Using the MT8852B to Test a *Bluetooth* Low Energy Device Controlled through a Proprietary Interface

BLE Overview

Bluetooth low energy (BLE) wireless technology is designed specifically for small, predominantly button-cell, battery-powered devices for which low power-consumption and low cost are the primary concerns. BLE devices are designed to work side-by-side with existing *Bluetooth* devices. They operate in the 2.4 GHz ISM band and offer data rates of 1 Mbit/sec over a range of 10 metres or more.

Scope of this Application Note

This Application Note explains how to perform low energy tests on a device (such as a fully assembled *Bluetooth* product) that does not provide access to an HCI or 2-Wire interface.

Note: Refer to Anritsu Application Note 13000-00323 for details of how to perform *Bluetooth* low energy tests on a device (such as a component module) controlled through an HCI or 2-Wire interface.

Two methods of testing are described in this Application Note:

- Running BLE tests using the MX885203A PC software supplied with option 27 (*Bluetooth* low energy).
- Running BLE tests using the MT8852B under GPIB control.

BLE Testing on the MT8852B

If an HCI interface is unavailable, the EUT must be initialized using the silicon vendor's control software running on a remote PC.

Testing of BLE devices on the MT8852B, MT8852B-040, MT8852B-041, or MT8852B-042 models requires option 27 and firmware version 4.16 or later. The MT8852B-043 is a dedicated low energy test set and does not require option 27 to perform low energy measurements.

Option 27 enables users to perform three transmitter and three receiver tests in full compliance the *Bluetooth* low energy specification.

Supported Transmitter Tests

- TRM-LE/CA/01(02)/C (Output Power)
- TRM-LE/CA/05/C (Modulation characteristics)
- TRM-LE/CA/06(07)/C (Carrier frequency offset and drift)

Supported Receiver Tests

- RCV-LE/CA/01(02)/C (Receiver sensitivity)
- RCV-LE/CA/06/C (Maximum input signal level)
- RCV-LE/CA/07/C (PER Report Integrity)

Method 1: Running BLE tests using the MX885203A PC software

Configuration

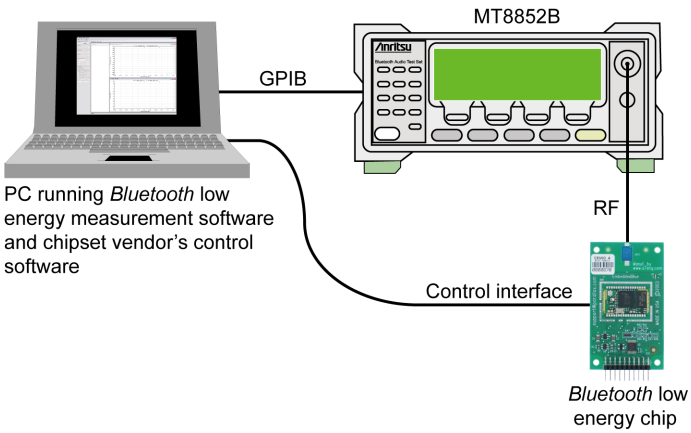

Figure 1. Testing using the MT885203A PC Software

1. Connect an RF cable between the antenna connector on the EUT and the "RF Port" on the front of the MT8852B.

2. Connect the GPIB cable from the rear of the MT8852B to the PC.

3. Connect the EUT control interface from the PC running the chipset vendor's control software to the EUT.

4. Turn on the MT8852B.

5. Launch the MX885203A *Bluetooth* low energy measurement software to display the main program window.

6. The program opens displaying the [Connection] tab for GPIB connection. Check that the default GPIB address (27) matches that of the instrument and click [Connect] to establish a remote connection.

7. Set "EUT Control" to “No Control” to denote that the EUT will be controlled using the vendor’s own control software.

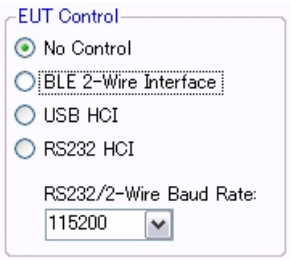

Figure 2. EUT Control Settings

Tx Testing

1. At the "EUT Tx Power" drop-down field, select the power level range at which data will be transmitted from the EUT.

2. At the "Trigger" drop-down entry field, select the trigger mechanism.

Note: “Trigger” should be set to “Internal RF” to enable stable packet capture and obtain a numeric display of measurement results.

3. Select the payload to match that transmitted by the EUT.

Note: Payload must be set to PRBS9 to run the output power measurement.

Note: Payload must be set to 10101010 to run the initial carrier and drift measurement.

Note: Payload must be set to 10101010 or 11110000 to run the modulation index measurement.

4. Select the Tx measurements to be performed by selecting the required check boxes.

5. Use the chipset vendor’s control software to initiate the transmission of low energy packets to the MT8852B in line with the settings made.

6. Click  (run once) or  (run continuously) to run tests. Test results display graphically and numerically as shown in the figure below.

If low energy tests are run as part of a script, the results display as a test report that can be saved and printed as required.

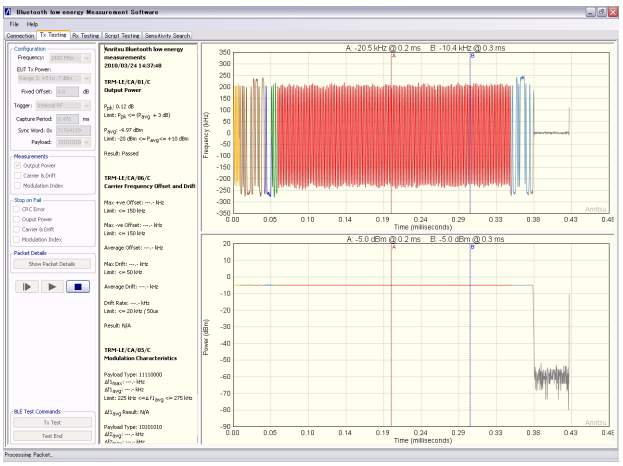

Figure 3. Tx Testing Results in Low Energy Measurement Software

Rx Testing

1. Click the [Rx Testing] tab.

2. At the "Frequency" drop-down field, select the frequency at which data will be transmitted to the EUT.

3. At the "Power Level" drop-down field, select the power level range at which data will be transmitted to the EUT.

4. Select the appropriate payload.

5. Set the Sync word. The defined sync word for a reference packet is 71764129. The sync word should be set to match the requirements of the EUT.

6. Set the spacing. The spacing setting defines the number of microseconds between the start of consecutive packets.

7. Specify the number of packets to be transmitted to the EUT.

8. Use the silicon vendor's control software to configure the EUT to receive low energy packets from the MT8852B.

9. Click  (run once) or  (run continuously) to transmit data.

10. Read the number of received packets using the silicon vendor's control software and calculate receiver sensitivity by making the calculation below.

PER % = 100 x (1 - (packets received / packets sent))

Note: Refer to the *MX885203A Operation Manual* (13000-00278) for full details of the option 27 low energy measurement software.

Method 2: Running BLE Tests using the MT8852B under GPIB control

Configuration

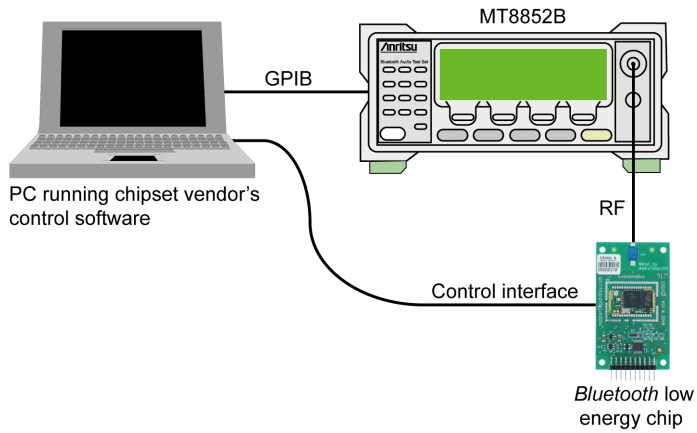

Figure 4. Testing over a GPIB Interface

1. Connect an RF cable between the antenna connector on the EUT and the "RF Port" on the front of the MT8852B.

2. Connect the GPIB cable from the rear of the MT8852B to the PC.

3. Connect the EUT control interface from the PC running the chipset vendor's software to the EUT.

4. Turn on the MT8852B.

Tx Testing

1. Use the silicon vendor's control software to configure the DUT to transmit BLE test packet with the required payload.

Note: Payload must be set to PRBS9 to run the output power measurement.

Note: Payload must be set to 10101010 to run the initial carrier and drift measurement.

Note: Payload must be set to 10101010 or 11110000 to run the modulation index measurement.

2. Use the RANGE command below to set the power range as required.

`SYSCFG<ws>CONFIG<,>RANGE<,><setting>`

The setting ranges are:

0 Auto ranging

1 +22 to +7 dBm

2 +9 to -3 dBm

3 +5 to -7 dBm

4 -4 to -16 dBm

5 -12 to -26 dBm

6 -24 to -35 dBm

3. Use the `CFGBLECAP` command below to configure the MT8852B to capture the BLE test packet on the required BLE channel:

`CFGBLECAP<ws><channel><,>RF`

The channel can be set within the range of 0 to 39.

4. Use the OPMD command below to set the MT8852B to script mode:

`OPMD<ws>SCRIPT`

5. Use the MEASBLECAP command below to configure the MT8852B to capture test packets (based on the trigger specified using the CFGBLECAP command) and make the BLE measurements:

`MEASBLECAP<ws><BLEmeas><,><MODType><,><syncword>`

When the packet is captured, the configured BLE Tx measurement is performed using the limit parameters set in the selected script.

<`BLEmeas`> can be set to LEOP, LEICD, or LEMI.

<`MODType`> is used only when BLEmeas is set to LEMI.

<`syncword`> is a 32 bit hexadecimal value (default: 71764129)

6. Wait for the test to complete by checking the CMP bit of the INS register.

7. When the test is complete, use the ORESULT command to request the test results:

`ORESULT<ws>TEST<,>0<,><test>`

<test> can be set to LEOP, LEICD, LEMI.

Rx Testing

1. Use the LESIGGEN command below to transmit low energy packets to the EUT:

`LESIGGEN<ws><syncword><,><pattern><,><spacing><,><channel><,><NumPkts><,><TxPwr><,><Dirty><,><AltCRC><,><state>`

<syncword>	32 bit hexadecimal value. (BLE default: 71764129)
<pattern>	10101010, 11110000, PRBS9
<spacing>	1µs steps, default is 625 for 625 us spacing (625 to 65535)
<channel>	*Bluetooth* low energy channels 0 to 39 (in MHz only)
<NumPkts>	0 = continuous
	1 - 65535 = Fixed number of packets to be sent
<TxPwr>	Transmitted power level 0.0 to -90.0
<Dirty>	ON or OFF

When ON, the packet generator uses the dirty table from the selected script LESS test.

<AltCrc> ON or OFF

When ON, packets are generated with alternate correct and incorrect CRC. The first packet transmitted has correct CRC.

<state> START, STOP

2. Use the silicon vendor's test control software to calculate receiver sensitivity by making the calculation below.

PER % = 100 x (1 - (packets received / packets sent))

Assistance

Support on Anritsu's range of *Bluetooth* products can be requested by sending an e-mail to bluetooth.support@anritsu.com.