![Texas Instruments logo]

CC2545EMK Quick Start Guide

Opening the Box and Running the *Packet Error Rate* Test Application

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1. Kit Contents
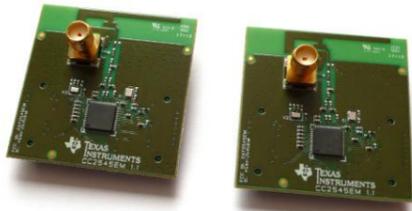
- 2 x CC2545 Evaluation Modules (EM)
- Documentation

The RF boards in this kit are FCC and IC certified and tested/complies with ETSI/R&TTE over temperature from 0 to +35°C. There is an on-board PCB antenna on the evaluation module.

Caution! The kit contains ESD sensitive components. Handle with care to prevent permanent damage.

2. Hardware Requirements

To run the example described in this Quick Start Guide, you need two CC2545EMs mounted on SmartRF05 Evaluation Boards (SmartRF05EB - Rev 1.8.1 or later). Two SmartRF05EBs are included in the CC2543-CC2544 Development Kit.

More information about the SmartRF05EB can be found in www.ti.com/lit/swru210.

The CC2545EM boards can also be plugged into a battery board (see www.ti.com/tool/soc-bb) for standalone operation.

3. Hardware Setup

Mount the CC2545EMs firmly on to connectors P5 and P6 on the SmartRF05EB.

Caution! To minimize risk of injury, avoid touching components during operation if symbolized as hot.

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4. Power Options

There are several ways of applying power to the SmartRF05EB.

- USB (5V)
- 2 x 1.5 V AA Alkaline Batteries
- External Power Supply (4-20V)

For the batteries, USB and external power supply via the DC jack, there are voltage regulators on the EB that will set the on-board voltage to 3.3 V.

Warning! To minimize risk of injury or property damage, never use rechargeable batteries to power the board. Always select a power source that is suitably rated for use with this EVM, **not exceeding 20 VDC, with a current output rating between 0 and 1500 mA. Note that there should only be one active power source at any one time.**

5. Power the Boards

Locate the power source header P11 just above the LCD on the EB. Connect pins 1 and 2 if you are using battery power. Connect pins 2 and 3 if you are using USB or an external power supply.
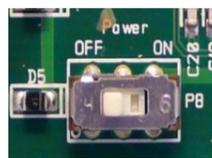

Once you have set P11, find switch P8 just next to the DC jack on the EB. To power up the boards, flip the switch from the "OFF" position to "ON".

Do not leave the EVM powered when unattended.

6. Start-up Screen

The CC2545EMs are pre-loaded with a Packet Error Rate (PER) test application. The LCD screens on the two SmartRF05EBs should display the messages below:

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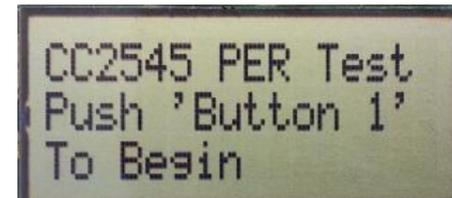
7. Choosing Mode

The application can be used between two CC2545EM's. There are two operating modes: "Remote" and "Master".

After button S1 is pushed at the start up screen, the mode selection screen (showed below) will appear. The Remote mode is shown by default. Press the joystick up and down to change between master and remote mode and press button S1 to confirm.
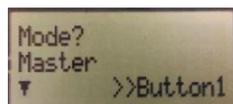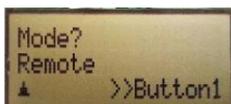
In the Remote mode all the parameters for the current PER test must be set up before the test begins (go to step 10).

8. Master Mode (Beacon)

In "Master" mode, the radio will repeatedly (once every 10 milliseconds) send out a "beacon" signal (250 kbps, GFSK modulation, 160 kHz deviation, 2402 MHz) and listen for a response from the remote device. The Green LED1 will blink continuously.
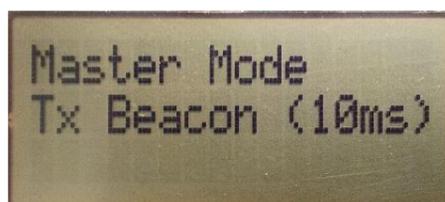
No more actions are needed from the user for the master device to work.

9. Master Mode (PER test)

Once the beacon is acknowledged by the "Remote", the actual PER test begins. The PER test configuration is included in the payload of the acknowledge packet. The Master device extracts this information and configures the radio parameters accordingly. During the PER test, packets are sent at a fixed repetition rate of 10 msec.
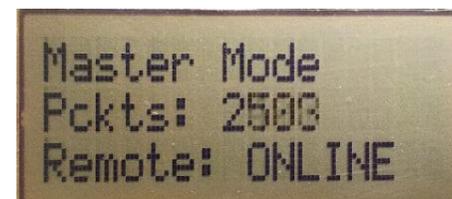
During the test the number of sent packets will be updated on the LCD display as well as the link status between the Master and Remote device.

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10. Frequency Selection

When the Remote mode is chosen, a series of settings must be configured to set up the link for the PER test. The frequency must be selected first (the selectable frequency range is from 2402 MHz to 2480 MHz). Move the joystick up or down to change the frequency (channel) and press S1 to confirm the choice.

11. Modulation Setup

There are 7 different modulation schemes available. The different bitrates are 250 Kbps, 500 Kbps, 1Mbps and 2 Mbps. MSK modulation is available for 250 Kbps and 500 Kbps data rate while GFSK has all of the mentioned above. Move the joystick up or down to change the scheme and press S1 to confirm the choice.
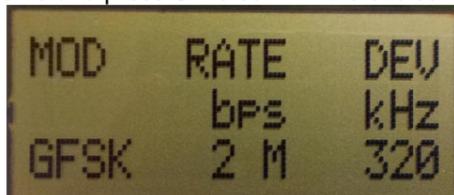
12. Packet Length

The packet length can be set to 10, 16, 32 or 63 bytes. Move the joystick up or down to change the packet length and press S1 to confirm the choice.
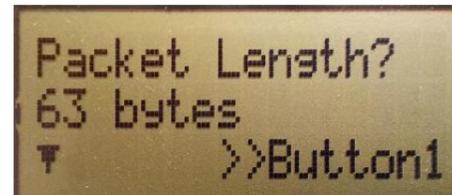
13. Number of Packets

The total number of packets to be sent for each run can be set to 100, 1000, 10000, 100000 and 1000000. Move the joystick up or down to change the number of packets and press S1 to confirm the choice.
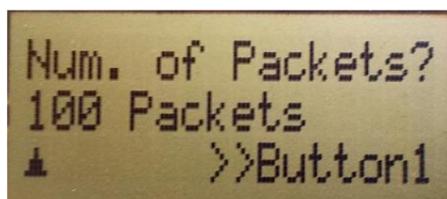
14. LNA Gain

For the 2Mbps data rates the AGC is enabled, while for lower rates the LNA gain must be set to HIGH or LOW. Move the joystick up or down to change between LOW and HIGH gain and press S1 to confirm the choice. After confirming the last choice the configuration packet will be sent to the Master device and the PER test begins.
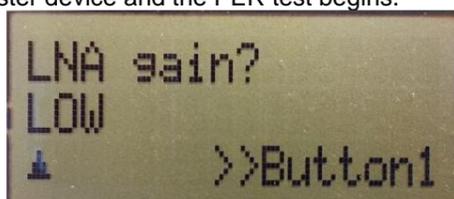
15. Results I

The packet error rate (PER) is presented as the sum of lost packets and packets with CRC error per thousand. The received signal strength indication (RSSI) is presented as a running average of the eight last samples. The number of received packets is continuously updated on the LCD display while the test is running.
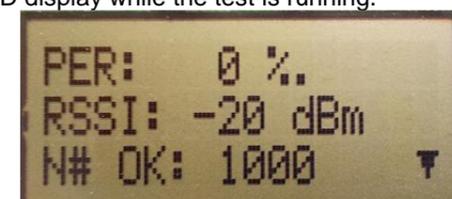
13. Results II

When the test is complete a small downward facing arrow will show in the bottom right of the LCD screen. This indicates that the test is complete and that there is an additional results screen "below". Move the joystick up and down to jump between the two test result screens. Press the S1 button to exit the test results.
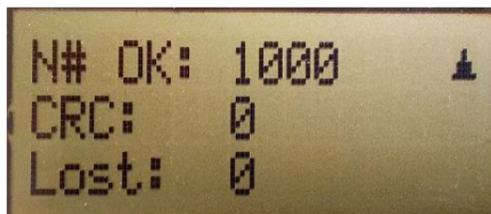
14. Repeat Test

After exiting the test results the user is presented with two choices. If "Restart Test" is chosen the same test as previously run will be repeated. The test can also be restarted at any time during the test by pushing the S1 button. Move the joystick up or down to switch between the two commands and press S1 to confirm the choice.
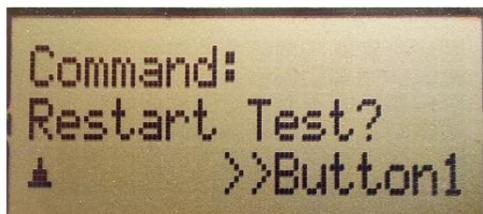
15. New Test

If "New Test" is chosen the application will return to setting up the configuration for a new test, starting at frequency selection. The test can also be stopped at any time during the test by pushing on the joystick like a button.
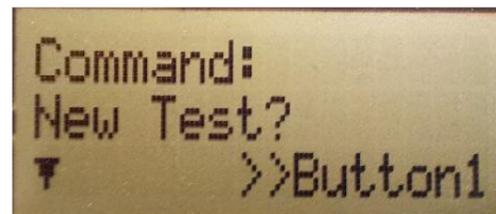
# Additional Tools and Links

SmartRF™ Studio

SmartRF Studio allows you to configure the radio, run RF performance tests, and run link tests between the two SmartRF05EBs.
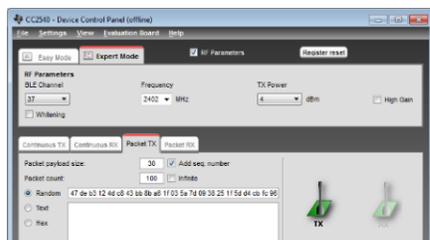
SmartRF Studio can be downloaded from www.ti.com/smartrfstudio

SmartRF Flash Programmer

Texas Instruments has a simple tool which can be used to program and flash the CC2545.
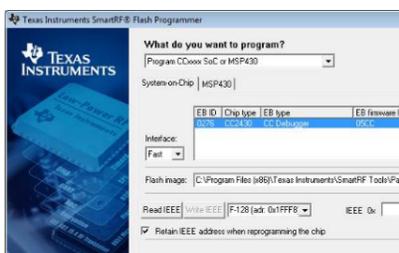
SmartRF Flash Programmer can be downloaded from www.ti.com/tool/flash-programmer

IAR Embedded Workbench

To develop software, program, and debug the CC2545, you should use IAR Embedded Workbench for 8051.
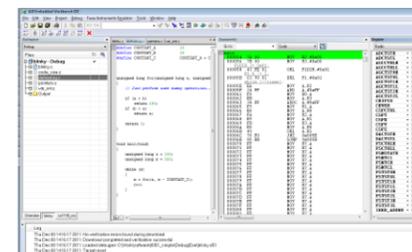
More information on IAR EW8051, including a free evaluation version download, can be found at www.iar.com/ew8051.

Useful Links

CC2545EMK Product Page:
www.ti.com/tool/cc2545emk

CC2543/44/45 Development Kit User's Guide:
www.ti.com/lit/swru318

CC2545 Product Page:
www.ti.com/product/cc2545

Useful Links

CC254x User's Guide:
http://www.ti.com/lit/swru283

For additional help, visit the TI E2E Forums:
www.ti.com/lprf-forum

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