

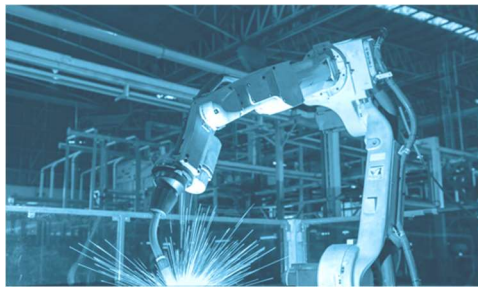


BLUETOOTH RADIO TEST CASES AND PROVISIONING HCI COMMANDS

for HCI-base Controllers

Abstract

List HCI Commands commonly used at testing Bluetooth radio,
Illustrate frequently used test cases.



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1 Introduction

The purpose of this document is to list the HCI commands required to be sent to the Bluetooth Controller by a Bluetooth Host stack so that the Bluetooth Controller may enter proper test mode to conduct Bluetooth radio tests. Complete details of these commands can be found in the BLUETOOTH CORE SPECIFICATIONS, <https://www.bluetooth.com/specifications/>.

This documented set of commands are intended for use with a Cypress Bluetooth BR/EDR and BLE Controllers.

2 HCI Commands

This section lists most common HCI standard and vendor specific commands which will be used when configuring Bluetooth Controller to conduct Bluetooth radio tests.

2.1 SIG Standard HCI Commands

2.1.1 HCI_Inquiry

Command (Core Spec. v. 4.2 and above)	
HCI_Inquiry	OGF:0x01, OCF:0x0001
Parameters	
LAP	Size: 3 octets (little endian format) 0x9E8B33 – General/Unlimited inquiry access code (GIAC) 0x9E8B00 – Limited dedicated inquiry access code (LIAC)
Inquiry_Length	Size: 1 octet N = 0x01 to 0x30 Specified time period = N * 1.28 seconds
Num_Responses	Size: 1 octet 0x00 – Unlimited number of responses 0xFF – Maximum number of responses before the Inquiry stops
Return	
Status	Size: 1 octet 0x00 – Success 0x01 to 0xFF – Fail

Example:

```
11:32.140 com13 c> Inquiry                                LAP: 0x9E8B33
    HCI Command
    com13@115200
    [01 04 05]: 33 8B 9E 08 00
    opcode = 0x401 (1025, "Inquiry")
    LAP = 0x9E8B33 (10390323)
    Inquiry_Length = 0x8 (8, N * 1.28 sec, 0=infinite)
    Num_Responses = 0x0 (0, 0=unlimited)

11:32.145 com13 <e Command Status
    HCI Event
    com13@115200
    [0F 04]: 00 01 01 04
    event = 0xF (15, "Command Status")
    Status = 0x0 (0, "Success")
    Num_HCI_Command_Packets = 0x1 (1)
    Command_Opcode = 0x401 (1025, "Inquiry")

11:32.459 com13 <e Inquiry Result                          Num_Responses: 0x1
    HCI Event
    com13@115200
    [02 0F]: 01 66 55 44 33 22 11 01 00 00 00 00 00 C5 06
    event = 0x2 (2, "Inquiry Result")
    Num_Responses = 0x1 (1)
    BD_ADDR[0] = "112233445566"
    Page_Scan_Repetition_Mode[0] = 0x1 (1, "R1")
    Page_Scan_Period_Mode[0] = 0x0 (0, "P0")
    Page_Scan_Mode[0] = 0x0 (0, "Mandatory Page Scan Mode")
    Class_of_Device[0] = 0x0 (0)
    Clock_Offset[0] = 0x6C5 (1733)

...
...

11:42.387 com13 <e Inquiry Complete
    HCI Event
    com13@115200
    [01 01]: 00
    event = 0x1 (1, "Inquiry Complete")
    Status = 0x0 (0, "Success")
```

2.1.2 HCI_Reset

Command (Core Spec. v. 4.2 and above)	
HCI_Reset	OGF:0x03, OCF:0x0003
Parameters	
None	
Return	
Status	Size: 1 octet
	0x00 – Success 0x01 to 0xFF – Fail

Example:

```

59:04.975 com13 c> Reset
    HCI Command
    com13@115200
    [03 0C 00]
    opcode = 0xC03 (3075, "Reset")

59:04.980 com13 <c Reset
    HCI Command Complete Event
    com13@115200
    [0E 04]: 01 03 0C 00
    event = 0xE (14, "Command Complete")
    Num_HCI_Command_Packets = 0x1 (1)
    Command_Opcode = 0xC03 (3075, "Reset")
    Status = 0x0 (0, "Success")

```

2.1.3 HCI_Set_Event_Filter

Command (Core Spec. v. 4.2 and above)	
HCI_Set_Event_Filter	OGF:0x03, OCF:0x0005
Parameters	
Filter_Type	Size: 1 octet 0x00 – Clear All Filters (check SIG spec. for details) 0x01 – Inquiry Result 0x02 – Connection Setup
Filter_Condition_Type	Size: 1 octet <i>Type = Inquiry Result</i> 0x00 – Report Responses from All Devices 0x01 – Specific Class of Device 0x02 – Specific BD_ADDR <i>Type = Connection Setup</i> 0x00 – Allow Connections from All Devices 0x01 – Specific Class of Device 0x02 – Specific BD_ADDR
Condition	Size: 1, 6 or 7 octets <i>Type = Inquiry Result, Condition = Class of Device</i> Class_Of_Device Size: 3 octets 0x000000 – All Devices 0xXXXXXX – Specific Interest Class_Of_Device_Mask Size: 3 octets 0xXXXXXX – Bit Mask <i>Type = Inquiry Result, Condition = BD_ADDR</i> BD_ADDR Size: 6 octets <i>Type = Connection Setup, Condition = All Devices</i> Auto_Accept_Flag Size: 1 octet 0x01 – Do NOT auto accept 0x02 – Do auto accept w/o role switch 0x03 – Do auto accept with role switch <i>Type = Connection Setup, Condition = Class of Device</i> Class_Of_Device Size: 3 octets 0x000000 – All Devices 0xXXXXXX – Specific Interest Class_Of_Device_Mask Size: 3 octets 0xXXXXXX – Bit Mask Auto_Accept_Flag Size: 1 octet 0x01 – Do NOT auto accept 0x02 – Do auto accept w/o role switch 0x03 – Do auto accept with role switch <i>Type = Connection Setup, Condition = BD_ADDR</i> BD_ADDR Size: 6 octets Auto_Accept_Flag Size: 1 octet 0x01 – Do NOT auto accept

		0x02 – Do auto accept w/o role switch 0x03 – Do auto accept with role switch
Return		
Status	0x00 – Success 0x01 to 0xFF – Fail	Size: 1 octet

Example:

```

07:19.547 com13 c> Set_Event_Filter                               Filter_Type: Connection Setup
    HCI Command
    com13@115200
    [05 0C 03]: 02 00 02
    opcode = 0xC05 (3077, "Set_Event_Filter")
    Filter_Type = 0x2 (2, "Connection Setup")
    Connection_Setup_Filter_Condition_Type = 0x0 (0, "Allow Connections from all devices")
    Auto_Accept_Flag = 0x2 (2, "Do Auto accept the connection with role switch disabled")

07:19.551 com13 <c Set_Event_Filter
    HCI Command Complete Event
    com13@115200
    [0E 04]: 01 05 0C 00
    event = 0xE (14, "Command Complete")
    Num_HCI_Command_Packets = 0x1 (1)
    Command_Opcode = 0xC05 (3077, "Set_Event_Filter")
    Status = 0x0 (0, "Success")

```


2.1.4 HCI_Write_Scan_Enable

Command (Core Spec. v. 4.2 and above)	
HCI_Write_Scan_Enable	OGF:0x03, OCF:0x001A
Parameters	
Scan_Enable	Size: 1 octet 0x00 – No Scans enabled 0x01 – Inquiry Scan enabled, Page Scan disabled 0x02 – Inquiry Scan disabled, Page Scan enabled 0x03 – Inquiry Scan enabled, Page Scan enabled
Return	
Status	Size: 1 octet 0x00 – Success 0x01 to 0xFF – Fail

Example:

<pre> 12:17.557 com13 c> Write_Scan_Enable Scan_Enable: Inquiry and Page Scan enabled HCI Command com13@115200 [1A 0C 01]: 03 opcode = 0xC1A (3098, "Write_Scan_Enable") Scan_Enable = 0x3 (3, "Inquiry and Page Scan enabled") 12:17.560 com13 <c Write_Scan_Enable HCI Command Complete Event com13@115200 [0E 04]: 01 1A 0C 00 event = 0xE (14, "Command Complete") Num_HCI_Command_Packets = 0x1 (1) Command_Opcode = 0xC1A (3098, "Write_Scan_Enable") Status = 0x0 (0, "Success") </pre>
--

2.1.5 HCI_Enable_Device_Under_Test_Mode

Command (Core Spec. v. 4.2 and above)	
HCI_Enable_Device_Under_Test_Mode	OGF:0x06, OCF:0x0003
Parameters	
None	
Return	
Status	Size: 1 octet 0x00 – Success 0x01 to 0xFF – Fail

Example:

```
03:47.425 com13 >c Enable_Device_Under_Test_Mode
    HCI Command
    com13@115200
    [03 18 00]
    opcode = 0x1803 (6147, "Enable_Device_Under_Test_Mode")

03:47.430 com13 <c Enable_Device_Under_Test_Mode
    HCI Command Complete Event
    com13@115200
    [0E 04]: 01 03 18 00
    event = 0xE (14, "Command Complete")
    Num_HCI_Command_Packets = 0x1 (1)
    Command_Opcode = 0x1803 (6147, "Enable_Device_Under_Test_Mode")
    Status = 0x0 (0, "Success")
```

2.1.6 HCI_LE_Receiver_Test

Command (Core Spec. v. 4.2 and above)	
HCI_LE_Receiver_Test [v1]	OGF:0x08, OCF:0x001D
Parameters	
RX_Channel	Size: 1 octet N = (Frequency - 2402) / 2 Range – 0x00 (i.e. 2402 MHz) to 0x27 (i.e. 2480 MHz)
Return	
Status	Size: 1 octet 0x00 – Success 0x01 to 0xFF – Fail

Command (Core Spec. v. 5.0 and above)	
HCI_LE_Receiver_Test [v2]	OGF:0x08, OCF:0x0033
Parameters	
RX_Channel	Size: 1 octet N = (Frequency - 2402) / 2 Range – 0x00 (i.e. 2402 MHz) to 0x27 (i.e. 2480 MHz)
PHY	Size: 1 octet 0x01 – LE 1M PHY 0x02 – LE 2M PHY 0x03 – LE Coded PHY
Modulation_Index	Size: 1 octet 0x01 – Transmitter will have a standard modulation index 0x02 – Transmitter will have a stable modulation index
Return	
Status	Size: 1 octet 0x00 – Success 0x01 to 0xFF – Fail

Command (Core Spec. v. 5.1 and above)	
HCI_LE_Receiver_Test [v3]	OGF:0x08, OCF:0x004F
Parameters	
RX_Channel	Size: 1 octet N = (Frequency - 2402) / 2 Range – 0x00 (i.e. 2402 MHz) to 0x27 (i.e. 2480 MHz)
PHY	Size: 1 octet 0x01 – LE 1M PHY 0x02 – LE 2M PHY 0x03 – LE Coded PHY
Modulation_Index	Size: 1 octet 0x01 – Transmitter will have a standard modulation index 0x02 – Transmitter will have a stable modulation index
Expected_CTE_Length	Size: 1 octet

	0x00 – No Constant Tone Extension expected 0x02 to 0x14 – Expected length in 8us units	
Expected_CTE_Type	0x00 – AoA Constant Tone Extension 0x01 – AoD Constant Tone Extension with 1us slot 0x02 – AoD Constant Tone Extension with 2us slot	Size: 1 octet
Slot_Durations	0x01 – Switching and sampling slots are 1us each 0x02 – Switching and sampling slots are 2us each	Size: 1 octet
Switching_Pattern_Length	0x02 to 0x4B – the number of Antenna IDs in the pattern	Size: 1 octet
Antenna_IDs[i]	0xXX ... 0xXX – List of Antenna IDs in the pattern	Size: Length_of_Switching_Pattern * 1 octet
Return		
Status	0x00 – Success 0x01 to 0xFF – Fail	Size: 1 octet

Example: [Core Spec. v. 5.0](#) and above

```

15:30.159 com13 c> LE_Enhanced_Receiver_Test          RX_Channel: 0x0
    HCI Command
    com13@115200
    [33 20 03]: 00 01 00
    opcode = 0x2033 (8243, "LE_Enhanced_Receiver_Test")
    RX_Channel = 0x0 (0, (F = 2402 + [k * 2 MHz]))
    PHY = 0x1 (1, "Receiver set to receive data at 1Ms/s")
    Modulation_Index = 0x0 (0, "Assume Transmitter will have a standard modulation index")

15:30.163 com13 <c LE_Enhanced_Receiver_Test
    HCI Command Complete Event
    com13@115200
    [0E 04]: 01 33 20 00
    event = 0xE (14, "Command Complete")
    Num_HCI_Command_Packets = 0x1 (1)
    Command_Opcode = 0x2033 (8243, "LE_Enhanced_Receiver_Test")
    Status = 0x0 (0, "Success")

```

2.1.7 HCI_LE_Transmitter_Test

Command (Core Spec. v. 4.2 and above)	
HCI_LE_Transmitter_Test [v1]	OGF:0x08, OCF:0x001E
Parameters	
TX_Channel	Size: 1 octet N = (Frequency - 2402) / 2 Range – 0x00 (i.e. 2402 MHz) to 0x27 (i.e. 2480 MHz)
Test_Data_Length	Size: 1 octet 0x00 to 0xFF – length in bytes of payload in each packet
Packet_Payload_Pattern	Size: 1 octet 0x00 – PRBS9 sequence 0x01 – repeated `11110000` 0x02 – repeated `10101010` 0x03 – PRBS15 sequence 0x04 – repeated `11111111` 0x05 – repeated `00000000` 0x06 – repeated `00001111` 0x07 – repeated `01010101`
Return	
Status	Size: 1 octet 0x00 – Success 0x01 to 0xFF – Fail

Command (Core Spec. v. 5.0 and above)	
HCI_LE_Transmitter_Test [v2]	OGF:0x08, OCF:0x0034
Parameters	
TX_Channel	Size: 1 octet N = (Frequency - 2402) / 2 Range – 0x00 (i.e. 2402 MHz) to 0x27 (i.e. 2480 MHz)
Test_Data_Length	Size: 1 octet 0x00 to 0xFF – length in bytes of payload in each packet
Packet_Payload_Pattern	Size: 1 octet 0x00 – PRBS9 sequence 0x01 – repeated `11110000` 0x02 – repeated `10101010` 0x03 – PRBS15 sequence 0x04 – repeated `11111111` 0x05 – repeated `00000000` 0x06 – repeated `00001111` 0x07 – repeated `01010101`
PHY	Size: 1 octet 0x01 – LE 1M PHY 0x02 – LE 2M PHY 0x03 – LE Coded PHY with S=8 data coding 0x04 – LE Coded PHY with S=2 data coding

Return	
Status	Size: 1 octet 0x00 – Success 0x01 to 0xFF – Fail

Command (Core Spec. v. 5.1 and above)	
HCI_LE_Transmitter_Test [v3]	OGF:0x08, OCF:0x0050
Parameters	
TX_Channel	Size: 1 octet N = (Frequency - 2402) / 2 Range – 0x00 (i.e. 2402 MHz) to 0x27 (i.e. 2480 MHz)
Test_Data_Length	Size: 1 octet 0x00 to 0xFF – length in bytes of payload in each packet
Packet_Payload_Pattern	Size: 1 octet 0x00 – PRBS9 sequence 0x01 – repeated `11110000` 0x02 – repeated `10101010` 0x03 – PRBS15 sequence 0x04 – repeated `11111111` 0x05 – repeated `00000000` 0x06 – repeated `00001111` 0x07 – repeated `01010101`
PHY	Size: 1 octet 0x01 – LE 1M PHY 0x02 – LE 2M PHY 0x03 – LE Coded PHY with S=8 data coding 0x04 – LE Coded PHY with S=2 data coding
CTE_Length	Size: 1 octet 0x00 – Do NOT transmit a Constant Tone Extension 0x02 to 0x14 – Length of the CTE in 8us units
CTE_Type	Size: 1 octet 0x00 – AoA Constant Tone Extension 0x01 – AoD Constant Tone Extension with 1us slot 0x02 – AoD Constant Tone Extension with 2us slot
Switching_Pattern_Length	Size: 1 octet 0x02 to 0x4B – the number of Antenna IDs in the pattern
Antenna_IDs[i]	Size: Length_of_Switching_Pattern * 1 octet 0xXX ... 0xXX – List of Antenna IDs in the pattern
Return	
Status	Size: 1 octet 0x00 – Success 0x01 to 0xFF – Fail

Command (Core Spec. v. 5.2 and above)	
HCI_LE_Transmitter_Test [v4]	OGF:0x08, OCF:0x007B
Parameters	

TX_Channel	N = (Frequency - 2402) / 2 Range – 0x00 (i.e. 2402 MHz) to 0x27 (i.e. 2480 MHz)	Size: 1 octet
Test_Data_Length	0x00 to 0xFF – length in bytes of payload in each packet	Size: 1 octet
Packet_Payload_Pattern	0x00 – PRBS9 sequence 0x01 – repeated `11110000` 0x02 – repeated `10101010` 0x03 – PRBS15 sequence 0x04 – repeated `11111111` 0x05 – repeated `00000000` 0x06 – repeated `00001111` 0x07 – repeated `01010101`	Size: 1 octet
PHY	0x01 – LE 1M PHY 0x02 – LE 2M PHY 0x03 – LE Coded PHY with S=8 data coding 0x04 – LE Coded PHY with S=2 data coding	Size: 1 octet
CTE_Length	0x00 – Do NOT transmit a Constant Tone Extension 0x02 to 0x14 – Length of the CTE in 8us units	Size: 1 octet
CTE_Type	0x00 – AoA Constant Tone Extension 0x01 – AoD Constant Tone Extension with 1us slot 0x02 – AoD Constant Tone Extension with 2us slot	Size: 1 octet
Switching_Pattern_Length	0x02 to 0x4B – the number of Antenna IDs in the pattern	Size: 1 octet
Antenna_IDs[i]	0xXX ... 0xXX – List of Antenna IDs in the pattern	Size: Length_of_Switching_Pattern * 1 octet
Transmit_Power_Level	0xXX – Approximate transmit power, -127 to +20 dBm 0x7E – Minimum transmit power 0x7F – Maximum transmit power	Size: 1 octet
Return		
Status	0x00 – Success 0x01 to 0xFF – Fail	Size: 1 octet

Example: Core Spec. v. 5.0 and above

```
10:32.062 com13 c> LE_Enhanced_Transmitter_Test          TX_Channel: 0x0
      HCI Command
      com13@115200
      [34 20 04]: 00 25 00 01
      opcode = 0x2034 (8244, "LE_Enhanced_Transmitter_Test")
      TX_Channel = 0x0 (0, (F = 2402 + [k * 2 MHz]))
      Length_of_Test_Data = 0x25 (37)
      Packet_Payload = 0x0 (0, "Pseudo-Random bit sequence 9")
      PHY = 0x1 (1, "Transmitter set to transmit data at 1Ms/s")

10:32.081 com13 <c LE_Enhanced_Transmitter_Test
      HCI Command Complete Event
      com13@115200
      [0E 04]: 01 34 20 00
      event = 0xE (14, "Command Complete")
      Num_HCI_Command_Packets = 0x1 (1)
      Command_Opcode = 0x2034 (8244, "LE_Enhanced_Transmitter_Test")
      Status = 0x0 (0, "Success")
```


2.1.8 HCI_LE_Test_End

Command (Core Spec. v. 4.2 and above)	
HCI_LE_Test_End	OGF:0x08, OCF:0x001F
Parameters	
None	
Return	
Status	Size: 1 octet 0x00 – Success 0x01 to 0xFF – Fail
Num_Packets	Size: 2 octets 0xXXXX – Numbers of packets received

Example:

```

13:00.679 com13 c> LE_Test_End
    HCI Command
    com13@115200
    [1F 20 00]
    opcode = 0x201F (8223, "LE_Test_End")

13:00.683 com13 <c LE_Test_End                               Num_Of_Packets_Received: 0xA0D7
    HCI Command Complete Event
    com13@115200
    [0E 06]: 01 1F 20 00 D7 A0
    event = 0xE (14, "Command Complete")
    Num_HCI_Command_Packets = 0x1 (1)
    Command_Opcode = 0x201F (8223, "LE_Test_End")
    Status = 0x0 (0, "Success")
    Num_Of_Packets_Received = 0xA0D7 (41175)

```

2.2 Cypress Vendor Specific HCI Commands

2.2.1 Set_Tx_Carrier_Frequency_ARM

Vendor Specific Command	
Set_Tx_Carrier_Frequency_ARM	OGF:0x3F, OCF:0x0014
Parameters	
Carrier_Enable	Size: 1 octet 0x00 – Carrier On 0x01 – Carrier Off
Carrier_Frequency (encoded)	Size: 1 octet N = (Frequency - 2400) Range – 0x02 (i.e. 2402 MHz) to 0x50 (i.e. 2480 MHz)
Modulation_Mode	Size: 1 octet 0x00 – Un-modulated 0x01 – PRBS9 sequence 0x02 – PRBS15 sequence 0x03 – repeated `00000000` 0x04 – repeated `11111111` 0x05 – incrementing symbols
Modulation_Type	Size: 1 octet 0x00 – GFSK (1Mb/s) 0x01 – QPSK (2Mb/s) 0x02 – 8DPSK (3Mb/s)
Transmit_Power	Size: 1 octet 0x00 – 0 dBm 0x01 – -4 dBm 0x02 – -8 dBm 0x03 – -12 dBm 0x04 – -16 dBm 0x05 – -20 dBm 0x06 – -24 dBm 0x07 – -28 dBm 0x08 – Specify power in dBm 0x09 – Specify power table index Note: To enable maximum output power, set the last 3 parameters as below <i>Transmit_Power</i> = 0x09 <i>Transmit_Power_dBm</i> = 0x00 <i>Transmit_Power_Table_Index</i> = 0x00
Transmit_Power_dBm	Size: 1 octet When <i>Transmit_Power</i> = 0x08, specify output power in dBm.
Transmit_Power_Table_Index	Size: 1 octet When <i>Transmit_Power</i> = 0x09, specify output power table index.

Return	
Status	Size: 1 octet 0x00 – Success 0x01 to 0xFF – Fail

Example:

```

23:10.488 com13 >c Set_Tx_Carrier_Frequency_ARM          Carrier_Enable: Carrier on
          HCI Command
          com13@115200
          [14 FC 07]: 00 02 01 00 09 00 00
          opcode = 0xFC14 (64532, "Set_Tx_Carrier_Frequency_ARM")
          Carrier_Enable = 0x0 (0, "Carrier on")
          Carrier_Frequency_Encoded = 0x2 (2)
          Carrier_Frequency = 0x962 (2402, MHz)
          Mode = 0x1 (1, "PRBS9")
          Modulation Type = 0x0 (0, "GFSK")
          Transmit_Power = 0x9 (9, "Specify Power Table index")
          Transmit_Power_Table_Index = 0x0 (0)

23:10.494 com13 <c Set_Tx_Carrier_Frequency_ARM
          HCI Command Complete Event
          com13@115200
          [0E 04]: 01 14 FC 00
          event = 0xE (14, "Command Complete")
          Num_HCI_Command_Packets = 0x1 (1)
          Command_Opcode = 0xFC14 (64532, "Set_Tx_Carrier_Frequency_ARM")
          Status = 0x0 (0, "Success")

```

2.2.2 Tx_Test

Vendor Specific Command	
Tx_Test	OGF:0x3F, OCF:0x0051
Parameters	
BD_ADDR	Size: 6 octets Local Bluetooth Device Address (little endian format)
Hopping_Mode	Size: 1 octet 0x00 – All Channels 0x01 – Single Channel 0x02 – Fixed Pattern
TX_Channel	Size: 1 octet When <i>Hopping_Mode</i> = `Single Channel`, N = (Frequency - 2402) Range – 0x00 (i.e. 2402 MHz) to 0x4E (i.e. 2480 MHz)
Modulation_Mode	Size: 1 octet 0x01 – repeated `00000000` 0x02 – repeated `11111111` 0x03 – repeated `10101010` 0x04 – PRBS9 sequence 0x09 – repeated `11110000`
Logical_Channel	Size: 1 octet 0x00 – ACL Enhanced Data Rate 0x01 – ACL Basic Data Rate 0x02 – eSCO Enhanced Data Rate 0x03 – eSCO Basic Data Rate 0x04 – SCO Basic Data Rate Note: When <i>Hopping_Mode</i> = `Fixed Pattern`, the only valid <i>Logical_Channel</i> is ACL Basic Data Rate.
Baseband_Packet_Type	Size: 1 octet 0x00 – NULL 0x01 – POLL 0x02 – FHS 0x03 – DM1 0x04 – DH1 / 2-DH1 0x05 – HV1 0x06 – HV2 / 2-EV3 0x07 – HV3 / EV3 / 3-EV3 0x08 – DV / 3-DH1 0x09 – AUX1 / PS 0x0A – DM3 / 2-DH3 0x0B – DH3 / 3-DH3 0x0C – EV4 / 2-EV5 0x0D – EV5 / 3-EV5 0x0E – DM5 / 2-DH5 0x0F – DH5 / 3-DH5

	Note: When <i>Hopping_Mode</i> = `Fixed Pattern`, the only valid <i>Baseband_Packet_Type</i> is DH1 / 2-DH1.
Baseband_Packet_Length	<p style="text-align: right;">Size: 2 octets</p> <p>0xXXXX – Length in bytes (little endian format). 0x0000 – Firmware will use its maximum length of each selected <i>Baseband_Packet_Type</i>.</p> <p>Note: To get highest duty cycle, use below setting in each packet type – DH1 – 27 DH3 – 183 DH5 – 339 2-DH1 – 54 2-DH3 – 367 2-DH5 – 679 3-DH1 – 83 3-DH3 – 552 3-DH5 – 1021</p>
Transmit_Power	<p style="text-align: right;">Size: 1 octet</p> <p>0x00 – 0 dBm 0x01 – -4 dBm 0x02 – -8 dBm 0x03 – -12 dBm 0x04 – -16 dBm 0x05 – -20 dBm 0x06 – -24 dBm 0x07 – -28 dBm 0x08 – Specify power in dBm 0x09 – Specify power table index</p> <p>Note: To enable maximum output power, set the last 3 parameters as below <i>Transmit_Power</i> = 0x09 <i>Transmit_Power_dBm</i> = 0x00 <i>Transmit_Power_Table_Index</i> = 0x00</p>
Transmit_Power_dBm	<p style="text-align: right;">Size: 1 octet</p> <p>When <i>Transmit_Power</i> = 0x08, specify output power in range of -127 to +128. Example – 0xFC (-4dBm), 0xFB (-5dBm), 0xFA (-6dBm), ...</p>
Transmit_Power_Table_Index	<p style="text-align: right;">Size: 1 octet</p> <p>When <i>Transmit_Power</i> = 0x09, specify output power table index.</p>
Return	
Status	<p style="text-align: right;">Size: 1 octet</p> <p>0x00 – Success 0x01 to 0xFF – Fail</p>

Example:

```
38:00.000 com13 c> Tx_Test                               Local_Device_BD_ADDR: 112233445566
    HCI Command
    com13@115200
    [51 FC 10]: 66 55 44 33 22 11 01 00 04 01 0F 00 00 09 00 00
    opcode = 0xFC51 (64593, "Tx_Test")
    Local_Device_BD_ADDR = "112233445566"
    Hopping_Mode = 0x1 (1, "Single frequency")
    Frequency = 0x0 (0, "2402 MHz")
    Modulation_Type = 0x4 (4, "PRBS9 Pattern")
    Logical_Channel = 0x1 (1, "ACL Basic")
    BB_Packet_Type = 0xF (15, "DH5 / 3-DH5")
    BB_Packet_Length = 0x0 (0, Firmware will limit len to max for BB_Packet_Type)
    Tx_Power_Level = 0x9 (9, "Specify Power Table index")
    Transmit_Power_Table_Index = 0x0 (0)

38:00.005 com13 <c Tx_Test
    HCI Command Complete Event
    com13@115200
    [0E 04]: 01 51 FC 00
    event = 0xE (14, "Command Complete")
    Num_HCI_Command_Packets = 0x1 (1)
    Command_Opcode = 0xFC51 (64593, "Tx_Test")
    Status = 0x0 (0, "Success")
```

2.2.3 Rx_Test

Vendor Specific Command	
Rx_Test	OGF:0x3F, OCF:0x0052
Parameters	
BD_ADDR	Size: 6 octets Remote "the side runs Tx_Test" Bluetooth Device Address (little endian format)
Report_Period	Size: 2 octets Time duration in milliseconds (little endian format). Example – `0xE8 0x03` means 1000 milliseconds (1000=0x03e8).
RX_Channel	Size: 1 octet When <i>Hopping_Mode</i> =`Single Channel` on peer Tx_Test, N = (Frequency - 2402) Range – 0x00 (i.e. 2402 MHz) to 0x4E (i.e. 2480 MHz) When <i>Hopping_Mode</i> =`Fixed Pattern` on peer Tx_Test, N = 0xF0 The Fixed Pattern hopping mode will cause the Rx_Test to attempt synchronization with a transmitter which is transmitting the fixed pattern.
Modulation_Mode	Size: 1 octet 0x01 – repeated `00000000` 0x02 – repeated `11111111` 0x03 – repeated `10101010` 0x04 – PRBS9 sequence 0x09 – repeated `11110000`
Logical_Channel	Size: 1 octet 0x00 – ACL Enhanced Data Rate 0x01 – ACL Basic Data Rate 0x02 – eSCO Enhanced Data Rate 0x03 – eSCO Basic Data Rate 0x04 – SCO Basic Data Rate Note: When <i>RX_Channel</i> = 0xF0 (`Fixed Pattern`), the only valid <i>Logical_Channel</i> is ACL Basic Data Rate.
Baseband_Packet_Type	Size: 1 octet 0x03 – DM1 0x04 – DH1 / 2-DH1 0x05 – HV1 0x06 – HV2 / 2-EV3 0x07 – HV3 / EV3 / 3-EV3 0x08 – DV / 3-DH1 0x09 – AUX1 0x0A – DM3 / 2-DH3 0x0B – DH3 / 3-DH3

	0x0C – EV4 / 2-EV5 0x0D – EV5 / 3-EV5 0x0E – DM5 / 2-DH5 0x0F – DH5 / 3-DH5 Note: When <i>RX_Channel</i> = 0xF0 (‘Fixed Pattern’), the only valid <i>Baseband_Packet_Type</i> is DH1 / 2-DH1.
Baseband_Packet_Length	Size: 2 octets 0xXXXX – Length in bytes (little endian format). 0x0000 – Firmware will assume its maximum length of each selected <i>Baseband_Packet_Type</i> .
Return	
Status	Size: 1 octet 0x00 – Success 0x01 to 0xFF – Fail

Example: Ran Rx_Test on com13; Started Tx_Test on com5; then Received Rx_Test statistics update on com13

```

48:57.890 com13 c> Rx_Test                               Remote_Device_BD_ADDR: 112233445566
    HCI Command
    com13@115200
    [52 FC 0E]: 66 55 44 33 22 11 E8 03 00 04 01 0F 00 00
    opcode = 0xFC52 (64594, "Rx_Test")
    Remote_Device_BD_ADDR = "112233445566"
    Report_Period = 0x3E8 (1000, milliseconds)
    Frequency = 0x0 (0, "2402 MHz")
    Modulation_Type = 0x4 (4, "PRBS9 pattern")
    Logical_Channel = 0x1 (1, "ACL Basic")
    BB_Packet_Type = 0xF (15, "DH5 / 3-DH5")
    BB_Packet_Length = 0x0 (0, Firmware will limit len to max for BB_Packet_Type)

48:57.902 com13 <c Rx_Test
    HCI Command Complete Event
    com13@115200
    [0E 04]: 01 52 FC 00
    event = 0xE (14, "Command Complete")
    Num_HCI_Command_Packets = 0x1 (1)
    Command_Opcode = 0xFC52 (64594, "Rx_Test")
    Status = 0x0 (0, "Success")

49:17.419 com5 c> Tx_Test                               Local_Device_BD_ADDR: 112233445566
    HCI Command
    com5@115200nfc
    [51 FC 10]: 66 55 44 33 22 11 01 00 04 01 0F 00 00 09 00 00
    opcode = 0xFC51 (64593, "Tx_Test")
    
```



```

Local_Device_BD_ADDR = "112233445566"
Hopping_Mode = 0x1 (1, "Single frequency")
Frequency = 0x0 (0, "2402 MHz")
Modulation_Type = 0x4 (4, "PRBS9 Pattern")
Logical_Channel = 0x1 (1, "ACL Basic")
BB_Packet_Type = 0xF (15, "DH5 / 3-DH5")
BB_Packet_Length = 0x0 (0, Firmware will limit len to max for BB_Packet_Type)
Tx_Power_Level = 0x9 (9, "Specify Power Table index")
Transmit_Power_Table_Index = 0x0 (0)

```

```

49:17.437 com5 <c Tx_Test
    HCI Command Complete Event
    com5@115200nfc
    [0E 04]: 01 51 FC 00
    event = 0xE (14, "Command Complete")
    Num_HCI_Command_Packets = 0x1 (1)
    Command_Opcode = 0xFC51 (64593, "Tx_Test")
    Status = 0x0 (0, "Success")

```

```

49:18.429 com13 <e Vendor Specific          Event_Sub_Code: Connectionless Rx Test Statistics
    HCI Event
    com13@115200
    [FF 21]:
    07 00 00 00 00 00 00 00 00 00 0B 01 00 00 0B 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
    event = 0xFF (255, "Vendor Specific")
    Event_Sub_Code = 0x7 (7, "Connectionless Rx Test Statistics")
    Sync_Timeout_Count = 0x0 (0)
    HEC_Error_Count = 0x0 (0)
    Total_Received_Packets = 0x10B (267)
    Good_Packets = 0x10B (267)
    CRC_Error_Packets = 0x0 (0)
    Total_Received_Bits = 0x0 (0)
    Good_Bits = 0x0 (0)
    Error_Bits = 0x0 (0)

```

```

49:19.430 com13 <e Vendor Specific          Event_Sub_Code: Connectionless Rx Test Statistics
    HCI Event
    com13@115200
    [FF 21]:
    07 00 00 00 00 00 00 00 00 00 16 02 00 00 16 02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
    event = 0xFF (255, "Vendor Specific")
    Event_Sub_Code = 0x7 (7, "Connectionless Rx Test Statistics")

```


3 Frequently Used Test Cases

When starting a new test case, the HCI_Reset shall always be the first HCI command sent to the Bluetooth Controller.

3.1 DUT Test Mode

The sequence of HCI commands to enable Bluetooth DUT mode on the Bluetooth Controller:

1. [HCI_Reset](#)
2. [HCI_Set_Event_Filter](#)
 - Filter_Type = 0x02¹, "Connection Setup"*
 - Filter_Condition_Type = 0x00², "Allow connections from all devices"*
 - Condition = 0x02³, "Auto accept the connection w/o role switch"*
3. [HCI_Write_Scan_Enable](#)
 - Scan_Enable = 0x03⁴, "Inquiry Scan enabled, Page Scan enabled"*
4. [HCI_Enable_Device_Under_Test_Mode](#)

Command Samples:

NOTICE – *In our command sample table, each command parameter byte has been labelled with a superscript number as a reference index to the corresponding annotation described in the command sequence paragraph.*

Command	Raw Bytes: OpCode1 OpCode2 Length Parameter(s)
HCI_Reset	0x03 0x0C 0x00
HCI_Set_Event_Filter	0x05 0x0C 0x03 0x02 ¹ 0x00 ² 0x02 ³
HCI_Write_Scan_Enable	0x1A 0x0C 0x01 0x03 ⁴
HCI_Enable_Device_Under_Test_Mode	0x03 0x18 0x00

Command	BlueZ Format: hcitool cmd OGF OCF Parameter(s)
HCI_Reset	hcitool -i hci0 cmd 0x03 0x003
HCI_Set_Event_Filter	hcitool -i hci0 cmd 0x03 0x005 0x02 ¹ 0x00 ² 0x02 ³
HCI_Write_Scan_Enable	hcitool -i hci0 cmd 0x03 0x01A 0x03 ⁴
HCI_Enable_Device_Under_Test_Mode	hcitool -i hci0 cmd 0x06 0x003

3.2 Inquiry Test

The sequence of HCI commands to start inquiry transmission on the Bluetooth Controller:

1. [HCI_Reset](#)
2. [HCI_Inquiry](#)

LAP = 0x9E8B33^{3,2,1}, "GIAC"

Inquiry_Length = 0x08⁴, "8 x 1.28 = 10.24 seconds"

Num_Responses = 0x00⁵, "Unlimited"

Command Samples:

Command	Raw Bytes: <i>OpCode1 OpCode2 Length Parameter(s)</i>
HCI_Reset	0x03 0x0C 0x00
HCI_Inquiry	0x01 0x04 0x05 0x33 ¹ 0x8B ² 0x9E ³ 0x08 ⁴ 0x00 ⁵

Command	BlueZ Format: <i>hcidtool cmd OGF OCF Parameter(s)</i>
HCI_Reset	hcidtool -i hci0 cmd 0x03 0x003
HCI_Inquiry	hcidtool -i hci0 cmd 0x01 0x001 0x33 ¹ 0x8B ² 0x9E ³ 0x08 ⁴ 0x00 ⁵

3.3 Fixed Frequency Continuous Waveform (CW) Transmission Test

The sequence of HCI commands to enable un-modulated CW transmission on the Bluetooth Controller:

1. [HCI_Reset](#)
2. [Set_Tx_Carrier_Frequency_ARM](#)

Carrier_Enable = 0x00¹, "Carrier On"

Carrier_Frequency =

Value	Frequency
0x02 ²	2402MHz
0x2A	2442MHz
0x50	2480MHz

Module_Mode = 0x00³, "Un-modulated"

Module_Type = 0x00⁴, N/A when un-modulated

Transmit_Power[†] = 0x09⁵

Transmit_Power_dBm[†] = 0x00⁶

Transmit_Power_Table_Index[†] = 0x00⁷

[†]Note: (0x09,0x00,0x00) combination sets maximum TX output

Command Samples:

Command	Raw Bytes: <i>OpCode1 OpCode2 Length Parameter(s)</i>
HCI_Reset	0x03 0x0C 0x00
Set_Tx_Carrier_Frequency_ARM	0x14 0xFC 0x07 0x00 ¹ 0x02 ² 0x00 ³ 0x00 ⁴ 0x09 ⁵ 0x00 ⁶ 0x00 ⁷

Command	BlueZ Format: <i>hcitool cmd OGF OCF Parameter(s)</i>
HCI_Reset	hcitool -i hci0 cmd 0x03 0x003
Set_Tx_Carrier_Frequency_ARM	hcitool -i hci0 cmd 0x3F 0x014 0x00 ¹ 0x02 ² 0x00 ³ 0x00 ⁴ 0x09 ⁵ 0x00 ⁶ 0x00 ⁷

3.4 Connectionless Transmitter Test

The sequence of HCI commands to enable modulated transmission with specific packet type and frequency on the Bluetooth Controller:

1. [HCI_Reset](#)
2. [Tx_Test](#)

BD_ADDR = 0x010203040506^{6,5,4,3,2,1} can be any value for connectionless TX only test

Hopping_Mode =

Value	Hopping
0x00	All Channels
0x01 ⁷	Fixed Single Channel

TX_Channel =

Value	Frequency
0x00 ⁸	2402MHz
0x28	2442MHz
0x4E	2480MHz

Module_Mode = 0x04⁹, "PBR59"

Logical_Channel and *Baseband_Packet_Type* =

<i>Logical_Channel</i>	<i>Baseband_Packet_Type</i>	"TX Packet"
0x01 ¹⁰	0x04 ¹¹	DH1
0x01	0x0B	DH3
0x01	0x0F	DH5
0x00	0x04	2-DH1
0x00	0x0A	2-DH3
0x00	0x0E	2-DH5
0x00	0x08	3-DH1
0x00	0x0B	3-DH3
0x00	0x0F	3-DH5

Baseband_Packet_Length = 0x0000^{13,12}, "Maximum length in each packet type"

Transmit_Power[†] = 0x09¹⁴

Transmit_Power_dBm[†] = 0x00¹⁵

Transmit_Power_Table_Index[†] = 0x00¹⁶

†Note: (0x09,0x00,0x00) combination sets maximum TX output

Command Samples:

Command	Raw Bytes: <i>OpCode1 OpCode2 Length Parameter(s)</i>
HCI_Reset	0x03 0x0C 0x00
Tx_Test (DH1@2402MHz)	0x51 0xFC 0x10 0x06 ¹ 0x05 ² 0x04 ³ 0x03 ⁴ 0x02 ⁵ 0x01 ⁶ 0x01 ⁷ 0x00 ⁸ 0x04 ⁹ 0x01 ¹⁰ 0x04 ¹¹ 0x00 ¹² 0x00 ¹³ 0x09 ¹⁴ 0x00 ¹⁵ 0x00 ¹⁶

Command	BlueZ Format: <i>hcitool cmd OGF OCF Parameter(s)</i>
HCI_Reset	hcitool -i hci0 cmd 0x03 0x003
Tx_Test (DH1@2402MHz)	hcitool -i hci0 cmd 0x3F 0x051 0x06 ¹ 0x05 ² 0x04 ³ 0x03 ⁴ 0x02 ⁵ 0x01 ⁶ 0x01 ⁷ 0x00 ⁸ 0x04 ⁹ 0x01 ¹⁰ 0x04 ¹¹ 0x00 ¹² 0x00 ¹³ 0x09 ¹⁴ 0x00 ¹⁵ 0x00 ¹⁶

3.5 Fixed Frequency Receiver Test

The Receiver Test requires two Cypress Bluetooth devices, one runs Tx_Test as a test transmitting source and the other runs Rx_Test as the test sink which composes reception statistics result. The sequence of HCI commands:

1. [HCI_Reset](#) @ both Test Source and Sink devices
2. [Rx_Test](#) @ Test Sink device

BD_ADDR = 0x112233445566^{6,5,4,3,2,1}, the device address of the TX device

Report_Period = 0x03E8^{3,7} (1000 ms)

RX_Channel =

Value	Frequency
0x00	2402MHz
0x28 ³	2442MHz
0x4E	2480MHz

Module_Mode = 0x04¹⁰, "PBR59"

Logical_Channel and *Baseband_Packet_Type* =

<i>Logical_Channel</i>	<i>Baseband_Packet_Type</i>	"TX Packet"
0x01	0x04	DH1
0x01	0x0B	DH3
0x01	0x0F	DH5
0x00	0x04	2-DH1
0x00	0x0A	2-DH3
0x00 ¹¹	0x0E ¹²	2-DH5
0x00	0x08	3-DH1
0x00	0x0B	3-DH3
0x00	0x0F	3-DH5

Baseband_Packet_Length = 0x0000^{14,13}, "Maximum length in each packet type"

3. [Tx_Test](#) @ Test Source device. **Note: Tx_Test command parameters should exactly match to the corresponding settings given in the Rx_Test command.**

BD_ADDR = 0x112233445566^{20,19,18,17,16,15}, the TX local device address

Hopping_Mode = 0x01²¹, must be "Fixed Single Channel"

TX_Channel = 0x28²², "2442MHz"

Module_Mode = 0x04²³, "PBR59"

Logical_Channel = 0x00²⁴, "ACL EDR"

Baseband_Packet_Type = 0x0E²⁵, "2-DH5"

Baseband_Packet_Length = 0x0000^{27,26}, "Maximum length in each packet type"

Transmit_Power[†] = 0x09²⁸

Transmit_Power_dBm[†] = 0x00²⁹

Transmit_Power_Table_Index[†] = 0x00³⁰

†Note: (0x09,0x00,0x00) combination sets maximum TX output

Command Samples:

Command (RX side)	Raw Bytes: <i>OpCode1 OpCode2 Length Parameter(s)</i>
-------------------	---

HCI_Reset	0x03 0x0C 0x00
Rx_Test (2-DH5@2442MHz)	0x52 0xFC 0x0E 0x66 ¹ 0x55 ² 0x44 ³ 0x33 ⁴ 0x22 ⁵ 0x11 ⁶ 0xE8 ⁷ 0x03 ⁸ 0x28 ⁹ 0x04 ¹⁰ 0x00 ¹¹ 0x0E ¹² 0x00 ¹³ 0x00 ¹⁴
(TX side)	
HCI_Reset	0x03 0x0C 0x00
Tx_Test (2-DH5@2442MHz)	0x51 0xFC 0x10 0x66 ¹⁵ 0x55 ¹⁶ 0x44 ¹⁷ 0x33 ¹⁸ 0x22 ¹⁹ 0x11 ²⁰ 0x01 ²¹ 0x28 ²² 0x04 ²³ 0x00 ²⁴ 0x0E ²⁵ 0x00 ²⁶ 0x00 ²⁷ 0x09 ²⁸ 0x00 ²⁹ 0x00 ³⁰
Command (RX side)	BlueZ Format: hcitool cmd <i>OGF OCF Parameter(s)</i>
HCI_Reset	hcitool -i hci0 cmd 0x03 0x003
Rx_Test (2-DH5@2442MHz)	hcitool -i hci0 cmd 0x3F 0x52 0x66 ¹ 0x55 ² 0x44 ³ 0x33 ⁴ 0x22 ⁵ 0x11 ⁶ 0xE8 ⁷ 0x03 ⁸ 0x28 ⁹ 0x04 ¹⁰ 0x00 ¹¹ 0x0E ¹² 0x00 ¹³ 0x00 ¹⁴
(TX side)	
HCI_Reset	hcitool -i hci0 cmd 0x03 0x003
Tx_Test (2-DH5@2442MHz)	hcitool -i hci0 cmd 0x3F 0x051 0x66 ¹⁵ 0x55 ¹⁶ 0x44 ¹⁷ 0x33 ¹⁸ 0x22 ¹⁹ 0x11 ²⁰ 0x01 ²¹ 0x28 ²² 0x04 ²³ 0x00 ²⁴ 0x0E ²⁵ 0x00 ²⁶ 0x00 ²⁷ 0x09 ²⁸ 0x00 ²⁹ 0x00 ³⁰

3.6 BLE Transmitter Test

The sequence of HCI commands to enable BLE transmission on the Bluetooth Controller:

1. [HCI_Reset](#)
2. [HCI_LE_Transmitter_Test](#)

[v1]

TX_Channel =

Value	Frequency
0x00	2402MHz
0x14	2442MHz
0x27 ¹	2480MHz

Test_Data_Length = 0x25², "37 bytes"

Packet_Payload_Pattern = 0x00³, "PRBS9"

3. To end the test, send [HCI_Reset](#) again.

Command Samples:

Command	Raw Bytes: <i>OpCode1 OpCode2 Length Parameter(s)</i>
HCI_Reset	0x03 0x0C 0x00
HCI_LE_Transmitter_Test [v1 ⁺] (@2480MHz)	0x1E ³ 0x20 0x03 0x27 ¹ 0x25 ² 0x00 ³

Command	BlueZ Format: <i>hcitool cmd OGF OCF Parameter(s)</i>
HCI_Reset	hcitool -i hci0 cmd 0x03 0x003
HCI_LE_Transmitter_Test [v1 ⁺] (@2480MHz)	hcitool -i hci0 cmd 0x08 0x01E ³ 0x27 ¹ 0x25 ² 0x00 ³

3.7 BLE Receiver Test

The sequence of HCI commands to enable BLE receiver on the Bluetooth Controller:

1. [HCI_Reset](#)
2. [HCI_LE_Receiver_Test](#)

[v1]

TX_Channel =

Value	Frequency
0x00	2402MHz
0x14	2442MHz
0x27 ¹	2480MHz

3. To end the test, send [HCI_LE_Test_End](#)

Command Samples:

Command	Raw Bytes: <i>OpCode1 OpCode2 Length Parameter(s)</i>
HCI_Reset	0x03 0x0C 0x00
HCI_LE_Receiver_Test [v1 ¹] (@2480MHz)	0x1D ¹ 0x20 0x01 0x27 ¹
HCI_LE_Test_End	0x1F 0x20 0x00

Command	BlueZ Format: <i>hcidtool cmd OGF OCF Parameter(s)</i>
HCI_Reset	hcidtool -i hci0 cmd 0x03 0x003
HCI_LE_Receiver_Test [v1 ¹] (@2480MHz)	hcidtool -i hci0 cmd 0x08 0x01D ¹ 0x27 ¹
HCI_LE_Test_End	hcidtool -i hci0 cmd 0x08 0x01F