BLE Regulation Test in Linux

Application Note  v1.0

INTRODUCTION

For legacy Bluetooth, you can set a Bluetooth module in test mode and control it using Bluetooth test equipment such as an Anritsu 8852B or R&S CBT Bluetooth tester. However, for BLE, there is no such test mode. You can only set TX power manually by HCI command for a specific channel, data length, and packet type.

LINUX SETUP

To set up your Linux system for the BLE regulation test, follow these steps:

1. Load the firmware to chipset.
   - For the Sterling-LWB or Sterling-LWB5, you must patch the firmware into the chipset prior to bring up the HCI interface.
   - Use the following command to load the firmware:
     ```
     $brcm_patchram_plus --patchram{path to .hcd file} --enable_hci --no2bytes --tosleep 1000 {path to /dev/ UART interface} &
     ```
   - For 60 series modules, the firmware is the same one of Wi-Fi firmware; once you load the Wi-Fi driver, the firmware is loaded already.

2. Open the HCI interface.

3. Use the `hciconfig` command to enable the HCI interface and to ensure that hci0 is in the list.
   ```
   $hciconfig hci0 up
   $hciconfig
   [root@imx6s-puck-ms5763:~] $ hciconfig
   hci0:   Type: BR/EDR  Bus: UART
           BD Address: 00:25:CA:08:4F:4A  ACL MTU: 1021:8  SCO MTU: 64:1
           UP RUNNING
           RX bytes:1385 acl:0 sco:0 events:75 errors:0
           TX bytes:1190 acl:0 sco:0 commands:75 errors:0
   ```

HCI COMMAND FOR A BLE TRANSMITTER TEST

To use the HCI command for a BLE transmitter test, follow these steps:

1. Use the hcitool command to reset the module. This HCI command is integrated in the BlueZ package.
   ```
   $hcitool cmd 0x03 0x03
   ```
   This results in the following HCI event:
   ```
   HCI Command: ogf 0x03, ocf 0x0003, plen 0
   HCI Event: 0x0e plen 4
   01 03 0C 00
   ```
2. Use the applicable HCI command to set the BLE transmitter test.

You must set the following parameters in this command: frequency index, data length, and packet payload type.

- **Frequency index** – \( k = 0 \sim 39 \)
  - Frequency 2402+2\( k \) (MHz)
- **Data length**
- **Packet payload type** – Payload length in the range of 0 to 37
  - 0x0: PRBS9
  - 0x1: 11110000
  - 0x2: 10101010
  - 0x3: PRBS15
  - 0x4: 11111111
  - 0x5: 00000000
  - 0x6: 00001111
  - 0x7: 01010101

HCI command format:

```bash
$hcitool cmd 0x08 0x1e Frequency_index Data_length Payload_type
```

Such as:

```bash
$hcitool cmd 0x08 0x1e 0x1 0x10 0x0
```

If you send the correct HCI command, the following HCI event displays:

- **HCI Command**: ogf 0x08, ocf 0x001e, plen 3
  - 01 10 00
- **HCI Event**: 0x0e plen 4
  - 01 1E 20 00

In the spectrum analyzer, you should have the following BLE signal (**Figure 1**).

![Figure 1: Spectrum analyzer - BLE signal](image-url)
3. Set the BLE test end command to stop BLE transmitter test.
   
   \$hcitool cmd 0x08 0x1f
   
   If you send the correct HCI command, the following HCI event displays:
   
   HCI Command: ogf 0x08, ocf 0x001f, plen 0
   HCI Event: 0x0e plen 6
   01 1F 20 00 00 00

**HCI COMMAND FOR BLE RECEIVER TEST**

To use the HCI command for a BLE receiver test, follow these steps:

1. Use the hcitool command to reset the module. This HCI command is integrated in the BlueZ package.
   
   \$hcitool cmd 0x03 0x03
   
   This results in the following HCI event:
   
   HCI Command: ogf 0x03, ocf 0x0003, plen 0
   HCI Event: 0x0e plen 4
   01 03 0C 00

2. Use the applicable HCI command to set the BLE receiver test.
   
   You must only set the frequency index parameter in this command.
   ▪ Frequency index: k= 0~39
   Frequency 2402+2k (MHz)
   HCI command format:
   \$hcitool cmd 0x08 0x1e Frequency_index
   
   Such as:
   \$hcitool cmd 0x08 0x1e 0x1
   
   If you send the correct HCI command, the following HCI event displays:
   
   HCI Command: ogf 0x03, ocf 0x0003, plen 0
   HCI Event: 0x0e plen 4
   01 03 0C 00

3. Set the BLE test end command to stop BLE receiver test.
   
   \$hcitool cmd 0x08 0x1f
   
   If you send the correct HCI command, the following HCI event displays:
   
   HCI Command: ogf 0x08, ocf 0x001f, plen 0
   HCI Event: 0x0e plen 6
   01 1F 20 00 00 00

**REVISION HISTORY**

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<th>Version</th>
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<tr>
<td>1.0</td>
<td>31 Jan 2018</td>
<td>Initial version</td>
<td>Miles Chung</td>
<td>Jonathan Kaye</td>
</tr>
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