

## Measuring Current Consumption in Different Power Modes

Associated Part Family: BCM4324/CYW4334

This document provides procedures for measuring the amount of current consumed by BCM4324/CYW4334 devices in different modes.

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## 1 About This Document

### 1.1 Purpose and Audience

This document is intended for use by Cypress and customers' test engineers.

### 1.2 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
BCM4334	CYW4334

### 1.3 Acronyms and Abbreviations

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

**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 Overview and Orientation

### 3.1 Overview

This document provides procedures for measuring the amount of current consumed by BCM4324/BCM4334 devices while in different modes. The modes for which such procedures are provided include the following:

- Sleep mode
- Standard 1.28s Inquiry Scan mode
- Standard 2.56s Inquiry Scan mode
- Standard Page Scan mode
- SNIFF\_500ms\_Master mode
- SNIFF\_500ms\_Slave mode
- HV(3/2) for DUT as Master mode
- HV(3/2) for DUT as Slave mode
- EV(4/5) eSCO for DUT as Master mode
- EV(4/5) eSCO for DUT as Slave mode
- Throughput ACL, 3DH5 mode

**Note:** For information regarding the measurement of current consumption of Bluetooth Low Energy devices, refer to the document cited in [Reference \[1\] on page 2](#).

### 3.2 Orientation

The following provides information that the user needs to know before starting to make current consumption measurements:

- Cypress BlueTool™ is used to place the device under test (DUT) in each mode. To obtain the latest version, contact your Cypress representative.
- The equipment needed for making power consumption measurements is described in [System Requirements on page 3](#).
- It is assumed that you are familiar with BlueTool and that you know how to set up and use the equipment needed for measuring current consumption.
- The procedure for downloading the BlueTool configuration and minidriver files to the DUT and reference board is also provided (see [Downloading the Minidriver and Configuration File on page 4](#)). You must download these files to the devices before you begin setting the various modes.
- In this document, **HCI control: com4** refers to the DUT, and **HCI Control: com5** refers to the reference board. The actual COM port number may be different for each test system.
- The number key shortcuts to switch to the various HCI command lists refer to the number keys above the letter keys on the keyboard.
- WLAN core is in reset (WL\_REG\_ON = low) for all measurements.

## 4 Test Setup

### 4.1 System Requirements

The system requirements are as follows:

- Host system  
A PC running Microsoft® Windows® (either Windows XP or Windows 7) is required to use BlueTool.
- Test equipment
  - Agilent variable attenuator (Agilent 8496A Attenuator/110 dB)
  - Ammeter (Agilent 34410A digital Multimeter or Agilent 6705B DC Power Analyzer)
  - DUT (BCM4324/BCM4334)
  - Reference board (Reference boards are available from Cypress.)
  - USB/RS-232 serial DB9 (straight-through) cables
  - USB to UART converter
- Software

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 Microsoft Windows (either Windows XP or Windows 7). BlueTool interfaces with the Cypress Bluetooth chips at the HCI protocol layer.

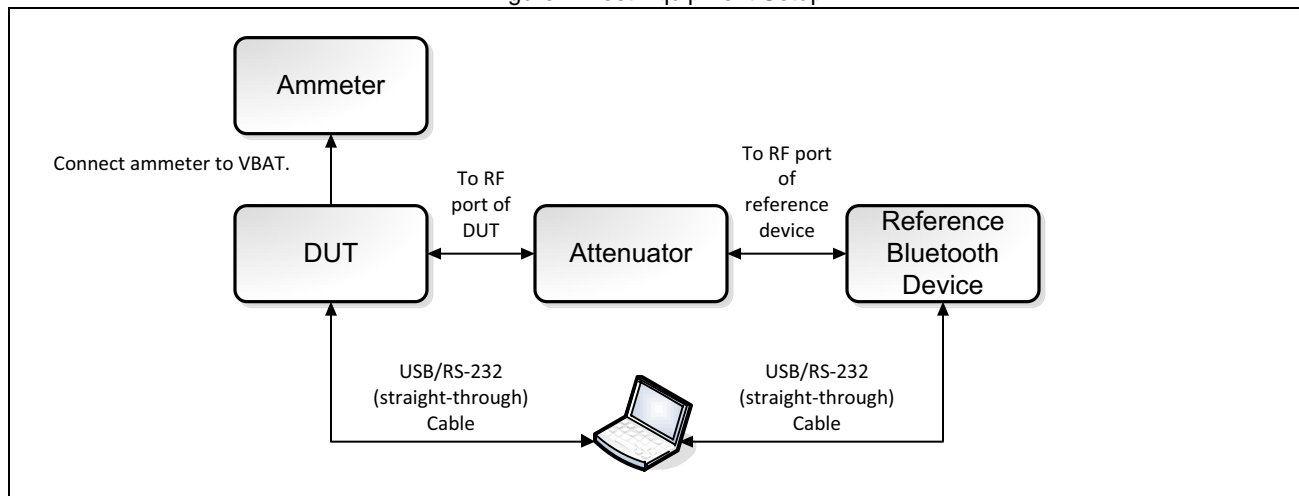
Firmware/configuration files and minidriver files for the BCM4324/BCM4334 are available via Cypress's Customer Support Portal (see [IoT Resources on page 2](#)).

## 4.2 Test Equipment Setup

Connect the test equipment as shown in [Figure 1](#).

- Use USB/RS-232 (straight-through) cables to connect the DUT to the PC.
- Use USB/RS-232 (straight-through) cables to connect the reference board to the PC.
- Using appropriate lead wires, connect the attenuator to the RF port of both the DUT and reference board.
- Using appropriate lead wires, connect the ammeter to VBAT on the DUT.

Figure 1. Test Equipment Setup



The range setting on the ammeter varies depending on the test mode. The ammeter range setting is specified in the procedure for that test mode.

## 4.3 Downloading the Minidriver and Configuration File

This section provides instructions for downloading the minidriver and configuration file to the DUT and reference board. You must download the minidriver and configuration file before you begin setting the various modes. Steps for downloading the minidriver and configuration file include the following and apply to both the DUT and reference board:

- Set the HCI Control Transport profile.
- Reset the DUT/reference board.
- Download the minidriver.
- Download the configuration file.

Before you begin, set up and turn on the test equipment and launch Cypress BlueTool.

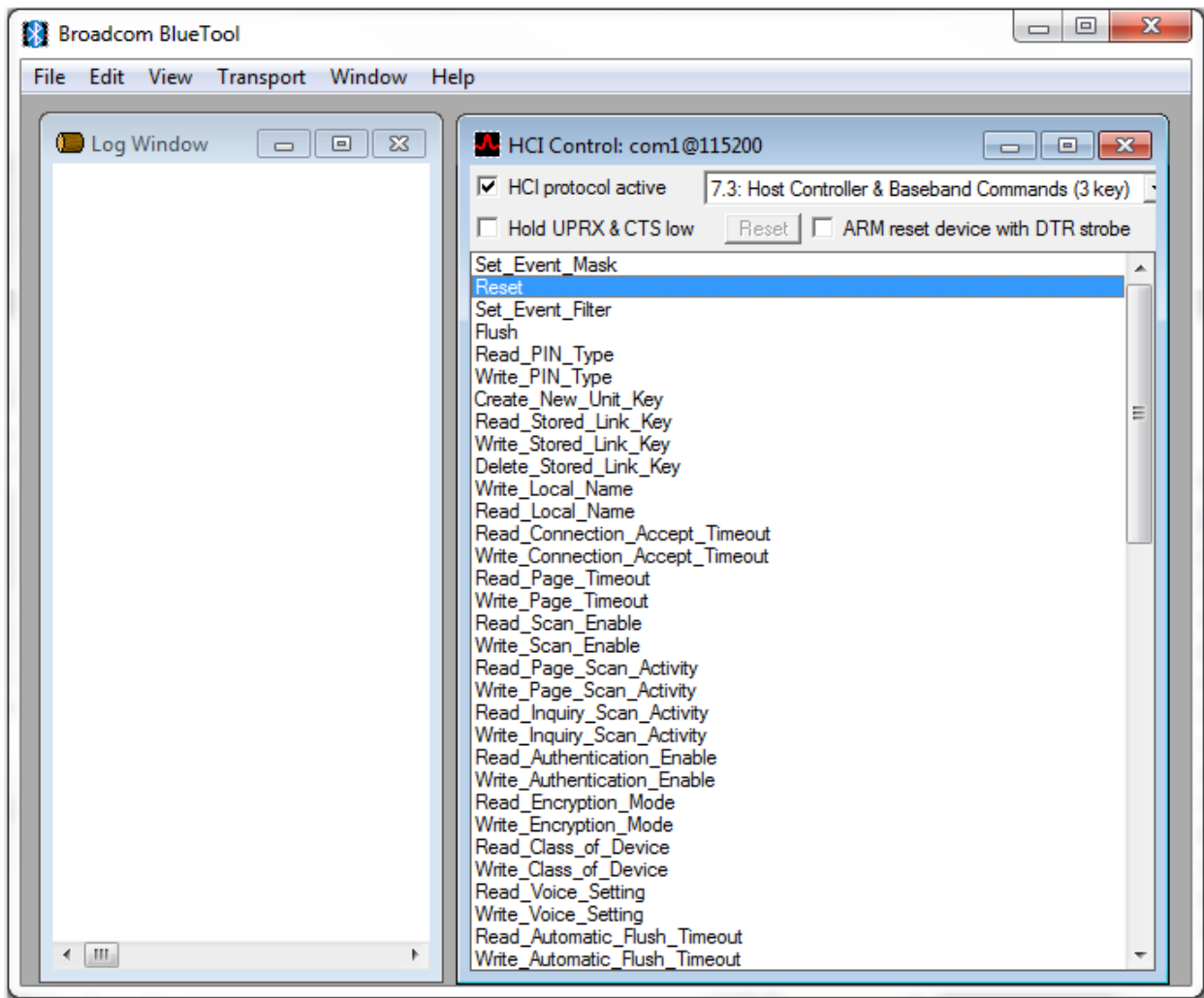
### Set the HCI Control Transport profile

1. Open a log window: On the **View** menu, click **Log Window Details**.
2. On the **Transport** menu, click **HCI Control**.
3. In HCI Control Window Transport:
  - a. Select **UART**.
  - b. In the top **UART** list, type the COM port of the PC to which each device is connected (**com4** for the DUT and **com5** for the reference board).
  - c. In the bottom **UART** list, select **115200**.

- d. Select the **CTS flow control** check box, and then click **OK**.

### Reset the DUT/reference board

1. While in HCI Control, press the **3 key** on the keyboard to select the Host controller & baseband commands.
2. In the list of Host controller & baseband commands, double-click **Reset**. In Log Window, verify that the DUT/reference board has been reset.



### Download the minidriver

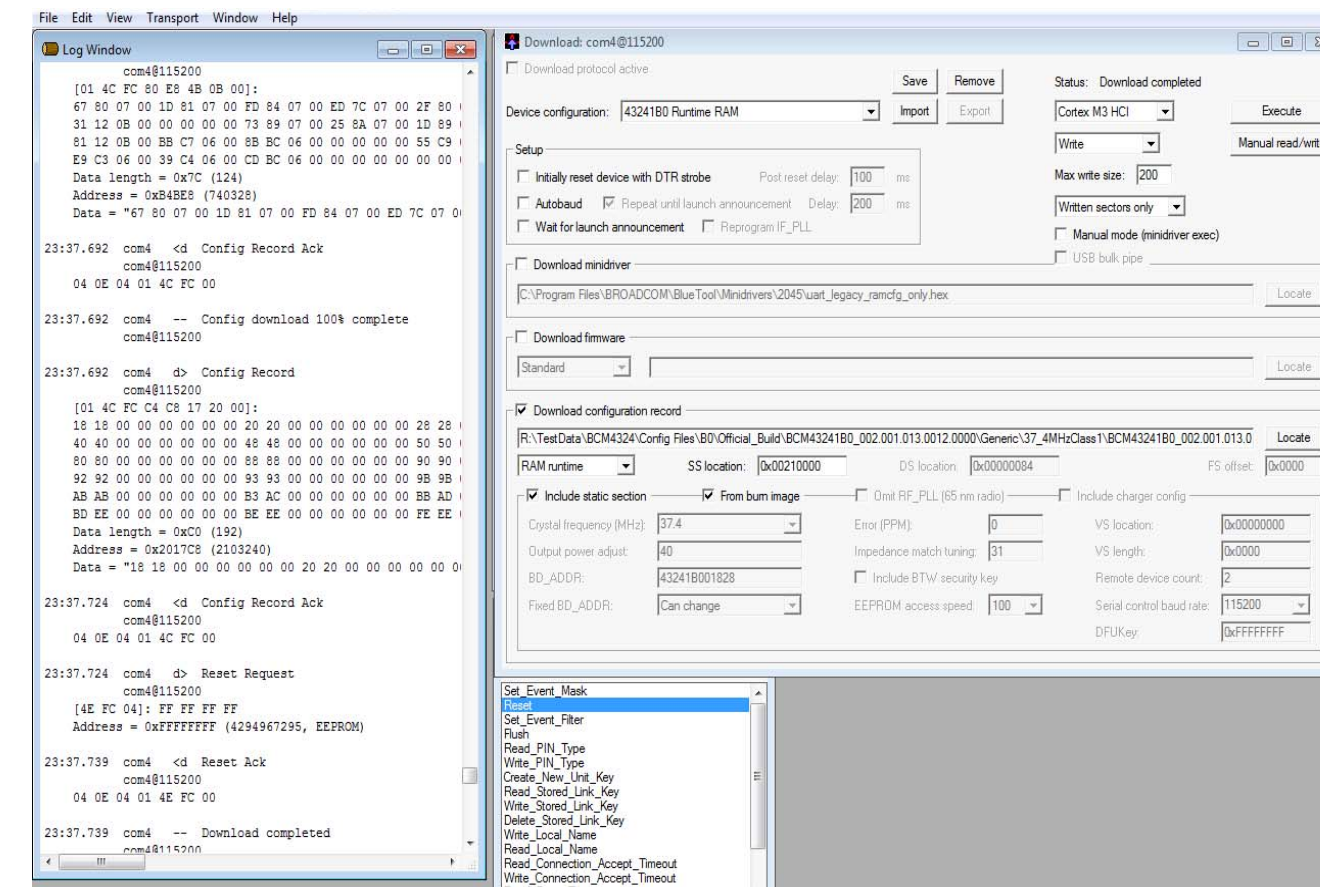
1. In HCI Control, press the **0 key** on the keyboard to select the Vendor-specific commands.
2. In the list of commands, double-click **Download Minidriver**. When the command has completed executing, verify that the **HCI protocol active** check box has been cleared, that HCI Control is no longer active, and that **Transport Closed** is displayed in Log Window.

### Download the configuration file

1. On the **Transport** menu, click **Download Firmware/Config**.
2. In Select Download Firmware/Config Transport, select the COM port used by the DUT (**com4**)/reference board (**com5**), and then click **OK**.
3. In Download: com4@115200/com5@115200:
  - a. In the **Device configuration** list, select the device you want to configure.
  - b. Select the **Download configuration record** check box.

- c. Select the **From burn image** check box.
- d. Click **Locate**, and then open the configuration file.
- e. Click **Execute**.

The download is completed when **Download Completed** is displayed in Log Window.



To download the configuration file for the reference board, repeat the procedure, making sure to change the UART COM port to **com5**.

## 5 Setting Modes and Measuring Current Consumption

This section contains procedures for setting the BCM4324/BCM4334 to various modes for the purpose of measuring the amount of current being consumed by the device when it is in each mode. This section also specifies the ammeter range for making current readings in each mode.

### 5.1 Sleep Mode

This section explains how to set the BCM4324/BCM4334 to Sleep mode. Steps include the following and apply only to the DUT:

- Set the HCI Control Transport profile.
- Reset the DUT.
- Set the Sleepmode parameters.

This section concludes by specifying the approximate ammeter range setting for measuring the current being consumed by the DUT. Host Controller & Baseband commands

Before you begin, set up and turn on the test equipment and launch Cypress BlueTool.

#### Set the HCI Control Transport profile

1. Open a log window. On the **View** menu, click **Log Window**.

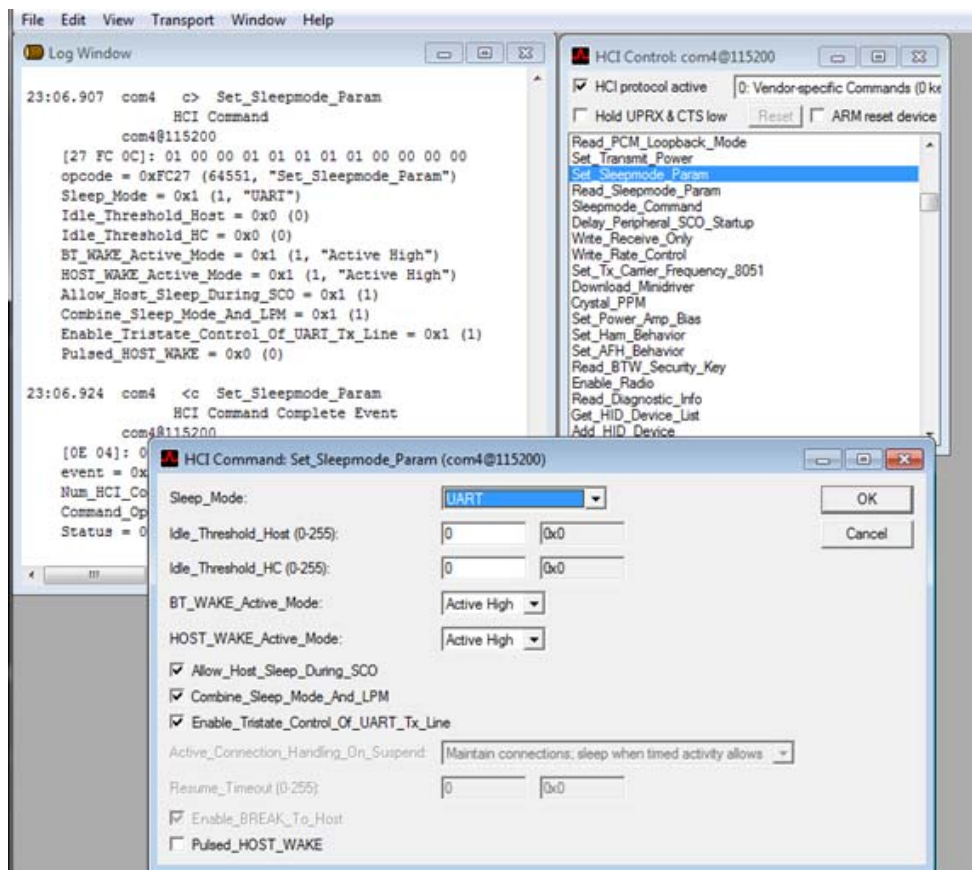
2. Set the HCI Control Transport profile.
  - a. On the **Transport** menu, click **HCI Control**.
  - b. In HCI Control Window Transport:
    - Select **UART**.
    - In the top **UART** list, type the COM port of the PC to which the DUT is connected (**com4**).
    - In the bottom **UART** list, select **115200**.
    - Select the **CTS flow control** check box, and then click **OK**.

### Reset the DUT

1. While in HCI Control: com4@115200, press the **3 key** on the keyboard to select the Host controller & baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Reset**. In Log Window, verify that the DUT has been reset.

### Set the Sleepmode parameters

1. In HCI Control: com4@115200, press the **0 key** on the keyboard to select the Vendor-specific commands.
2. In the list of Vendor-specific commands, double-click **Set\_Sleepmode\_Param**.
3. In HCI Command: Set\_Sleepmode\_Param (com4@15200):
  - a. Make the following settings:
    - Sleep\_Mode**UART**
    - Idle\_Threshold\_Host**0x0**
    - Idle\_Threshold\_HC**0x0**
    - BT\_WAKE\_Active\_Mode**Active High**
    - Host\_WAKE\_Active\_Mode**Active High**
    - Select the following check boxes:
      - Allow\_Host\_Sleep\_During\_SCO
      - Combine\_Sleep\_Mode\_And LPM
      - Enable\_Tristate\_Control\_Of\_UART\_Tx\_Line
      - Pulsed\_HOST\_WAKE



### Measure the current consumption

Set the approximate range of the ammeter to 0.01 mA and measure the current being consumed by the DUT.

## 5.2 Standard 1.28s Inquiry Scan Mode

This section explains how to set the BCM4324/BCM4334 to Standard 1.28s Inquiry Scan mode. Steps include the following and apply only to the DUT:

- Set the HCI Control Transport profile.
- Reset the DUT.
- Set the Sleepmode parameters.
- Set the Scan Type.
- Generate 2048 slots of 1.28s activity.
- Set the Current IAC Lower Address Portion (LAP) parameters.
- Set the Write Scan Enable parameters.

This section concludes by specifying the approximate ammeter range setting for measuring the current being consumed by the DUT.

Before you begin, set up and turn on the test equipment and launch Cypress BlueTool.

### Set the HCI Control Transport profile

1. Open a log window. On the **View** menu, click **Log Window**.
2. Set the HCI Control Transport profile.
  - a. On the **Transport** menu, click **HCI Control**.
  - b. In HCI Control Window Transport:
    - Select **UART**.
    - In the top **UART** list, type the COM port of the PC to which the DUT is connected (**com4**).
    - In the bottom **UART** list, select **115200**.

- Select the **CTS flow control** check box, and then click **OK**.

### Reset the DUT

1. In HCI Control: com4@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Reset**.

### Set the Sleepmode parameters

1. In HCI Control: com4@115200, press the **0 key** on the keyboard to select the Vendor-specific commands.
2. In the list of Vendor-specific commands, double-click **Set\_Sleepmode\_Param**.
3. In HCI Command: Set\_Sleepmode\_Param (com4@115200)
  - a. Make the following settings:
    - **Sleep\_ModeUART**
    - **Idle\_Threshold\_Host0x0**
    - **Idle\_Threshold\_HC0x0**
    - **BT\_WAKE\_Active\_ModeActive High**
    - **Host\_WAKE\_Active\_ModeActive High**
      - b. Select the following check boxes, and then click **OK**:
        - **Allow\_Host\_Sleep\_During\_SCO**
        - **Combine\_Sleep\_Mode\_And LPM**
        - **Enable\_Tristate\_Control\_Of\_UART\_Tx\_Line**

### Set the Scan Type

1. In HCI Control: com4@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Write\_Inquiry\_Scan\_Type**.
3. In HCI Command: Write\_Inquiry\_Scan\_Type (com4@115200), in the **Scan\_Type** list, select **Mandatory Standard Scan**, and then click **OK**.

### Generate 2048 slots for 1.28s of activity

1. In the list of Host Controller & Baseband commands, double-click **Write\_Inquiry\_Scan\_Activity**.
2. In HCI Command: Write\_Inquiry\_Scan\_Activity (com4@115200):
  - a. For the **Inquiry\_Scan\_Interval**, type **2048** in the space provided.
  - b. For the **Inquiry\_Scan\_Window**, type **0x12** in the space provided.
  - c. Click **OK**.

### Set the Current IAC Lower Address Portion (LAP) parameters

1. In the list of Host Controller & Baseband commands, double-click **Write\_Current\_IAC\_LAP**.
2. In HCI Command: Write\_Current\_IAC\_LAP (com4@115200):
  - a. For the **Num\_Current\_IAC**, type **1** in the space provided.
  - b. For the **IAC\_LAP**, type **10390288** in the space provided.
  - c. Click **OK**.

### Set the Write Scan Enable parameters

1. In the list of Host Controller & Baseband commands, double-click **Write\_Scan\_Enable**.
2. In HCI Command: Write\_Scan\_Enable (com4@115200), in the **Scan\_Enable** list, select **Inquiry Scan enabled**, and then click **OK**.

### Measure the current consumption

Set the approximate range of the ammeter to 0.2 mA and measure the current being consumed by the DUT.

### 5.3 Standard 2.56s Inquiry Scan Mode

This section explains how to set the BCM4324/BCM4334 to Standard 2.56s Inquiry Scan mode. Steps include the following and apply only to the DUT:

- Set the HCI Control Transport profile.
- Reset the DUT.
- Set the Sleepmode Parameters.
- Set the Scan Type.
- Generate 4096 slots for 2.56s of activity.
- Set the Current IAC Lower Address Portion (LAP) parameters.
- Set the Write Scan Enable parameters.

This section concludes by specifying the approximate ammeter range setting for measuring the current being consumed by the DUT.

Before you begin, set up and turn on the test equipment and launch Cypress BlueTool.

#### Set the HCI Control Transport profile

1. Open a log window. On the **View** menu, click **Log Window**.
2. Set the HCI Control Transport profile.
  - a. On the **Transport** menu, click **HCI Control**.
  - b. In HCI Control Window Transport:
    - Select **UART**.
    - In the top **UART** list, type the COM port of the PC that the DUT is connected to (**com4**).
    - In the bottom **UART** list, select **115200**.
    - Select the **CTS flow control** check box, and then click **OK**.

#### Reset the DUT

1. In HCI Control: com4@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Reset**.

#### Set the Sleepmode parameters

1. In HCI Control: com4@115200, press the **0 key** on the keyboard to select the Vendor-specific commands.
2. In the list of Vendor-specific commands, double-click **Set\_Sleepmode\_Param**.
3. In HCI Command: Set\_Sleepmode\_Param (com4@115200):
  - a. Make the following settings:
    - Sleep\_Mode**UART**
    - Idle\_Threshold\_Host**0x0**
    - Idle\_Threshold\_HC**0x0**
    - BT\_WAKE\_Active\_Mode**Active High**
    - Host\_WAKE\_Active\_Mode**Active High**
      - b. Select the following check boxes, and then click **OK**:
        - Allow\_Host\_Sleep\_During\_SCO
        - Combine\_Sleep\_Mode\_And LPM
        - Enable\_Tristate\_Control\_Of\_UART\_Tx\_Line

#### Set the Scan Type

1. In HCI Control: com4@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Write\_Inquiry\_Scan\_Type**.
3. In HCI Command: Write\_Inquiry\_Scan\_Type (com4@115200), in the **Scan\_Type** list, select **Mandatory Standard Scan**, and then click **OK**.

**Generate 4096 slots for 2.56s of activity**

1. In the list of Host Controller & Baseband commands, double-click **Write\_Inquiry\_Scan\_Activity**.
2. In HCI Command: Write\_Inquiry\_Scan\_Activity (com4@115200):
  - a. For the **Inquiry\_Scan\_Interval**, type **4096** in the space provided.
  - b. For the **Inquiry\_Scan\_Window**, type **0x18** in the space provided.
  - c. Click **OK**.

**Set the Current IAC Lower Address Portion (LAP) parameters**

1. In the list of Host Controller & Baseband commands, double-click **Write\_Current\_IAC\_LAP**.
2. In HCI Command: Write\_Current\_IAC\_LAP (com4@115200):
  - a. For the **Num\_Current\_IAC**, type **1** in the space provided.
  - b. For the **IAC\_LAP**, type **10390288** in the space provided.
  - c. Click **OK**.

**Set the Write Scan Enable parameters**

1. In the list of Host Controller & Baseband commands, double-click **Write\_Scan\_Enable**.
2. In HCI Command: Write\_Scan\_Enable (com4@115200), in the **Scan\_Enable** list, select **Inquiry Scan enabled**, and then click **OK**.

**Measure the current consumption**

Set the approximate range of the ammeter to 0.2 mA and measure the current being consumed by the DUT.

**5.4****Standard Page Scan**

This section explains how to set the BCM4324/BCM4334 to Standard Page Scan mode. Steps include the following and apply only to the DUT:

- Set the HCI Control Transport profile.
- Reset the DUT.
- Set the Sleepmode parameters.
- Set the Scan Type.
- Generate 2048 slots for 1.28s of activity.
- Set the Write Scan Enable parameters.

This section concludes by specifying the approximate ammeter range setting for measuring the current being consumed by the DUT.

Before you begin, set up and turn on the test equipment and launch Cypress BlueTool.

**Set the HCI Control Transport profile**

1. Open a log window. On the **View** menu, click **Log Window**.
2. Set the HCI Control Transport profile.
  - a. On the **Transport** menu, click **HCI Control**.
  - b. In HCI Control Window Transport:
    - Select **UART**.
    - In the top **UART** list, type the COM port of the PC that the DUT is connected to (**com4**).
    - In the bottom **UART** list, select **115200**.
    - Select the **CTS flow control** check box, and then click **OK**.

**Reset the DUT**

1. While in HCI Control, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Reset**.

### Set the Sleepmode parameters

1. While in HCI Control: com4@115200, press the **0 key** on the keyboard to select the Vendor-specific commands.
2. In the list of Vendor-specific commands, double-click **Set\_Sleepmode\_Param**.
3. In HCI Command: Set\_Sleepmode\_Param (com4@115200):
  - a. Make the following settings:
    - Sleep\_Mode**UART**
    - Idle\_Threshold\_Host**0x0**
    - Idle\_Threshold\_HC**0x0**
    - BT\_WAKE\_Active\_Mode**Active High**
    - Host\_WAKE\_Active\_Mode**Active High**
      - b. Select the following check boxes, and then click **OK**:
        - Allow\_Host\_Sleep\_During\_SCO
        - Combine\_Sleep\_Mode\_And LPM
        - Enable\_Tristate\_Control\_Of\_UART\_Tx\_Line

### Set the Scan Type

1. While in HCI Control: com4@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Write\_Page\_Scan\_Type**.
3. In HCI Command: Write\_Page\_Scan\_Type (com4@115200), in the **Scan\_Type** list, select **Mandatory Standard Scan**, and then click **OK**.

### Generate 2048 slots for 1.28s of activity

1. In the list of Host Controller & Baseband commands, double-click **Write\_Page\_Scan\_Activity**.
2. In HCI Command: Write\_Page\_Scan\_Activity (com4@115200):
  - a. For the **Page\_Scan\_Interval**, type **2048** in the space provided.
  - b. For the **Page\_Scan\_Window**, type **0x18** in the space provided.
  - c. Click **OK**.

### Set the Write Scan Enable parameters

1. In the list of Host Controller & Baseband commands, double-click **Write\_Scan\_Enable**.
2. In HCI Command: Write\_Scan\_Enable (com4@115200), in the **Scan\_Enable** list, select **Page Scan enabled**, and then click **OK**.

### Measure the current consumption

Set the approximate range of the ammeter to 0.2 mA and measure the current being consumed by the DUT.

## 5.5 SNIFF\_500ms\_Master Mode

This section explains how to set the BCM4324/BCM4334 to SNIFF\_500ms\_Master mode. Steps include the following (Some of the steps apply to the DUT, and others apply to the reference board.):

- Set the HCI Control Transport profile on the DUT.
- Reset the DUT.
- Set the Sleepmode parameters on the DUT.
- Set the HCI Control Transport profile on the reference board.
- Read the Bluetooth Device (BD) Address of the reference board.
- Set the Event Filter parameters on the reference board.
- Set the Write Scan Enable parameters on the reference board.
- Create a connection from the DUT.
- Reset the Write Scan Enable parameters on the reference board.
- Set the Write Link Policy parameters on the DUT.

- Set the Write Link Policy parameters on the reference board.
  - Set the Sniff Mode parameters on the DUT.
- This section concludes by specifying the approximate ammeter range setting for measuring the current being consumed by the DUT.

Before you begin, set up and turn on the test equipment and launch Cypress BlueTool.

### Set the HCI Control Transport profile on the DUT

1. Open a log window. On the **View** menu, click **Log Window**.
2. On the **Transport** menu, click **HCI Control**.
3. In HCI Control Window Transport:
  - Select **UART**.
  - In the top **UART** list, type the COM port of the PC to which the DUT is connected (**com4**).
  - In the bottom **UART** list, select **115200**.
  - Select the **CTS flow control** check box, and then click **OK**.

### Reset the DUT

1. In HCI Control: com4@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Reset**.

### Set the Sleepmode parameters on the DUT

1. While in HCI Control: com4@115200, press the **0 key** on the keyboard to select the Vendor-specific commands.
2. In the list of Vendor-specific commands, double-click **Set\_Sleepmode\_Param**.
3. In HCI Command: Set\_Sleepmode\_Param:
  - a. Make the following settings:
    - Sleep\_Mode**UART**
    - Idle\_Threshold\_Host**0x0**
    - Idle\_Threshold\_HC**0x0**
    - BT\_WAKE\_Active\_Mode**Active High**
    - Host\_WAKE\_Active\_Mode**Active Low**
  - b. Select the following check boxes, and then click **OK**:
    - Allow\_Host\_Sleep\_During\_SCO
    - Combine\_Sleep\_Mode\_And LPM
    - Enable\_Tristate\_Control\_Of\_UART\_Tx\_Line

### Set the HCI Control Transport profile on the reference board

1. Open a log window. On the **View** menu, click **Log Window**.
2. Set the HCI Control Transport profile.
  - a. On the **Transport** menu, click **HCI Control**.
  - b. In HCI Control Window Transport:
    - Select **UART**.
    - In the top **UART** list, type the COM port of the PC to which the reference board is connected (**com5**).
    - In the bottom **UART** list, select **115200**.
    - Select the **CTS flow control** check box, and then click **OK**.

### Read the BD Address of the reference board

1. On the **Transport** menu, click **HCI Control**.
2. In HCI Control Window Transport:
  - a. Select **UART**.

- b. In the top **UART** list, type the COM port of the PC to which the reference board is connected (**com5**).
  - c. In the bottom **UART** list, select **115200**.
  - d. Select the **CTS flow control** check box, and then click **OK**.
3. While in HCI Control: com5@115200, press the **4 key** on the keyboard to select the informational parameters commands.
4. In the list of informational parameters commands, double-click **Read\_BD\_ADDR**.  
Verify that the BD Address is displayed in Log Window and note the address for later use.

#### Set the Event Filter parameters on the reference board

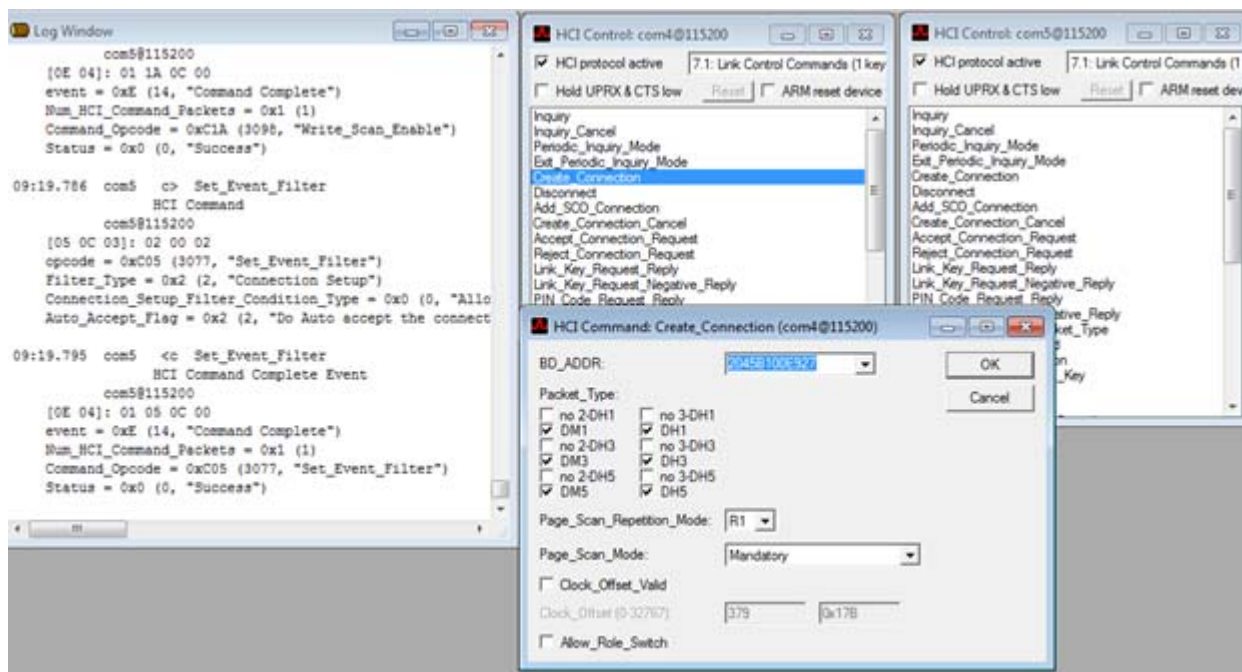
1. While in HCI Control: com5@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Set\_Event\_Filter**.
3. In HCI Command: Set\_Event\_Filter (com5@115200):
  - a. In the **Filter\_Type** list, select **Connection Setup**.
  - b. In the **Connection\_Setup\_Filter\_Condition\_Type** list, select **Allow Connections from all devices**.
  - c. In the **Auto\_Accept\_Flag** list, select **Do Auto accept the connection with role switch disabled**, and then click **OK**.

#### Set the Write Scan Enable parameters on the reference board

1. In the list of Host Controller & Baseband commands, double-click **Write\_Scan\_Enable**.
2. In HCI Command: Write\_Scan\_Enable (com5@115200), in the **Scan\_Enable** list, select **Inquiry and Page Scan enabled**, and then click **OK**.

#### Create a connection from the DUT

1. Reestablish the HCI Control Transport profile for the DUT (**com4**).
2. While in HCI Control: com4@115200, press the **1 key** on the keyboard to select the Link Control commands.
3. In the list of Link Control commands, double-click **Inquiry** to display a list of found devices.
4. In the list of Link Control commands, double-click **Create\_Connection**.
5. In HCI Command: Create\_Connection (com4@115200):
  - a. In the **BD\_ADDR** list, select the BD address (of the reference board) that was noted earlier.
  - b. Set the packet type by selecting the following check boxes:
    - DM1
    - DM3
    - DM5
  - c. In the **Page\_Scan\_Repetition\_Mode** list, select **R0**.
  - d. In the **Page\_Scan\_Mode** list, select **Mandatory**, and then click **OK**.



6. In Log Window, verify that the devices have successfully connected and note the connection handle.

### Reset the Write Scan Enable parameters on the reference board

1. Reestablish the HCI Control Transport profile for the reference board (**com5**).
2. While in HCI Control: com5@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
3. In the list of Host Controller & Baseband commands, double-click **Write\_Scan\_Enable**.
4. In HCI Command: Write\_Scan\_Enable (com5@115200), in the **Scan\_Enable** list, select **No Scans enabled**, and then click **OK**.

### Set the Write Link Policy parameters on the DUT

1. Reestablish the HCI Control Transport profile for the DUT (**com4**).
2. While in HCI Control: com4@115200, press the **2 key** on the keyboard to select the Link Policy commands.
3. In the list of Link Policy commands, double-click **Write\_Link\_Policy\_Settings**.
4. In HCI Command: Write\_Link\_Policy\_Settings (com4@115200), select the **Enable Sniff Mode** check box, and then click **OK**.

### Set the Write Link Policy parameters on the reference board

1. Reestablish the HCI Control Transport profile for the reference board (**com5**).
2. While in HCI Control: com5@115200, press the **2 key** on the keyboard to select the Link Policy commands.
3. In the list of Link Policy commands, double-click **Write\_Link\_Policy\_Settings**.
4. In HCI Command: Write\_Link\_Policy\_Settings (com4@115200), select the **Enable Sniff Mode** check box, and then click **OK**.

### Set the Sniff Mode parameters on the DUT

1. Reestablish the HCI Control Transport profile for the DUT (**com4**).
2. While in HCI Control: com4@115200, press the **2 key** on the keyboard to select the Link Policy commands.
3. In the list of Link Policy commands, double-click **Sniff\_Mode**.
4. In HCI Command: Sniff\_Mode (com4@115200), make the following settings, and then click **OK**.

- ❑ Connection\_Handle
- ❑ Sniff\_Max\_Interval**0x320**
- ❑ Sniff\_Min\_Interval**0x320**
- ❑ Sniff\_Attempt**0x4**
- ❑ Sniff\_Timeout**0x0**

### Measure the current consumption

Set the approximate range of the ammeter to 0.2 mA and measure the current being consumed by the DUT.

## 5.6

### SNIFF\_500ms\_Slave Mode

This section explains how to set the BCM4324/BCM4334 to SNIFF\_500ms\_Slave mode. Steps include the following (Some of the steps apply to the DUT, and others apply to the reference board.):

- Set the HCI Control Transport profile on the DUT.
- Reset the DUT.
- Set the Sleepmode parameters on the DUT.
- Read and record the Bluetooth Device (BD) Address of the DUT.
- Set the Write Scan Enable parameters on the DUT.
- Set the Event Filter parameters on the DUT.
- Create a connection from the reference board.
- Set the Write Scan Enable parameters on the reference board.
- Set the Write Link Policy Settings parameters on the DUT.
- Set the Write Link Policy Settings parameters on the reference board.
- Set the Sniff Mode parameters on the reference board.

This section concludes by specifying the approximate ammeter range setting for measuring the current being consumed by the DUT.

Before you begin, set up and turn on the test equipment and launch Cypress BlueTool.

### Set the HCI Control Transport profile for the DUT

1. Open a log window. On the **View** menu, click **Log Window**.
2. On the **Transport** menu, click **HCI Control**.
3. In HCI Control Window Transport:
  - Select **UART**.
  - In the top **UART** list, type the COM port of the PC to which the DUT is connected (**com4**).
  - In the bottom **UART** list, select **115200**.
  - Select the **CTS flow control** check box, and then click **OK**.

### Reset the DUT

1. In HCI Control: com4@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Reset**.

### Set the Sleepmode parameters on the DUT

1. While in HCI Control: com4@115200, press the **0 key** on the keyboard to select the Vendor-specific commands.
2. In the list of Vendor-specific commands, double-click **Set\_Sleepmode\_Param**.
3. In HCI Command: Set\_Sleepmode\_Param:
  - a. Make the following settings:
    - Sleep\_Mode**UART**
    - Idle\_Threshold\_Host**0x0**
    - Idle\_Threshold\_HC**0x0**
    - BT\_WAKE\_Active\_Mode**Active High**

- Host\_WAKE\_Active\_Mode **Active Low**
  - b. Select the following check boxes, and then click **OK**:
- Allow\_Host\_Sleep\_During\_SCO
- Combine\_Sleep\_Mode\_And LPM
- Enable\_Tristate\_Control\_Of\_UART\_Tx\_Line

### Read and record the BD Address of the DUT

1. On the **Transport** menu, click **HCI Control**.
2. In HCI Control Window Transport:
  - a. Select **UART**.
  - b. In the top **UART** list, type the COM port of the PC to which the DUT is connected (**com4**).
  - c. In the bottom **UART** list, select **115200**.
  - d. Select the **CTS flow control** check box, and then click **OK**.
3. While in HCI Control: com4@115200, press the **4 key** on the keyboard to select the Informational Parameters commands.
4. In the list of Informational Parameters commands, double-click **Read\_BD\_ADDR**.
5. Verify that the BD Address is displayed in Log Window and note the address for later use.

### Set the Write Scan Enable parameters on the DUT

1. While in HCI Control: com4@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Write\_Scan\_Enable**.
3. In HCI Command: Write\_Scan\_Enable (com4@115200), in the **Scan\_Enable** list, select **Inquiry and Page Scan enabled**, and then click **OK**.

### Set the Event Filter parameters on the DUT

1. In the list of Host Controller & Baseband commands, double-click **Set\_Event\_Filter**.
2. In HCI Command: Set\_Event\_Filter (com4@115200):
  - a. In the **Filter\_Type** list, select **Connection Setup**.
  - b. In the **Connection\_Setup\_Filter\_Condition\_Type** list, select **Allow Connections from all devices**.
  - c. In the **Auto\_Accept\_Flag** list, select **Do Auto accept the connection with role switch disabled**, and then click **OK**.

### Create a connection from the reference board

1. Reestablish the HCI Control Transport profile for the reference board (**com5**).
2. While in HCI Control: com5@115200, press the **1 key** on the keyboard to select the Link Control commands.
3. In the list of Link Control commands, double-click **Inquiry** to display a list of found devices.
4. In the list of Link Control commands, double-click **Create\_Connection**.
5. In HCI Command: Create\_Connection (com5@115200):
  - a. In the **BD\_ADDR** list, select the BD address (of the DUT) that was noted earlier.
  - b. Set the packet type by selecting the following check boxes:
    - DM1
    - DM3
    - DM5
  - c. In the **Page\_Scan\_Repetition\_Mode** list, select **R0**.
  - d. In the **Page\_Scan\_Mode** list, select **Mandatory**, and then click **OK**.
6. In Log Window, verify that the devices have successfully connected and note the connection handle for later use.

### Set the Write Scan Enable parameters for the reference board

1. While in HCI Control: com5@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Write\_Scan\_Enable**.
3. In HCI Command: Write\_Scan\_Enable (com5@115200), in the **Scan\_Enable** list, select **No Scans enabled**, and then click **OK**.

### Set the Write Link Policy Settings parameters for the DUT

1. Reestablish the HCI Control Transport profile for the DUT (**com4**).
2. While in HCI Control: com4@115200, press the **2 key** on the keyboard to select the Link Policy commands.
3. In the list of Link Policy commands, double-click **Write\_Link\_Policy\_Settings**.
4. In HCI Command: Write\_Link\_Policy\_Settings (com4@115200), select the **Enable Sniff Mode** check box, and then click **OK**.

### Set the Write Link Policy Settings parameters for the reference board

1. Reestablish the HCI Control Transport profile for the reference board (**com5**).
2. While in HCI Control: com5@115200, press the **2 key** on the keyboard to select the Link Policy commands.
3. In the list of Link Policy commands, double-click **Write\_Link\_Policy\_Settings**.
4. In HCI Command: Write\_Link\_Policy\_Settings (com4@115200), select the **Enable Sniff Mode** check box, and then click **OK**.

### Set the Sniff\_Mode parameters for the DUT

1. Reestablish the HCI Control Transport profile for the DUT (**com4**).
2. While in HCI Control: com4@115200, press the **2 key** on the keyboard to select the Link Policy commands.
3. In the list of Link Policy commands, double-click **Sniff\_Mode**.
4. In HCI Command: Sniff\_Mode (com4@115200), make the following settings, and then click **OK**.
  - Connection\_HandleSelect the connection handle noted earlier when creating a connection.
  - Sniff\_Max\_Interval**0x320**
  - Sniff\_Min\_Interval**0x320**
  - Sniff\_Attempt**0x4**
  - Sniff\_Timeout**0x0**

### Measure the current consumption

Set the approximate range of the ammeter to 3 mA and measure the current being consumed by the DUT.

## 5.7 HV(3/2) for DUT as Master Mode

This section explains how to set the BCM4324/BCM4334 to HV(3/2) for DUT as Master mode. Steps include the following (Some of the steps apply to the DUT, and others apply to the reference board.):

- Set the HCI Control Transport profile on the DUT.
- Reset the DUT.
- Set the HCI Control Transport profile on the reference board.
- Reset the reference board.
- Read and record the BD Address of the DUT.
- Set the Event Filter parameters on the DUT.
- Set the Write Scan Enable parameters on the DUT.
- Reset the reference board.
- Read and record the BD Address of the reference board.
- Set the Event Filter parameters on the reference board.
- Set the Write Scan Enable parameters on the reference board.
- Read the local supported features on the reference board.

- Write the local supported features on the reference board.
- Read the local supported features on the DUT.
- Write the local supported features on the DUT.
- Create a connection from the reference board.
- Set the Write Scan Enable parameters on the reference board.
- Add an SCO connection from the DUT.

This section concludes by specifying the approximate ammeter range setting for measuring the current being consumed by the DUT.

Before you begin, set up and turn on the test equipment and launch Cypress BlueTool.

### Set the HCI Control Transport profile on the DUT

1. Open a log window. On the **View** menu, click **Log Window**.
2. Set the HCI Control Transport profile.
  - a. On the **Transport** menu, click **HCI Control**.
  - b. In HCI Control Window Transport:
    - ☐ Select **UART**.
    - ☐ In the top **UART** list, type the COM port of the PC that the DUT is connected to (**com4**).
    - ☐ In the bottom **UART** list, select **115200**.
    - ☐ Select the **CTS flow control** check box, and then click **OK**.

### Reset the DUT

1. While in HCI Control, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Reset**.

### Set the HCI Control Transport profile on the reference board

1. On the **Transport** menu, click **HCI Control**.
2. In HCI Control Window Transport:
  - a. Select **UART**.
  - b. In the top **UART** list, type the COM port of the PC that the DUT is connected to (**com5**).
  - c. In the bottom **UART** list, select **115200**.
  - d. Select the **CTS flow control** check box, and then click **OK**.

### Reset the reference board

1. While in HCI Control, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Reset**.

### Read and record the BD Address of the DUT

1. Reestablish the HCI Control Transport profile for the DUT (**com4**).
2. While in HCI Control: com4@115200, press the **4 key** on the keyboard to select the Informational Parameters commands.
3. In the list of Informational Parameters commands, double-click **Read\_BD\_ADDR**.
4. Verify that the BD Address is displayed in Log Window and note the address for later use.

### Set the Event Filter parameters on the DUT

1. While in HCI Control: com4@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Set\_Event\_Filter**.
3. In HCI Command: Set\_Event\_Filter (com4@115200):
  - a. In the **Filter\_Type** list, select **Connection Setup**.
  - b. In the **Connection\_Setup\_Filter\_Condition\_Type** list, select **Allow Connections from all devices**.

- c. In the **Auto\_Accept\_Flag** list, select **Do Auto accept the connection with role switch disabled**, and then click **OK**.

### Set the Write Scan Enable parameters on the DUT

1. In the list of Host controller & baseband commands, double-click **Write\_Scan\_Enable**.
2. In HCI Command: Write\_Scan\_Enable (com4@115200), in the **Scan\_Enable** list, select **Inquiry and Page Scan enabled**, and then click **OK**.

### Read and record the BD Address of the reference board

1. Reestablish the HCI Control Transport profile for the reference board (**com5**).
2. While in HCI Control: com5@115200, press the **4 key** on the keyboard to select the Informational Parameters commands.
3. In the list of Informational Parameters commands, double-click **Read\_BD\_ADDR**.
4. Verify that the BD Address is displayed in Log Window and note the address for later use.

### Set the Event Filter parameters on the reference board

1. While in HCI Control: com5@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Set\_Event\_Filter**.
3. In HCI Command: Set\_Event\_Filter (com5@115200):
  - a. In the **Filter\_Type** list, select **Connection Setup**.
  - b. In the **Connection\_Setup\_Filter\_Condition\_Type** list, select **Allow Connections from all devices**.
  - c. In the **Auto\_Accept\_Flag** list, select **Do Auto accept the connection with role switch disabled**, and then click **OK**.

### Set the Write Scan Enable parameters on the reference board

1. In the list of Host Controller & Baseband commands, double-click **Write\_Scan\_Enable**.
2. In HCI Command: Write\_Scan\_Enable (com5@115200), in the **Scan\_Enable** list, select **Inquiry and Page Scan enabled**, and then click **OK**.

### Read the local supported features on the reference board

1. While in HCI Control: com5@115200, press the **4 key** on the keyboard to select the Informational Parameters commands.
2. In the list of Informational Parameters commands, double-click **Read\_Local\_Version\_Information** and note which SCO Links are supported for the device being tested.

### Write the local supported features on the reference board

1. While in HCI Control: com5@115200, press the **0 key** on the keyboard to select the Vendor-specific commands.
2. In the list of Vendor-specific commands, double-click **Write\_Local\_Supported\_Features**.
3. In HCI Command: Write\_Local\_Supported\_Features (com5@115200), clear the **Power control** check box.

### Read the local supported features on the DUT

1. Reestablish the HCI Control Transport profile for the DUT (**com4**).
2. While in HCI Control: com4@115200, press the **4 key** on the keyboard to select the Informational Parameters commands.
3. In the list of Informational Parameters commands, double-click **Read\_Local\_Version\_Information** and note which SCO Links are supported for the device being tested.

**Write the local supported features on the DUT**

1. While in HCI Control: com4@115200, press the **0 key** on the keyboard to select the Vendor-specific commands.
2. In the list of Vendor-specific commands, double-click **Write\_Local\_Supported\_Features**.
3. In HCI Command: Write\_Local\_Supported\_Features (com4@115200), clear the **Power control** check box.

**Create a connection from the DUT**

1. While in HCI Control: com4@115200, press the **1 key** on the keyboard to select the Link Control commands.
2. In the list of Link Control commands, double-click **Inquiry** to display a list of found devices.
3. In the list of Link Control commands, double-click **Create\_Connection**.
4. In HCI Command: Create\_Connection (com4@115200):
  - a. In the **BD\_ADDR** list, select the BD address (of the reference board) that was noted earlier.
  - b. Set the packet type by selecting the following check boxes:
    - DM1
    - DM3
    - DM5
  - c. In the **Page\_Scan\_Repetition\_Mode** list, select **R0**.
  - d. In the **Page\_Scan\_Mode** list, select **Mandatory**, and then click **OK**.Note that the connection handle = 0xB (This is an ACL connection.).

**Set the Write Scan Enable parameters on the reference board**

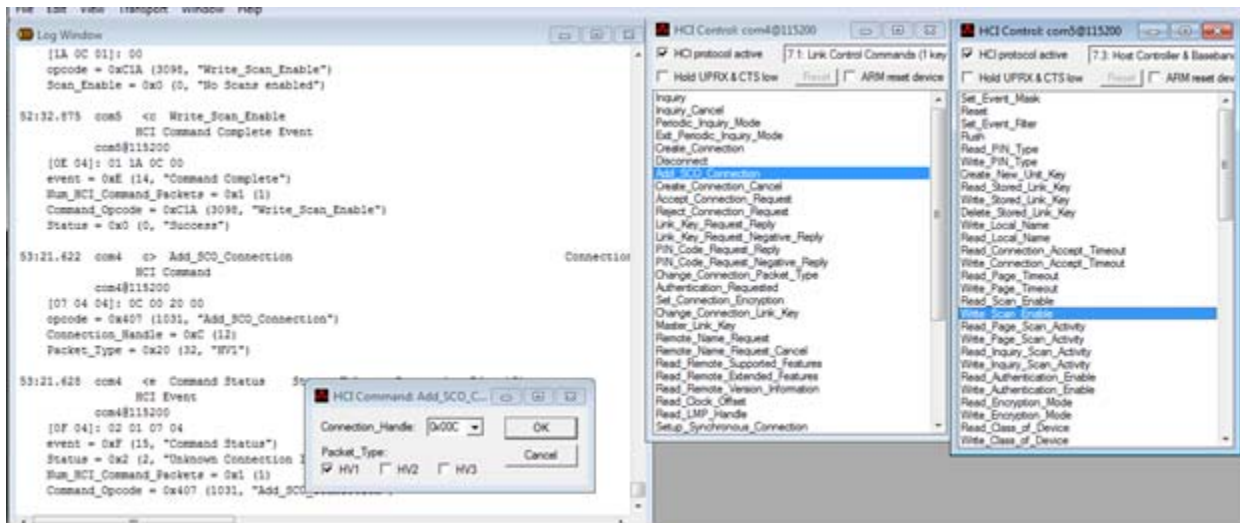
1. Reestablish the HCI Control Transport profile for the reference board (**com5**).
2. While in HCI Control: com5@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
3. In the list of Host Controller & Baseband Commands, double-click **Write\_Scan\_Enable**.
4. In HCI Command: Write\_Scan\_Enable (com5@115200), in the **Scan\_Enable** list, select **No Scans enabled**, and then click **OK**.

**Add an SCO connection from the DUT**

1. Reestablish the HCI Control Transport profile for the DUT (**com4**).
2. While in HCI Control: com4@115200, press the **1 key** on the keyboard to select the Link Control commands.
3. In the list of Link Control commands, double-click **Add\_SCO\_Connection**.
4. In HCI Command: Add\_SCO\_Connection (com4@115200):
  - a. In the **Connection\_Handle** list, select **0xB**.
  - b. Select only the **HV3 Packet\_Type** check box, and then click **OK**.

**Note:** For HV2 packet types, select only the **HV2** check box.

5. In Log Window, verify that the connection is successful. "Max\_Slots Change" should be displayed, along with the connection request for the BD\_ADDR, the acceptance of the connection request, and the indication that the connection was complete.



### Measure the current consumption

Set the approximate range of the ammeter to 10 mA and measure the current being consumed by the DUT.

## 5.8 HV(3/2) for DUT as Slave Mode

This section explains how to set the BCM4324/BCM4334 to HV(3/2) for DUT as Slave mode. Steps include the following (Some of the steps apply to the DUT, and others apply to the reference board.):

- Set the HCI Control Transport profile on the DUT.
- Reset the DUT.
- Set the HCI Control Transport profile on the reference board.
- Reset the reference board.
- Read and record the BD Address of the DUT.
- Set the Event Filter parameters on the DUT.
- Set the Write Scan Enable parameters on the DUT.
- Reset the reference board.
- Read and record the BD Address of the reference board.
- Set the Event Filter parameters on the reference board.
- Set the Write Scan Enable parameters on the reference board.
- Read the local supported features on the reference board.
- Write the local supported features on the reference board.
- Read the local supported features on the DUT.
- Write the local supported features on the DUT.
- Create a connection from the reference board.
- Set the Write Scan Enable parameters on the reference board.
- Add an SCO connection from the reference board.

This section concludes by specifying the approximate ammeter range setting for measuring the current being consumed by the DUT.

Before you begin, set up and turn on the test equipment and launch Cypress BlueTool.

### Set the HCI Control Transport profile on the DUT

1. Open a log window. On the **View** menu, click **Log Window**.
2. Set the HCI Control Transport profile.
  - a. On the **Transport** menu, click **HCI Control**.
  - b. In HCI Control Window Transport:
    - Select **UART**.

- In the top **UART** list, type the COM port of the PC that the DUT is connected to (**com4**).
- In the bottom **UART** list, select **115200**.
- Select the **CTS flow control** check box, and then click **OK**.

### Reset the DUT

1. While in HCI Control, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Reset**.

### Set the HCI Control Transport profile on the reference board

1. On the **Transport** menu, click **HCI Control**.
2. In HCI Control Window Transport:
  - a. Select **UART**.
  - b. In the top **UART** list, type the COM port of the PC that the DUT is connected to (**com5**).
  - c. In the bottom **UART** list, select **115200**.
  - d. Select the **CTS flow control** check box, and then click **OK**.

### Reset the reference board

1. While in HCI Control, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Reset**.

### Read and record the BD Address of the DUT

1. Reestablish the HCI Control Transport profile for the DUT (**com4**).
2. While in HCI Control: com4@115200, press the **4 key** on the keyboard to select the Informational Parameters commands.
3. In the list of Informational Parameters commands, double-click **Read\_BD\_ADDR**.
4. Verify that the BD Address is displayed in Log Window and note the address for later use.

### Set the Event Filter parameters on the DUT

1. While in HCI Control: com4@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Set\_Event\_Filter**.
3. In HCI Command: Set\_Event\_Filter (com4@115200):
  - a. In the **Filter\_Type** list, select **Connection Setup**.
  - b. In the **Connection\_Setup\_Filter\_Condition\_Type** list, select **Allow Connections from all devices**.
  - c. In the **Auto\_Accept\_Flag** list, select **Do Auto accept the connection with role switch disabled**, and then click **OK**.

### Set the Write Scan Enable parameters on the DUT

1. In the list of Host Controller & Baseband commands, double-click **Write\_Scan\_Enable**.
2. In HCI Command: Write\_Scan\_Enable (com4@115200), in the **Scan\_Enable** list, select **Inquiry and Page Scan enabled**, and then click **OK**.

### Read and record the BD Address of the reference board

1. Reestablish the HCI Control Transport profile for the reference board (**com5**).
2. While in HCI Control: com5@115200, press the **4 key** on the keyboard to select the Informational Parameters commands.
3. In the list of Informational Parameters commands, double-click **Read\_BD\_ADDR**.
4. Verify that the BD Address is displayed in Log Window and note the address for later use.

**Set the Event Filter parameters on the reference board**

1. While in HCI Control: com5@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Set\_Event\_Filter**.
3. In HCI Command: Set\_Event\_Filter (com5@115200):
  - a. In the **Filter\_Type** list, select **Connection Setup**.
  - b. In the **Connection\_Setup\_Filter\_Condition\_Type** list, select **Allow Connections from all devices**.
  - c. In the **Auto\_Accept\_Flag** list, select **Do Auto accept the connection with role switch disabled**, and then click **OK**.

**Set the Write Scan Enable parameters on the reference board**

1. In the list of Host controller & baseband commands, double-click **Write\_Scan\_Enable**.
2. In HCI Command: Write\_Scan\_Enable (com5@115200), in the **Scan\_Enable** list, select **Inquiry and Page Scan enabled**, and then click **OK**.

**Read the local supported features on the reference board**

1. While in HCI Control: com5@115200, press the **4 key** on the keyboard to select the Informational Parameters commands.
2. In the list of Informational parameters commands, double-click **Read\_Local\_Version\_Information** and note which SCO Links are supported for the device being tested.

**Write the local supported features on the reference board**

1. While in HCI Control: com5@115200, press the **0 key** on the keyboard to select the Vendor-specific commands.
2. In the list of Vendor-specific commands, double-click **Write\_Local\_Supported\_Features**.
3. In HCI Command: Write\_Local\_Supported\_Features (com5@115200), clear the **Power control** check box.

**Read the local supported features on the DUT**

1. Reestablish the HCI Control Transport profile for the DUT (**com4**).
2. While in HCI Control: com4@115200, press the **4 key** on the keyboard to select the Informational Parameters commands.
3. In the list of Informational Parameters commands, double-click **Read\_Local\_Version\_Information** and note which SCO Links are supported for the device being tested.

**Write the local supported features on the DUT**

1. While in HCI Control: com4@115200, press the **0 key** on the keyboard to select the Vendor-specific commands.
2. In the list of Vendor-specific commands, double-click **Write\_Local\_Supported\_Features**.
3. In HCI Command: Write\_Local\_Supported\_Features (com4@115200), clear the **Power control** check box.

**Create a connection from the reference board**

1. Reestablish the HCI Control Transport profile for the reference board (**com5**).
2. While in HCI Control: com5@115200, press the **1 key** on the keyboard to select the Link Control commands.
3. In the list of Link Control commands, double-click **Inquiry** to display a list of found devices.
4. In the list of Link Control commands, double-click **Create\_Connection**.
5. In HCI Command: Create\_Connection (com5@115200):
  - a. In the **BD\_ADDR** list, select the BD address (of the DUT) that was noted earlier.
  - b. Set the packet type by selecting the following check boxes:
    - DM1
    - DM3

#### ■DM5

- c. In the **Page\_Scan\_Repetition\_Mode** list, select **R0**.
- d. In the **Page\_Scan\_Mode** list, select **Mandatory**, and then click **OK**.

Note that the connection handle = 0xB (this is an ACL connection).

#### Set the Write Scan Enable parameters on the reference board

1. While in HCI Control: com5@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband Commands, double-click **Write\_Scan\_Enable**.
3. In HCI Command: Write\_Scan\_Enable (com5@115200), in the **Scan\_Enable** list, select **No Scans enabled**, and then click **OK**.

#### Add an SCO connection from the reference board

1. While in HCI Control: com5@115200, press the **1 key** on the keyboard to select the Link Control commands.
2. In the list of Link Control commands, double-click **Add\_SCO\_Connection**.
3. In HCI Command: Add\_SCO\_Connection (com4@115200):
  - a. In the **Connection\_Handle** list, select **0xB**.
  - b. Select only the **HV3 Packet\_Type** check box, and then click **OK**.

**Note:** For HV2 packet types, select only the **HV2** check box.

4. In Log Window, verify that the connection is successful. "Max\_Slots Change" should be displayed, along with the connection request for the BD\_ADDR, the acceptance of the connection request, and the indication that the connection was complete.

#### Measure the current consumption

Set the approximate range of the ammeter to 10 mA and measure the current being consumed by the DUT.

## 5.9

### EV(4/5) eSCO for DUT as Master Mode

This section explains how to set the BCM4324/BCM4334 to EV(4/5) eSCO for DUT as Master mode. Steps include the following (Some of the steps apply to the DUT, and others apply to the reference board.):

- Set the HCI Control Transport profile on the DUT.
- Reset the DUT.
- Set the HCI Control Transport profile on the reference board.
- Reset the reference board.
- Read and record the BD Address of the DUT.
- Set the Event Filter parameters on the DUT.
- Set the Write Scan Enable parameters on the DUT.
- Reset the reference board.
- Read and record the BD Address of the reference board.
- Set the Event Filter parameters on the reference board.
- Set the Write Scan Enable parameters on the reference board.
- Read the local supported features on the reference board.
- Write the local supported features on the reference board.
- Read the local supported features on the DUT.
- Write the local supported features on the DUT.
- From the DUT, create a connection to the reference board.
- Set the Write Scan Enable parameters on the reference board.
- From the DUT, add an eSCO connection.

This section concludes by specifying the approximate ammeter range setting for measuring the current being consumed by the DUT.

Before you begin, set up and turn on the test equipment and launch Cypress BlueTool.

### Set the HCI Control Transport profile on the DUT

1. Open a log window. On the **View** menu, click **Log Window**.
2. Set the HCI Control Transport profile.
  - a. On the **Transport** menu, click **HCI Control**.
  - b. In HCI Control Window Transport:
    - Select **UART**.
    - In the top **UART** list, type the COM port of the PC that the DUT is connected to (**com4**).
    - In the bottom **UART** list, select **115200**.
    - Select the **CTS flow control** check box, and then click **OK**.

### Reset the DUT

1. While in HCI Control, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Reset**.

### Set the HCI Control Transport profile on the reference board

1. On the **Transport** menu, click **HCI Control**.
2. In HCI Control Window Transport:
  - a. Select **UART**.
  - b. In the top **UART** list, type the COM port of the PC that the DUT is connected to (**com5**).
  - c. In the bottom **UART** list, select **115200**.
  - d. Select the **CTS flow control** check box, and then click **OK**.

### Reset the reference board

1. While in HCI Control, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Reset**.

### Read and record the BD Address of the DUT

1. Reestablish the HCI Control Transport profile for the DUT (**com4**).
2. While in HCI Control: com4@115200, press the **4 key** on the keyboard to select the Informational Parameters commands.
3. In the list of Informational Parameters commands, double-click **Read\_BD\_ADDR**.
4. Verify that the BD Address is displayed in Log Window and note the address for later use.

### Set the Event Filter parameters on the DUT

1. While in HCI Control: com4@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Set\_Event\_Filter**.
3. In HCI Command: Set\_Event\_Filter (com4@115200):
  - a. In the **Filter\_Type** list, select **Connection Setup**.
  - b. In the **Connection\_Setup\_Filter\_Condition\_Type** list, select **Allow Connections from all devices**.
  - c. In the **Auto\_Accept\_Flag** list, select **Do Auto accept the connection with role switch disabled**, and then click **OK**.

### Set the Write Scan Enable parameters on the DUT

1. In the list of Host Controller & Baseband commands, double-click **Write\_Scan\_Enable**.
2. In HCI Command: Write\_Scan\_Enable (com4@115200), in the **Scan\_Enable** list, select **Inquiry and Page Scan enabled**, and then click **OK**.

**Read and record the BD Address of the reference board**

1. Reestablish the HCI Control Transport profile for the reference board (**com5**).
2. While in HCI Control: com5@115200, press the **4 key** on the keyboard to select the Informational Parameters commands.
3. In the list of Informational Parameters commands, double-click **Read\_BD\_ADDR**.
4. Verify that the BD Address is displayed in Log Window and note the address for later use.

**Set the Event Filter parameters on the reference board**

1. While in HCI Control: com5@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Set\_Event\_Filter**.
3. In HCI Command: Set\_Event\_Filter (com5@115200):
  - a. In the **Filter\_Type** list, select **Connection Setup**.
  - b. In the **Connection\_Setup\_Filter\_Condition\_Type** list, select **Allow Connections from all devices**.
  - c. In the **Auto\_Accept\_Flag** list, select **Do Auto accept the connection with role switch disabled**, and then click **OK**.

**Set the Write Scan Enable parameters on the reference board**

1. In the list of Host Controller & Baseband commands, double-click **Write\_Scan\_Enable**.
2. In HCI Command: Write\_Scan\_Enable (com5@115200), in the **Scan\_Enable** list, select **Inquiry and Page Scan enabled**, and then click **OK**.

**Read the local supported features on the reference board**

1. While in HCI Control: com5@115200, press the **4 key** on the keyboard to select the Informational Parameters commands.
2. In the list of Informational Parameters commands, double-click **Read\_Local\_Version\_Information** and note which SCO Links are supported for the device being tested.

**Write the local supported features on the reference board**

1. While in HCI Control: com5@115200, press the **0 key** on the keyboard to select the Vendor-specific commands.
2. In the list of Vendor-specific commands, double-click **Write\_Local\_Supported\_Features**.
3. In HCI Command: Write\_Local\_Supported\_Features (com5@115200), clear the **Power control** check box.

**Read the local supported features on the DUT**

1. Reestablish the HCI Control Transport profile for the DUT (**com4**).
2. While in HCI Control: com4@115200, press the **4 key** on the keyboard to select the Informational Parameters commands.
3. In the list of Informational Parameters commands, double-click **Read\_Local\_Version\_Information** and note which SCO Links are supported for the device being tested.

**Write the local supported features on the DUT**

1. While in HCI Control: com4@115200, press the **0 key** on the keyboard to select the Vendor-specific commands.
2. In the list of Vendor-specific commands, double-click **Write\_Local\_Supported\_Features**.
3. In HCI Command: Write\_Local\_Supported\_Features (com4@115200), clear the **Power control** check box.

**From the DUT, create a connection to the reference board**

1. While in HCI Control: com4@115200, press the **1 key** on the keyboard to select the Link Control commands.
2. In the list of Link Control commands, double-click **Inquiry** to display a list of found devices.

3. In the list of Link Control commands, double-click **Create\_Connection**.
  4. In HCI Command: Create\_Connection (com4@115200):
    - a. In the **BD\_ADDR** list, select the BD address of the reference board that was noted earlier.
    - b. Set the packet type by selecting the following check boxes:
      - DM1
      - DM3
      - DM5
    - c. In the **Page\_Scan\_Repetition\_Mode** list, select **R0**.
    - d. In the **Page\_Scan\_Mode** list, select **Mandatory**, and then click **OK**.
- Note that the connection handle = 0xB (This is an ACL connection.).

#### Set the Write Scan Enable parameters on the reference board

1. Reestablish the HCI Control Transport profile for the reference board (**com5**).
2. While in HCI Control: com5@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
3. In the list of Host Controller & Baseband Commands, double-click **Write\_Scan\_Enable**.
4. In HCI Command: Write\_Scan\_Enable (com5@115200), in the **Scan\_Enable** list, select **No Scans enabled**, and then click **OK**.

#### Add an eSCO connection from the DUT

1. Reestablish the HCI Control Transport profile for the DUT (**com4**).
2. While in HCI Control: com4@115200, press the **1 key** on the keyboard to select the Link Control commands.
3. In the list of Link Control commands, double-click **Setup\_Synchronous\_Connection**.
4. In HCI Command: Add\_SCO\_Connection (com4@115200):
  - a. In the **Connection\_Handle** list, select the connection handle indicated in Log Window.
  - b. Select only the **EV4 Packet\_Type** check box, and then click **OK**.

**Note:** For EV5 packet types, select only the **EV5** check box.

5. In Log Window, verify that the connection is successful. "Synchronous connection Complete" from both COM ports should be displayed.

#### Measure the current consumption

Set the approximate range of the ammeter to 10 mA and measure the current being consumed by the DUT.

### 5.10 EV(4/5) eSCO for DUT as Slave Mode

This section explains how to set the BCM4324/BCM4334 to EV(4/5) for DUT as Slave mode. Steps include the following (Some of the steps apply to the DUT, and others apply to the reference board.):

- Set the HCI Control Transport profile on the DUT.
- Reset the DUT.
- Set the HCI Control Transport profile on the reference board.
- Reset the reference board.
- Read and record the BD Address of the DUT.
- Set the Event Filter parameters on the DUT.
- Set the Write Scan Enable parameters on the DUT.
- Reset the reference board.
- Read and record the BD Address of the reference board.
- Set the Event Filter parameters on the reference board.
- Set the Write Scan Enable parameters on the reference board.
- Read the local supported features on the reference board.
- Write the local supported features on the reference board.
- Read the local supported features on the DUT.

- Write the local supported features on the DUT.
- From the DUT, create a connection to the reference board.
- Set the Write Scan Enable parameters on the reference board.
- Add an eSCO connection from the DUT.

This section concludes by specifying the approximate ammeter range setting for measuring the current being consumed by the DUT.

Before you begin, set up and turn on the test equipment and launch Cypress BlueTool.

### Set the HCI Control Transport profile on the DUT

1. Open a log window. On the **View** menu, click **Log Window**.
2. Set the HCI Control Transport profile.
  - a. On the **Transport** menu, click **HCI Control**.
  - b. In HCI Control Window Transport:
    - Select **UART**.
    - In the top **UART** list, type the COM port of the PC that the DUT is connected to (**com4**).
    - In the bottom **UART** list, select **115200**.
    - Select the **CTS flow control** check box, and then click **OK**.

### Reset the DUT

1. While in HCI Control, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Reset**.

### Set the HCI Control Transport profile on the reference board

1. On the **Transport** menu, click **HCI Control**.
2. In HCI Control Window Transport:
  - a. Select **UART**.
  - b. In the top **UART** list, type the COM port of the PC that the reference board is connected to (**com5**).
  - c. In the bottom **UART** list, select **115200**.
  - d. Select the **CTS flow control** check box, and then click **OK**.

### Reset the reference board

1. While in HCI Control, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Reset**.

### Read and record the BD Address of the DUT

1. Reestablish the HCI Control Transport profile for the DUT (**com4**).
2. While in HCI Control: com4@115200, press the **4 key** on the keyboard to select the Informational Parameters commands.
3. In the list of Informational Parameters commands, double-click **Read\_BD\_ADDR**.
4. Verify that the BD Address is displayed in Log Window and note the address for later use.

### Set the Event Filter parameters on the DUT

1. While in HCI Control: com4@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Set\_Event\_Filter**.
3. In HCI Command: Set\_Event\_Filter (com4@115200):
  - a. In the **Filter\_Type** list, select **Connection Setup**.
  - b. In the **Connection\_Setup\_Filter\_Condition\_Type** list, select **Allow Connections from all devices**.
  - c. In the **Auto\_Accept\_Flag** list, select **Do Auto accept the connection with role switch disabled**, and then click **OK**.

### Set the Write Scan Enable parameters on the DUT

1. In the list of Host Controller & Baseband commands, double-click **Write\_Scan\_Enable**.
2. In HCI Command: Write\_Scan\_Enable (com4@115200), in the **Scan\_Enable** list, select **Inquiry and Page Scan enabled**, and then click **OK**.

### Read and record the BD Address of the reference board

1. Reestablish the HCI Control Transport profile for the reference board (**com5**).
2. While in HCI Control: com5@115200, press the **4 key** on the keyboard to select the Informational Parameters commands.
3. In the list of Informational Parameters commands, double-click **Read\_BD\_ADDR**.
4. Verify that the BD Address is displayed in Log Window and note the address for later use.

### Set the Event Filter parameters on the reference board

1. While in HCI Control: com5@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
2. In the list of Host Controller & Baseband commands, double-click **Set\_Event\_Filter**.
3. In HCI Command: Set\_Event\_Filter (com5@115200):
  - a. In the **Filter\_Type** list, select **Connection Setup**.
  - b. In the **Connection\_Setup\_Filter\_Condition\_Type** list, select **Allow Connections from all devices**.
  - c. In the **Auto\_Accept\_Flag** list, select **Do Auto accept the connection with role switch disabled**, and then click **OK**.

### Set the Write Scan Enable parameters on the reference board

1. In the list of Host Controller & Baseband commands, double-click **Write\_Scan\_Enable**.
2. In HCI Command: Write\_Scan\_Enable (com5@115200), in the **Scan\_Enable** list, select **Inquiry and Page Scan enabled**, and then click **OK**.

### Read the local supported features on the reference board

1. While in HCI Control: com5@115200, press the **4 key** on the keyboard to select the Informational Parameters commands.
2. In the list of Informational Parameters commands, double-click **Read\_Local\_Version\_Information** and note which SCO Links are supported for the device being tested.

### Write the local supported features on the reference board

1. While in HCI Control: com5@115200, press the **0 key** on the keyboard to select the Vendor-specific commands.
2. In the list of Vendor-specific commands, double-click **Write\_Local\_Supported\_Features**.
3. In HCI Command: Write\_Local\_Supported\_Features (com5@115200), clear the **Power control** check box.

### Read the local supported features on the DUT

1. Reestablish the HCI Control Transport profile for the DUT (**com4**).
2. While in HCI Control: com4@115200, press the **4 key** on the keyboard to select the Informational Parameters commands.
3. In the list of Informational Parameters commands, double-click **Read\_Local\_Version\_Information** and note which SCO Links are supported for the device being tested.

### Write the local supported features on the DUT

1. While in HCI Control: com4@115200, press the **0 key** on the keyboard to select the Vendor-specific commands.
2. In the list of Vendor-specific commands, double-click **Write\_Local\_Supported\_Features**.

3. In HCI Command: Write\_Local\_Supported\_Features (com4@115200), clear the **Power control** check box.

#### From the DUT, create a connection to the reference board

1. While in HCI Control: com4@115200, press the **1 key** on the keyboard to select the Link Control commands.
  2. In the list of Link Control commands, double-click **Inquiry** to display a list of found devices.
  3. In the list of Link Control commands, double-click **Create\_Connection**.
  4. In HCI Command: Create\_Connection (com4@115200):
    - a. In the **BD\_ADDR** list, select the BD address of the reference board that was noted earlier.
    - b. Set the packet type by selecting the following check boxes:
      - DM1
      - DM3
      - DM5
    - c. In the **Page\_Scan\_Repetition\_Mode** list, select **R0**.
    - d. In the **Page\_Scan\_Mode** list, select **Mandatory**, and then click **OK**.
- Note that the connection handle = 0xB (This is an ACL connection.).

#### Set the Write Scan Enable parameters on the reference board

1. Reestablish the HCI Control Transport profile for the reference board (**com5**).
2. While in HCI Control: com5@115200, press the **3 key** on the keyboard to select the Host Controller & Baseband commands.
3. In the list of Host Controller & Baseband Commands, double-click **Write\_Scan\_Enable**.
4. In HCI Command: Write\_Scan\_Enable (com5@115200), in the **Scan\_Enable** list, select **No Scans enabled**, and then click **OK**.

#### Add an eSCO connection from the DUT

1. While in HCI Control: com5@115200, press the **1 key** on the keyboard to select the Link Control commands.
2. In the list of Link Control commands, double-click **Setup\_Synchronous\_Connection**.
3. In HCI Command: Add\_SCO\_Connection (com5@115200):
  - a. In the **Connection\_Handle** list, select the connection handle indicated in Log Window.
  - b. Select only the **EV4 Packet\_Type** check box, and then click **OK**.

**Note:** For EV5 packet types, select only the **EV5** check box.

4. In Log Window, verify that the connection is successful. "Synchronous connection Complete" from both COM ports should be displayed.

#### Measure the current consumption

Set the approximate range of the ammeter to 10 mA and measure the current being consumed by the DUT.

## 5.11 Throughput ACL, 3DH5 Mode

This section explains how to set the BCM4324/BCM4334 to Throughput ACL, 3DH5 mode. Steps include the following (Some of the steps apply to the DUT, and others apply to the reference device.):

- Set the HCI Control Transport profile for both the DUT and the reference device.
- Set the Event Filter and Write Scan Enable parameters for both the DUT and the reference device.
- Create a connection between the DUT and the reference device.
- Execute the Receive test on the reference device and the Transmit test on the DUT.

This section concludes by specifying the approximate ammeter range setting for measuring the current being consumed by the DUT.

Before you begin, set up and turn on the test equipment and launch Cypress BlueTool.

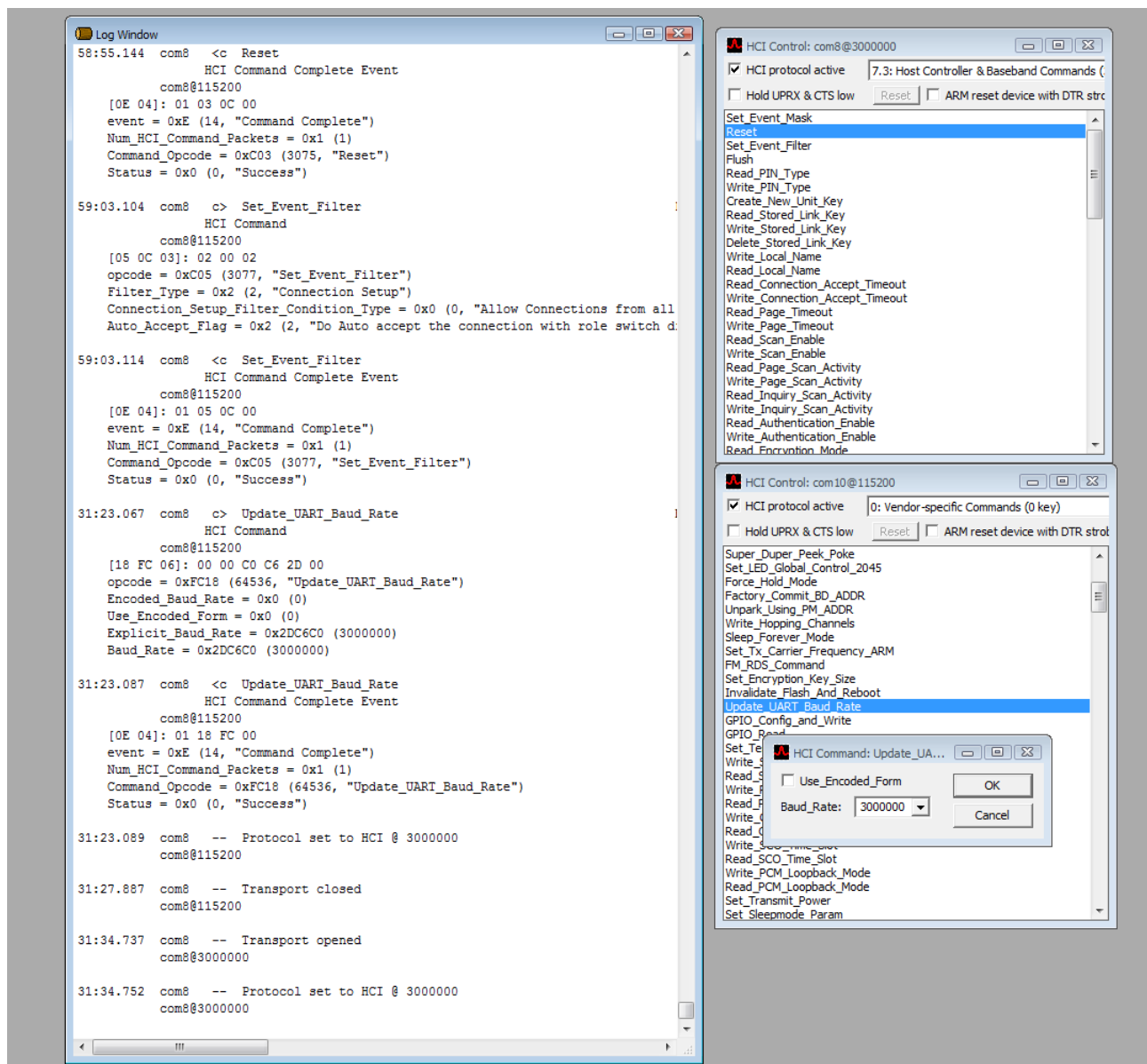
**Note:** A USB cable and USB/UART converter may be needed due to the limitations of some RS-232 ports/cables.

**Set the HCI Control Transport profile for both the DUT and the reference device**

1. Open a log window. On the **View** menu, click **Log Window**.
2. Set the HCI Control Transport profile for the DUT.
  - a. On the **Transport** menu, click **HCI Control**.
  - b. In HCI Control Window Transport:
    - Select **UART**.
    - In the top **UART** list, select the COM port for the DUT.
    - In the bottom **UART** list, select 115200, and then click **OK**.
3. Set the HCI Control Transport profile for the reference device.
  - a. On the **Transport** menu, click **HCI Control**.
  - b. In HCI Control Window Transport:
    - Select **UART**.
    - In the top **UART** list, select COM port for the reference device.
    - In the bottom **UART** list, select 115200, and then click **OK**.

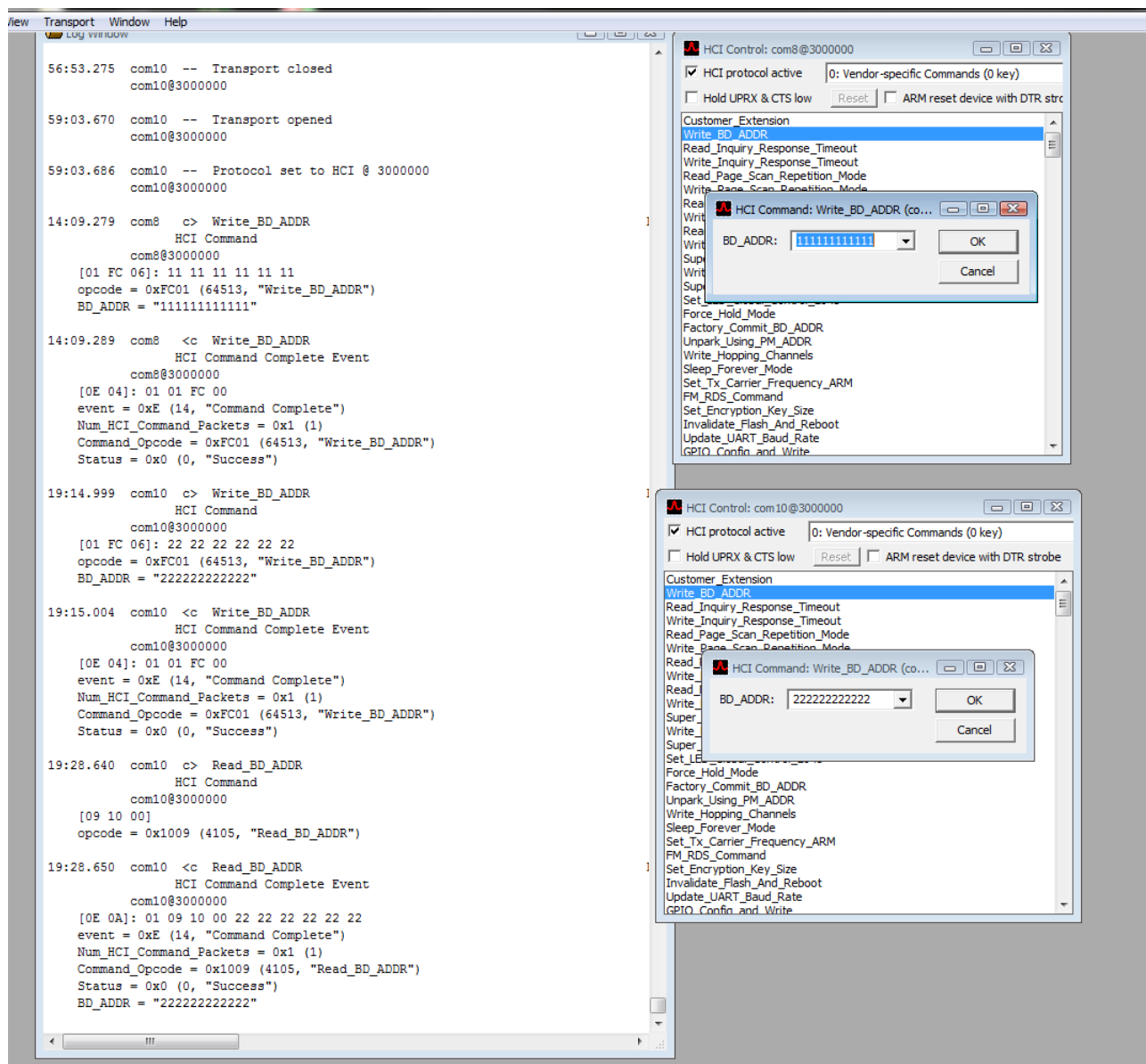
**Set the Event Filter and Write Scan Enable parameters for both the DUT and reference device**

1. While in HCI Control: com#@115200, press the **3** key on the keyboard to select the list of Host Controller & Baseband commands. In the list, double-click **Set\_Event\_Filter**. In HCI Command: Set\_Event\_Filter (com#@115200):
  - a. In the **Filter\_Type** list, select **Connection Setup**.
  - b. In the **Connection\_Setup\_Filter\_Condition\_Type** list, select **Allow Connections from all devices**.
  - c. In the **Auto\_Accept\_Flag** list, select **Do Auto accept the connection with role switch disabled**, and then click **OK**.
2. In the list of Host Controller & Baseband commands, double-click **Write\_Scan\_Enable**, and then click **OK**.
3. Change the UART baud rate to 3000000 for both the DUT and the reference device.
  - a. While in HCI Command, press the **0** key to select the list of Vendor-specific Commands. In the list, double click **Update\_UART\_Baud\_Rate**.
  - b. In HCI Command: Update\_UART\_Baud\_Rate, in the **Baud\_Rate** list, select **3000000**, and then click **OK**.
  - c. Close HCI Control, and then reopen it (On the **Transport** menu, click **HCI Control**.)
  - d. In the **bottom UART list**, select **3000000**, and then click **OK**. Notice that the updated baud rate of 3000000 is now displayed in the title bar of HCI Control.



### Create a connection between the DUT and the reference device

1. While in the HCI Control window for the DUT, press the **0** key to select the list of Vendor-specific Commands. In the list, double-click **Write\_BD\_ADDR**. In HCI Command: Write\_BD\_ADDR, in the BD\_ADDR box, type **111111111111** (12 ones), and then click **OK**.
2. While in the HCI Control window for the DUT, press the **4** key to select the list of Informational Parameters. In the list, double-click **Read\_BD\_ADDR**. In Log Window verify that BD\_ADDR = "111111111111" is displayed.
3. While in the HCI Control window for the reference device, press the **0** key to select the list of Vendor-specific Commands. In the list, double-click **Write\_BD\_ADDR**. In the **Write\_BD\_ADDR** box, type **222222222222** (12 twos), and then click **OK**.
4. While in the HCI Control window for the reference device, press the **4** key to select the list of Informational Parameters. In the list, double-click **Read\_BD\_ADDR**. In the Log Window verify that BD\_ADDR = "222222222222" is displayed.

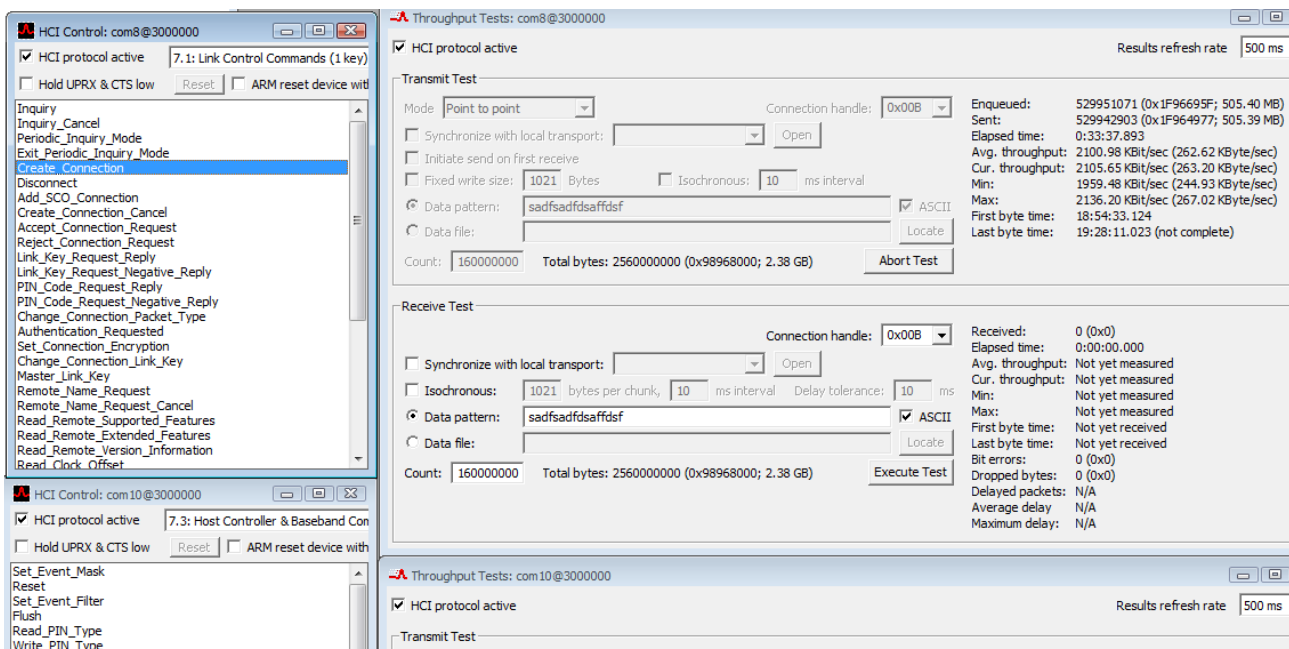


5. While in the HCI Control window for the DUT, press the **1** key to select the list of Control Commands. In the list, double-click **Create\_Connection**. In HCI Command: Create\_Connection:
  - a. In the **BD\_ADDR** box, type **222222222222**.
  - b. Under **Packet\_type**, select the following check boxes: **DH5**, **DH3**, **DH1**, **DM5**, **DM3**, and **DM1**, and then click **OK**. In Log Window, notice that Connection Handle = 0xB is displayed.

### Execute the Receive test on the reference device and the Transmit test on the DUT

1. On the **Transport** menu, click **Throughput Test**.
2. In Throughput Tests: com#@3000000 (com# is the COM number of the reference device):
  - a. Under **Transmit Test**, verify that the value shown in the **Connection handle** box is 0x00B.
  - b. In the **Data pattern** box, type a data pattern. For example, **asdasdfasdf;ljkl**.
  - c. In the **Count** box, type a value of at least **16000000**.
3. On the **Transport** menu, click **Throughput Test**.
4. In Throughput Tests: com#@3000000 (com# is the COM number of the DUT):
  - a. Under **Receive Test**, verify that the value shown in the **Connection handle** box is 0x00B.
  - b. In the **Data pattern** box, type a data pattern. For example, **asdasdfasdfasdf**.

- c. In the **Count** box, type a value of at least **16000000**.
  5. Under **Receive Test** in Throughput Tests: com#@3000000 for the reference device, click **Execute Test**.
  6. Under **Transmit Test** in Throughput Tests: com#@3000000 for the DUT, click **Execute Test**.
- Note that the data flow values (throughput) are approximately 2000 KBit/sec for both the Transmit and Receive tests.



### Measure the current consumption

Set the approximate range of the ammeter to 10 mA and measure the current being consumed by the DUT.

## 6 References

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

Document (or Item) Name	Number	Source
<b>Cypress Items</b>		
[1] <i>Bluetooth Low Energy Current Consumption Measurements</i>	4330-AN4XX-R	Cypress Developer Community

## Document History Page

Document Title: AN214914 - Measuring Current Consumption in Different Power Modes				
Document Number: 002-14914				
Rev.	ECN No.	Orig. of Change	Submission Date	Description of Change
**	—	—	07/03/2012	4324_4334-AN101-R Initial release
*A	—	—	08/06/2012	4324_4334-AN100-R Updated: <a href="#">System Requirements on page 3</a> <a href="#">Throughput ACL, 3DH5 Mode on page 31</a>
*B	5456055	UTSV	10/03/2016	Updated to Cypress template Added Cypress part numbering scheme
*C	5834576	BENV	07/27/2017	Updated logo and copyright

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