuring BlueTool for over-the-air throughput testing.

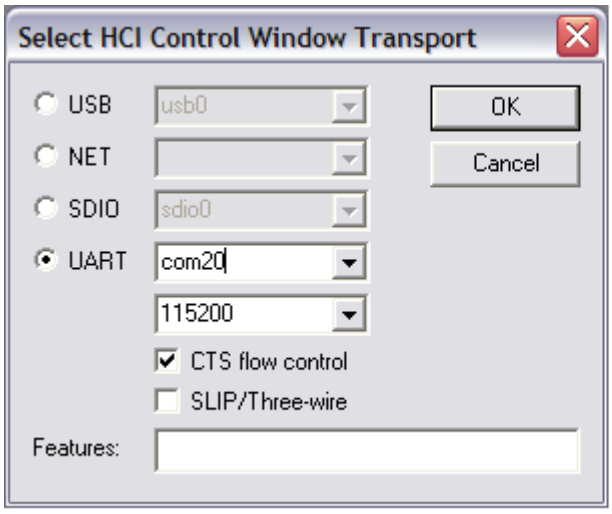
- Setting Up the HCI Control Transport on page 4
- Low Energy Control for Advertising on page 6
- Setting Up Devices for Throughput Testing on page 12

Note: As shown in Figure 6 on page 3, the host PC has two UART connections. The associated COM ports displayed in the screenshots of this section are com20 and com21. These COM ports can vary among different test setups.

7.1 Setting Up the HCI Control Transport

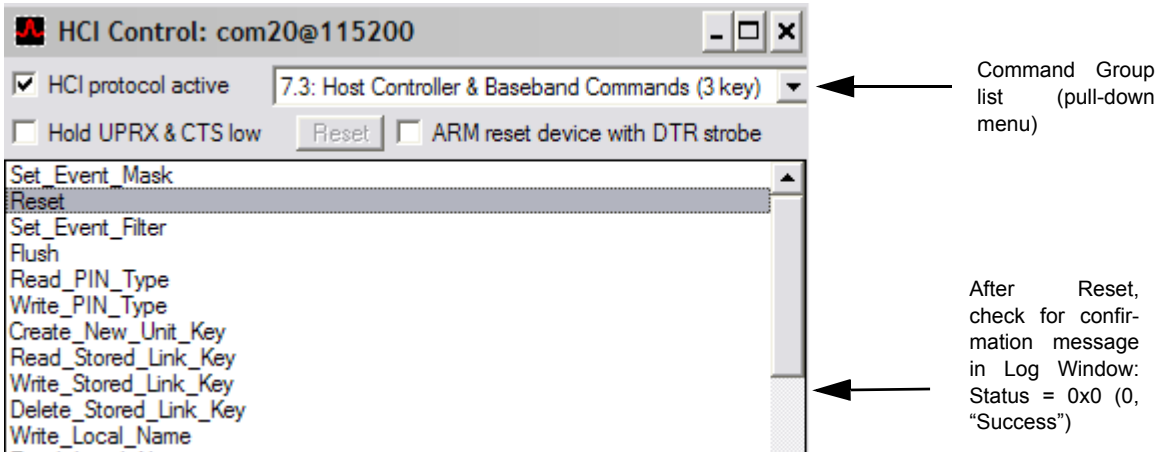
7.1.1 Setting Up the HCI Control Transport for Device 1

1. Click **Transport>HCI Control** (keyboard shortcut **CTRL+1**) to display the Select HCI Control Window Transport window.



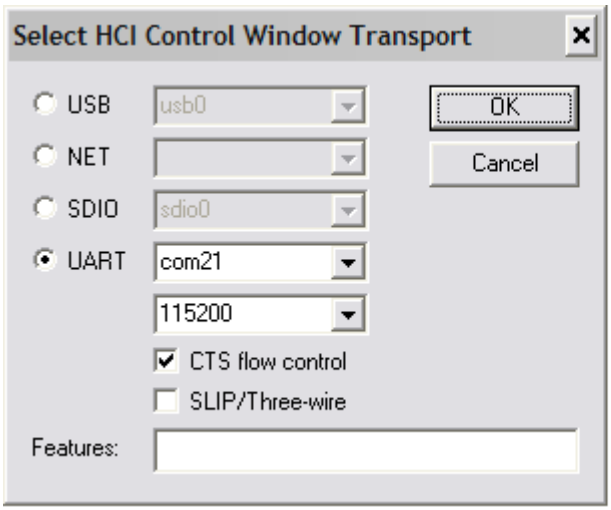
2. Select the **UART** option and select or type the Device 1 COM port, and then click **OK**.

BlueTool displays an HCI Control window with the selected COM port and rate displayed in the window title. For the following screenshot, the port and data rate is shown as com20@115200.



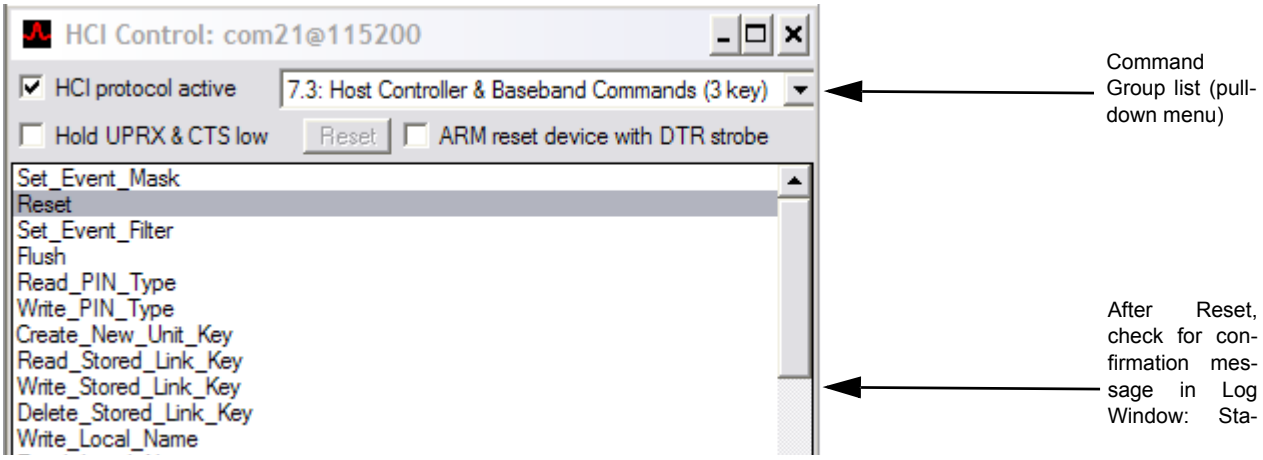
7.1.2 Setting Up the HCI Control Transport for Device 2

1. Click **Transport>HCI Control** (keyboard shortcut **CTRL+1**) to display the Select HCI Control Window Transport window.



2. Select the **UART** option and select or type the Device 2 COM port, and then click **OK**.

BlueTool displays an HCI Control window with the selected COM port and rate displayed in the window title. For the following screenshot, the port and rate are shown as com21@115200.



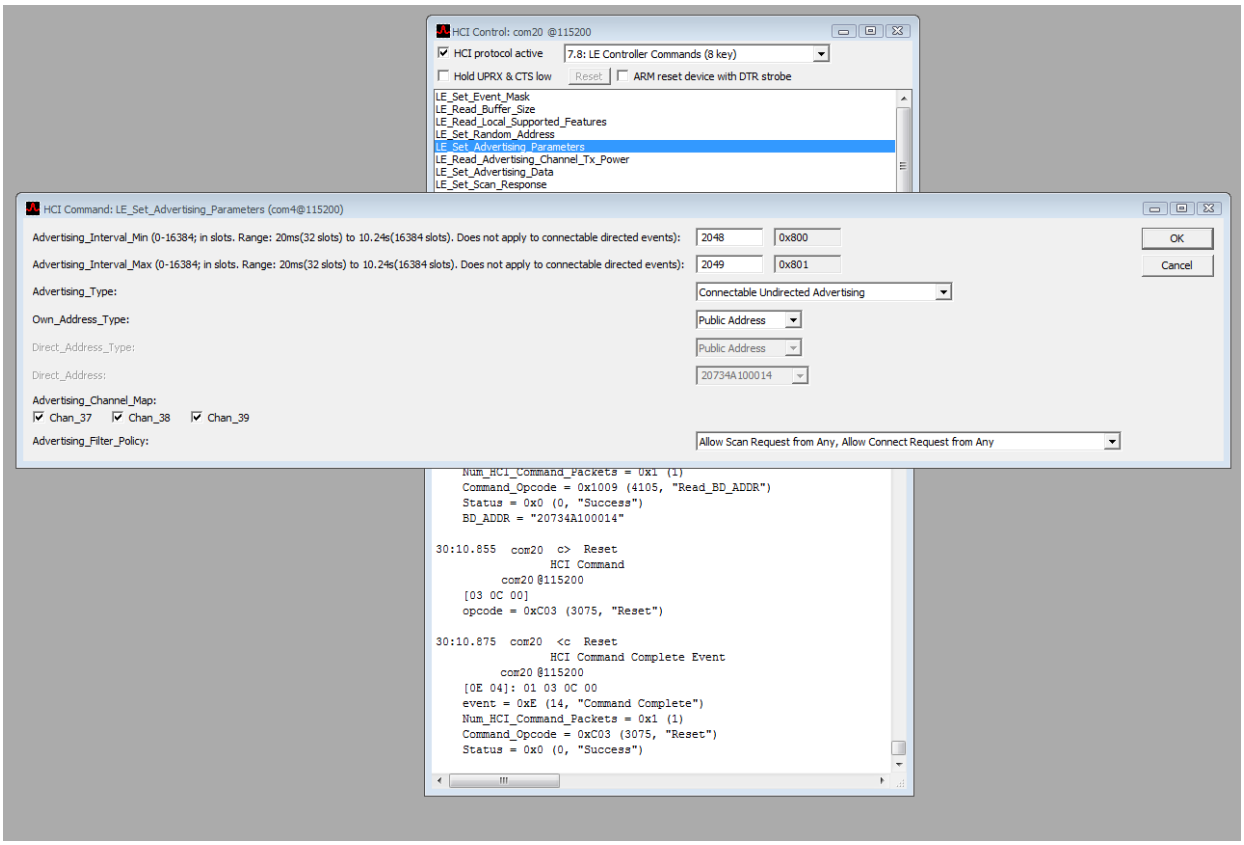
7.2 Low Energy Control for Advertising

Advertising is done between boards via ports. This procedure describes advertising between two CYW20734-equipped devices.

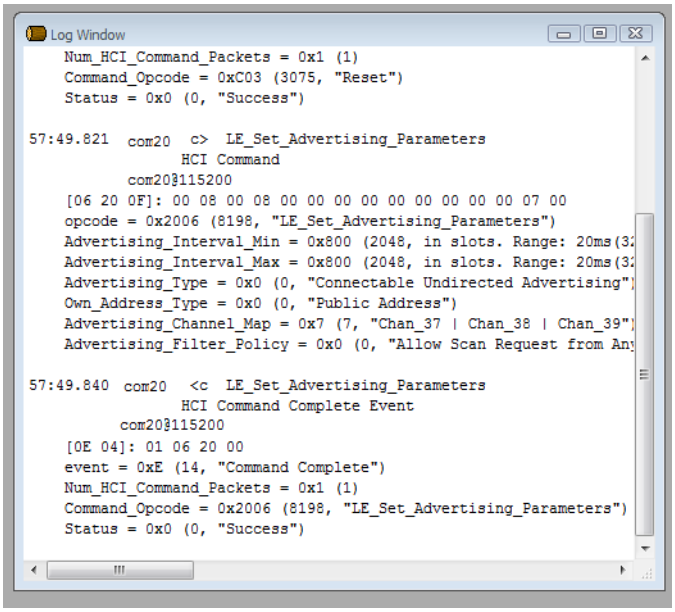
7.2.1 Setting LE Advertising Parameters

These steps apply to the first of two CYW20734-equipped boards.

1. In the HCI Control window, do the following to set advertising parameters:
   a. Select **7.8: LE Controller Commands (8 key)** from the Command Group list.
   b. From the list of available subcommands, select **LE_Set_Advertising_Parameters**.
2. Enter the settings according to the screenshot shown below:

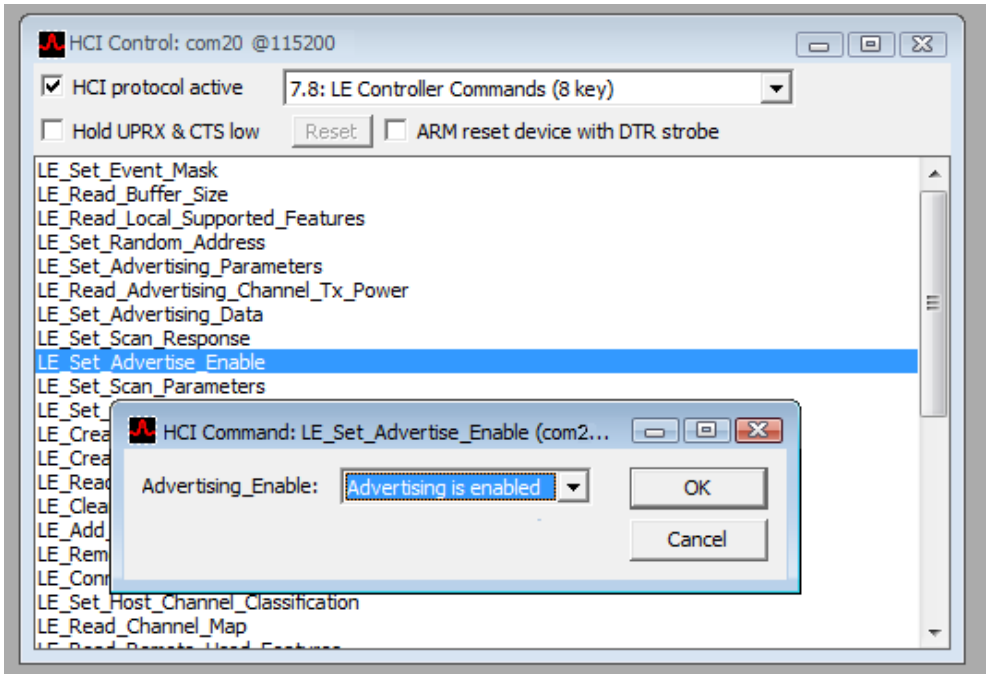


3. Click **OK** and check for success status in the log window as shown in the following screenshot.

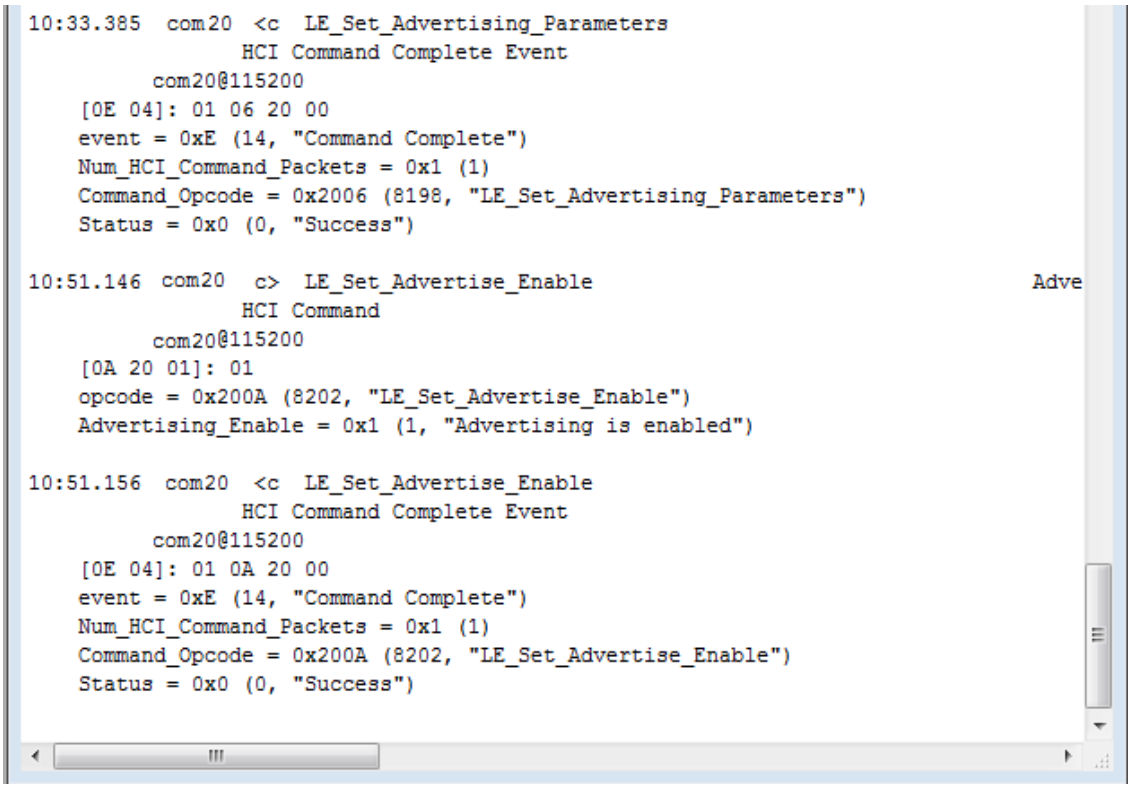


7.2.2 Enabling LE Advertising Parameters

1. In the HCI Control window, do the following to enable advertising parameters:
   a. Select **7.8: LE Controller Commands (8 key)** from the Command Group list.
   b. From the list of available subcommands, select **LE_Set_Advertise_Enable.**
2. Select **Advertising is enabled** according to the screenshot shown below:



3. Click **OK** and make sure LE advertise has been enabled. This is confirmed by the display of the Status=0x0 (0,"success") message as shown in the following screenshot.

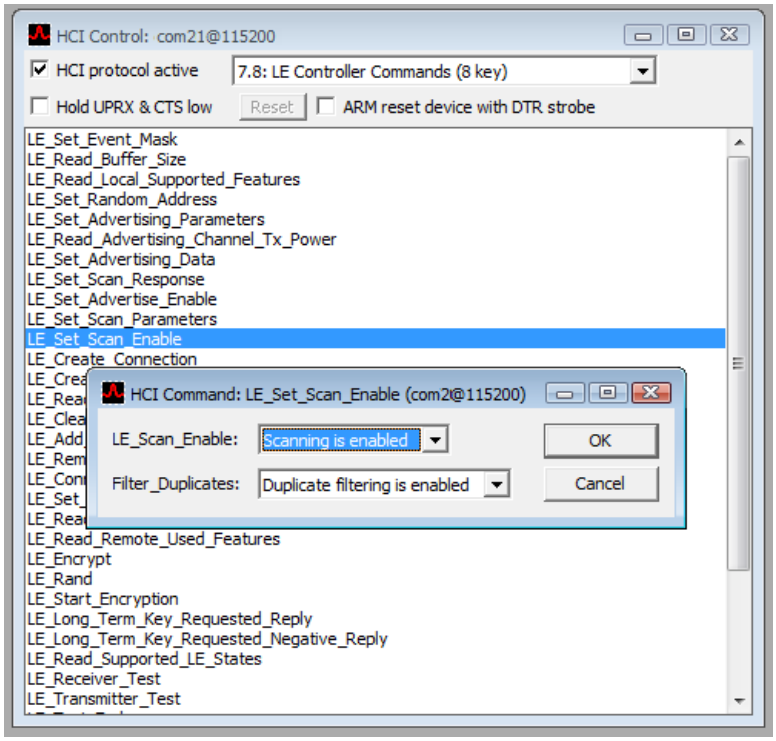


7.3 Starting an LE Connection

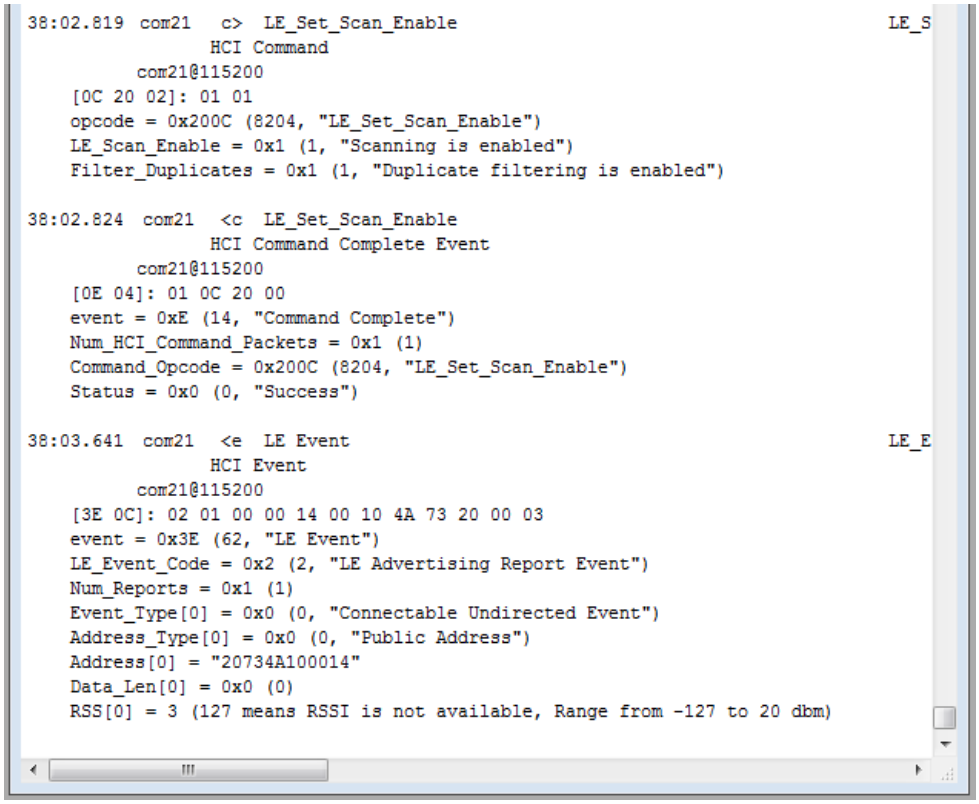
These steps apply to the second of two CYW20734-equipped boards.

7.3.1 Enabling LE Scanning

1. In the HCI Control window, do the following to enable LE scanning:
   a. Select **7.8: LE Controller Commands (8 key)** from the Command Group list.
   b. From the list of available subcommands, select **LE_Set_Scan_Enable.**
2. Select **Scanning is enabled** and **Duplicate filtering is enabled** according to the screenshot shown below:



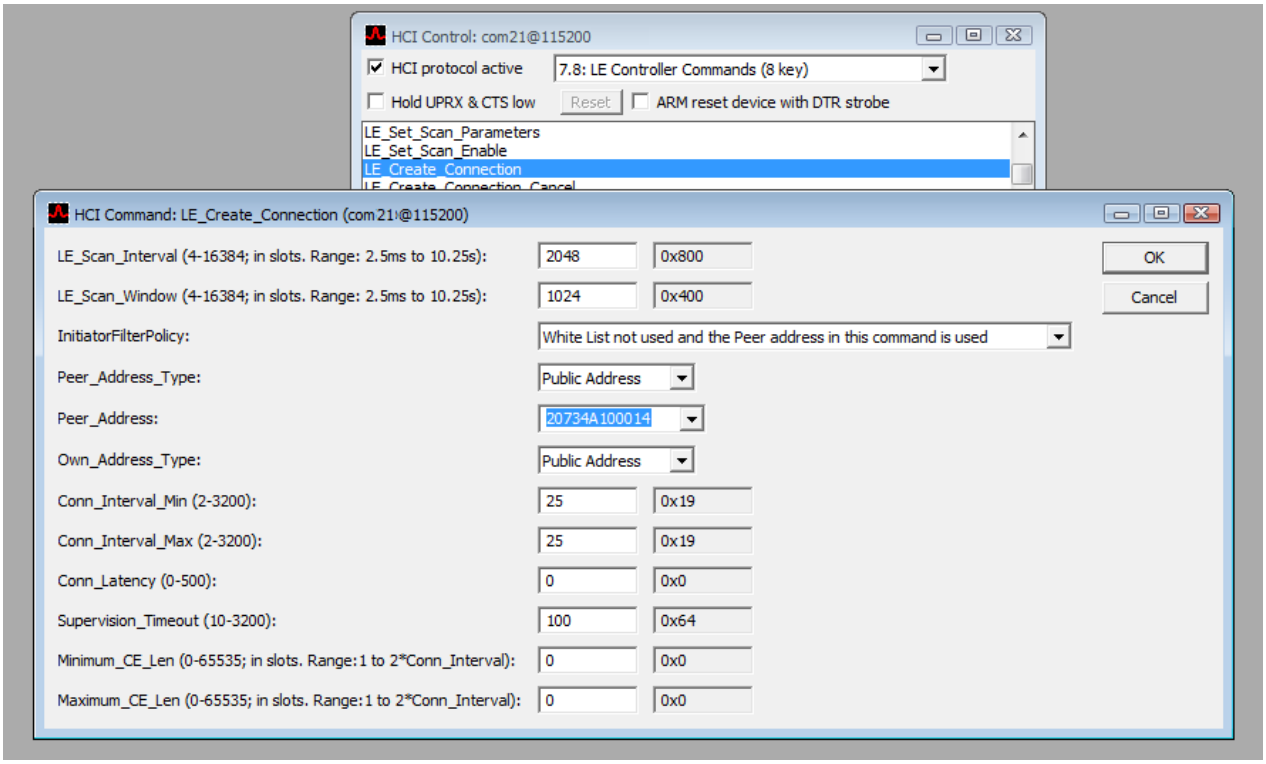
3. Click **OK** and check to verify that LE scan is enabled as shown in the following screenshot.



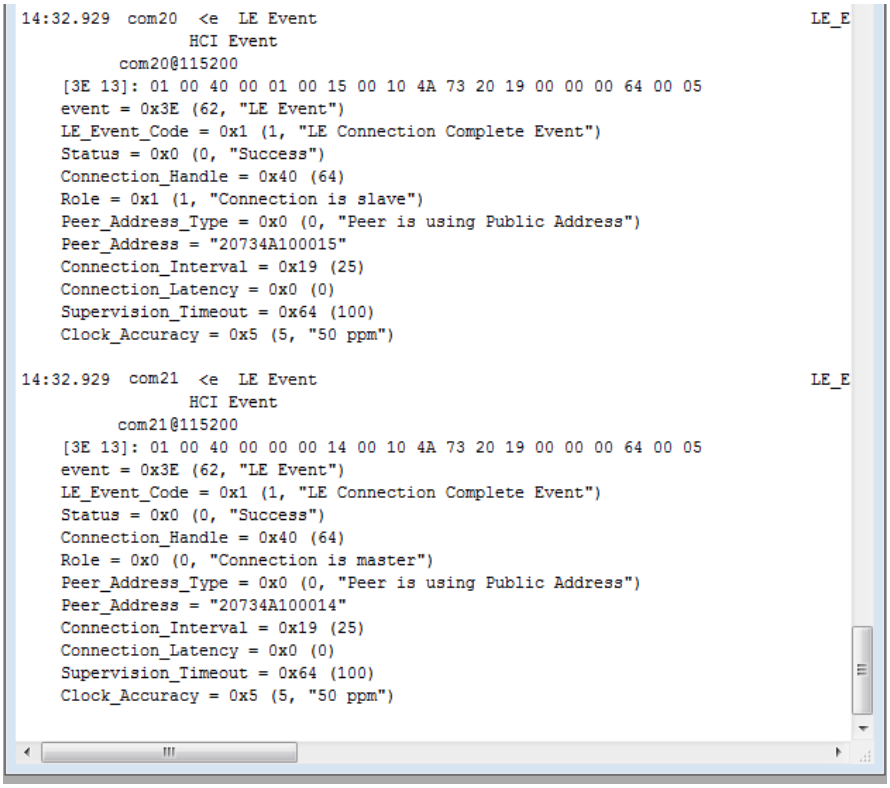
7.4 Creating an LE Connection

1. In the HCI Control window, do the following to enable LE scanning:
   a. Select **7.8: LE Controller Commands (8 key)** from the Command Group list.
   b. From the list of available subcommands, select **LE_Create_Connection.**
2. Select the settings according to the screenshot shown below.

Note: The Peer_Address is the BD_Address of the port for the device that was configured as *Advertise Enabled* (see Enabling LE Advertising Parameters on page 7).



3. Click **OK** once the settings illustrated above are set. To confirm that the creation of a connection is completed, see the display of the Status=0x0 (0,"success") message as shown in the following screenshot.

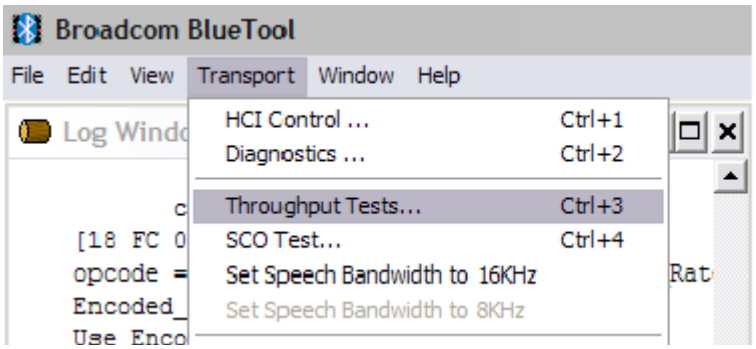


7.5 Setting Up Devices for Throughput Testing

The screenshot used in this section applies to configuration for both Device 1 and Device 2.

7.5.1 Preparing Device 1

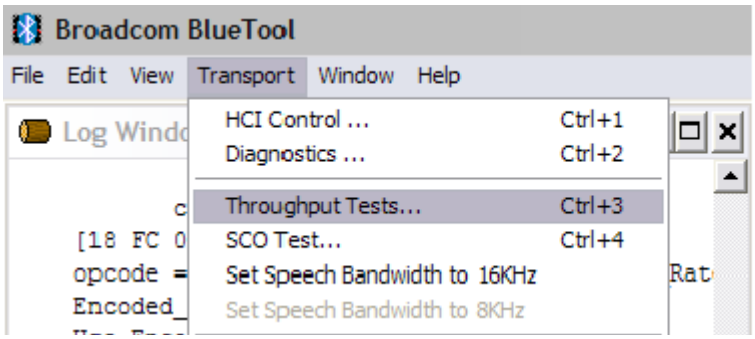
1. Click **Transport>Throughput Tests...** (keyboard shortcut **CTRL+3**).



2. In the Select Throughput Tests Transport window, choose **UART**, select or type the Device 1 COM port, and then click **OK.**

7.5.2 Preparing Device 2

1. Click **Transport>Throughput Tests...** (keyboard shortcut **CTRL+3**).

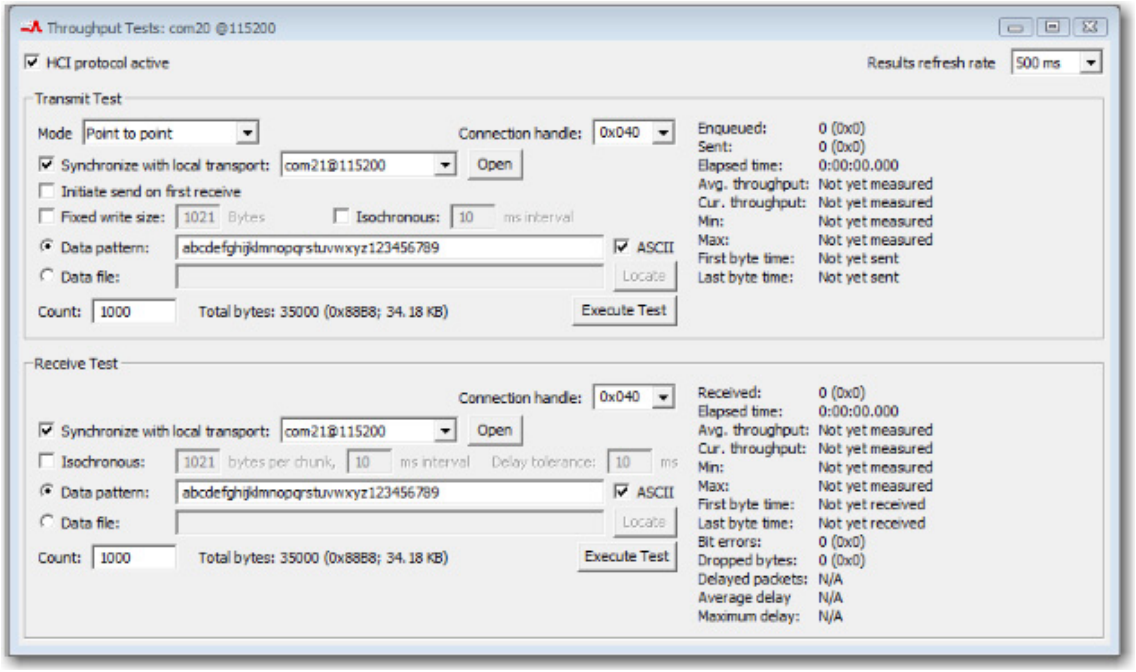


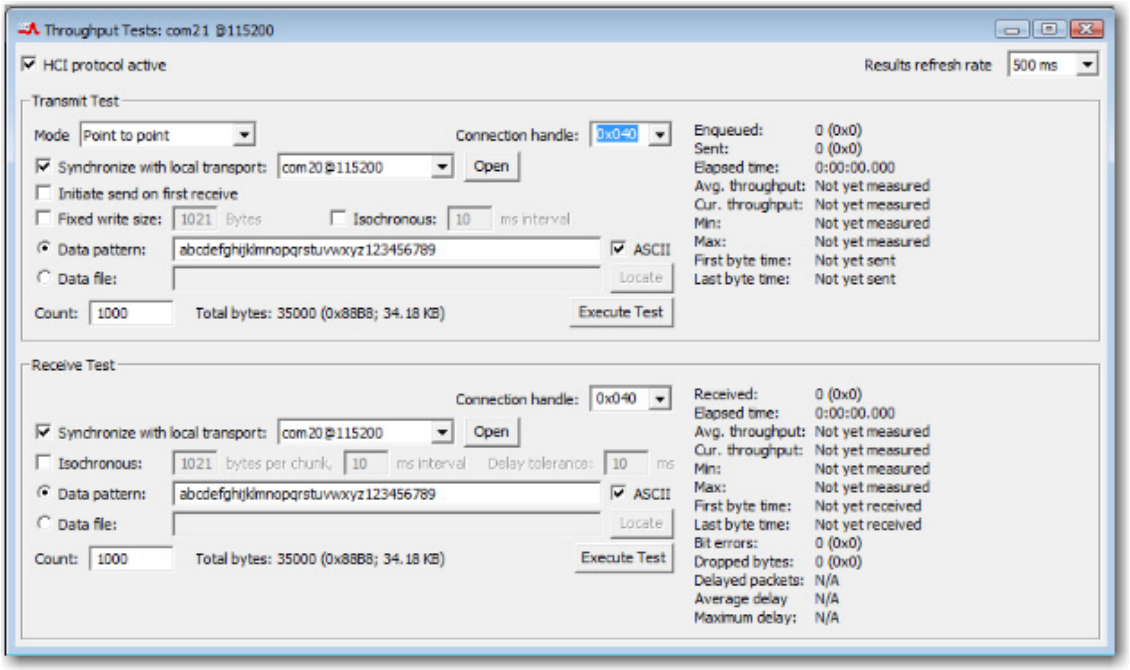
2. In the Select Throughput Tests Transport window, choose **UART**, select or type the Device 2 COM port, and then click **OK.**

7.5.3 Setting up Throughput

1. In the Throughput Tests window, do the following in both the Transmit Test and Receive Test panes:
   a. Verify that a value is generated for the connection handle.
   b. Select the **Data pattern** option.
   c. If not already selected, select **ASCII**, and then enter the desired data pattern (a typical ASCII data pattern is a string of alphanumeric characters).
   d. In the Count field, enter the number of bytes to be sent, being sure not to exceed the total byte limitations of the host PC.
2. Select **Synchronize with local transport**, and then select the communications port for the other device.

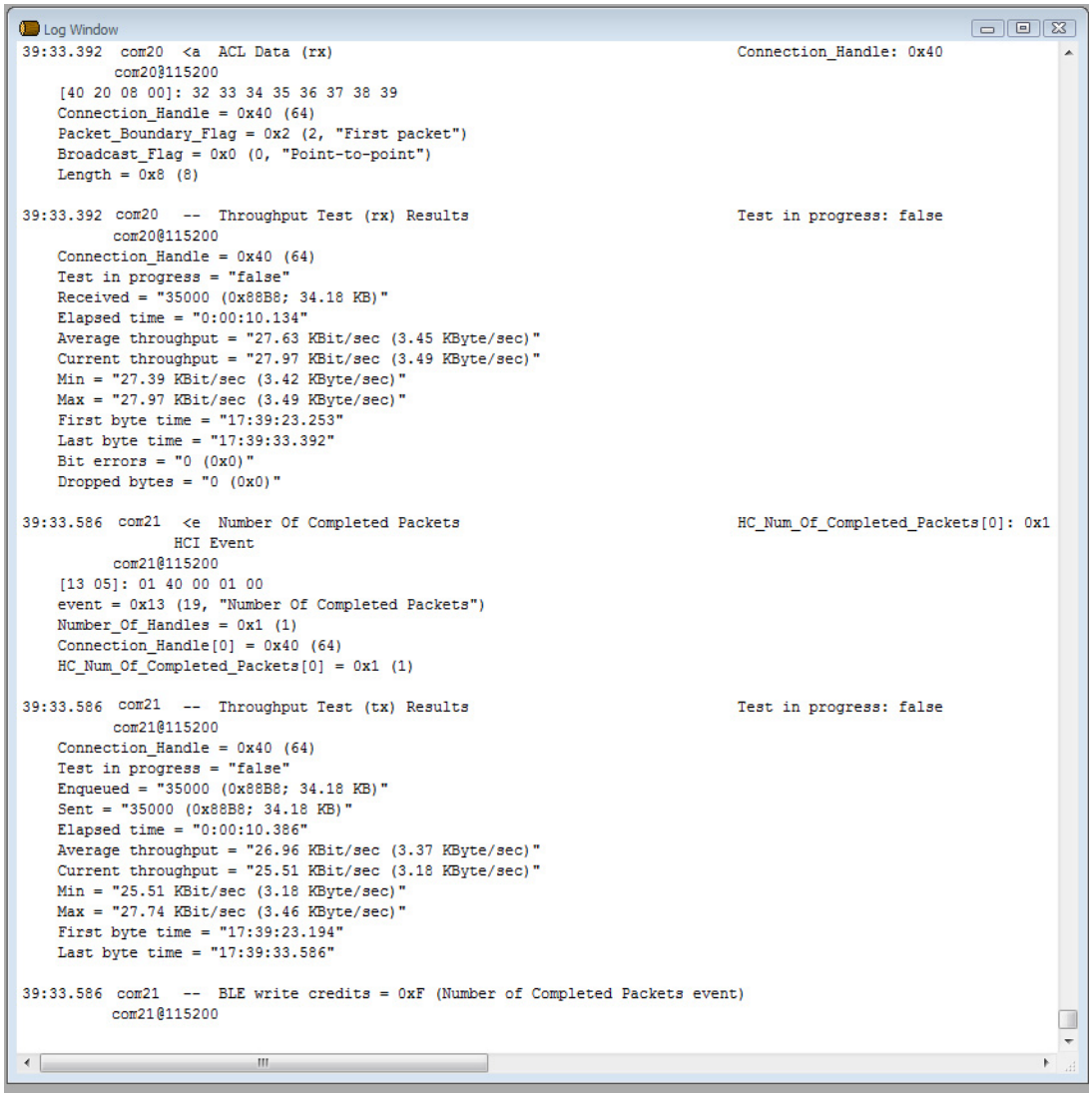
   The following two screenshots show representative configuration examples.





7.5.4 Executing Test

1. Click **Execute Test** in the Transmit Test pane to automatically select the Receive Test settings for the second device communications port.
2. The following screenshot shows the results in the Log Window.


Log Window
39:33.392 com20 <a ACL Data (rx) Connection_Handle: 0x40
com20@115200
[40 20 08 00]: 32 33 34 35 36 37 38 39
Connection_Handle = 0x40 (64)
Packet_Boundary_Flag = 0x2 (2, "First packet")
Broadcast_Flag = 0x0 (0, "Point-to-point")
Length = 0x8 (8)
39:33.392 com20 -- Throughput Test (rx) Results Test in progress: false
com20@115200
Connection_Handle = 0x40 (64)
Test in progress = "false"
Received = "35000 (0x88B8; 34.18 KB)"
Elapsed time = "0:00:10.134"
Average throughput = "27.63 KBit/sec (3.45 KByte/sec)"
Current throughput = "27.97 KBit/sec (3.49 KByte/sec)"
Min = "27.39 KBit/sec (3.42 KByte/sec)"
Max = "27.97 KBit/sec (3.49 KByte/sec)"
First byte time = "17:39:23.253"
Last byte time = "17:39:33.392"
Bit errors = "0 (0x0)"
Dropped bytes = "0 (0x0)"
39:33.586 com21 <e Number Of Completed Packets HC_Num_Of_Completed_Packets[0]: 0x1
HCI Event
com21@115200
[13 05]: 01 40 00 01 00
event = 0x13 (19, "Number Of Completed Packets")
Number_Of_Handles = 0x1 (1)
Connection_Handle[0] = 0x40 (64)
HC_Num_Of_Completed_Packets[0] = 0x1 (1)
39:33.586 com21 -- Throughput Test (tx) Results Test in progress: false
com21@115200
Connection_Handle = 0x40 (64)
Test in progress = "false"
Enqueued = "35000 (0x88B8; 34.18 KB)"
Sent = "35000 (0x88B8; 34.18 KB)"
Elapsed time = "0:00:10.386"
Average throughput = "26.96 KBit/sec (3.37 KByte/sec)"
Current throughput = "25.51 KBit/sec (3.18 KByte/sec)"
Min = "25.51 KBit/sec (3.18 KByte/sec)"
Max = "27.74 KBit/sec (3.46 KByte/sec)"
First byte time = "17:39:23.194"
Last byte time = "17:39:33.586"
39:33.586 com21 -- BLE write credits = 0xF (Number of Completed Packets event)
com21@115200

Document History Page

Document Title: AN214871 - Establishing Bluetooth Low Energy (BLE) Connections and Conducting Throughput Testing using BlueTool™ Document Number: 002-14871				
Rev.	**ECN No.**	**Orig. of Change**	**Submission Date**	**Description of Change**
**	-	-	01/09/2015	Initial release
*A	5450652	UTSV	09/27/2016	Updated to Cypress template Added Cypress part numbering scheme
*B	5882753	AESATMP9	09/13/2017	Updated logo and copyright.

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