

CC2543-CC2544 Development Kit Quick Start Guide

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

1. Kit Contents



- 2 x SmartRF05 Evaluation Boards (EB)
- 2 x CC2543 Evaluation Modules (EM)
- 2 x Pulse W1010 Antennas
- 1 x CC2544 USB Dongle
- Cables
- Documentation

The RF boards in this kit designed, but not certified, to comply with FCC/IC/ETSI requirements over temperature from 0 to +35°C. The antenna, W1010 from Pulse, is a ¼ wave dipole antenna with 2 dBi gain.



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

4. Power Options

There are several ways of applying power to the SmartRF05EB;

- USB (5V through USB plug)
- External power supply (see below)
- 2 x 1.5V AA non-rechargeable alkaline batteries

Voltage regulators on the SmartRF05EB will set the on-board voltage to 3.3V.

External Power Supply Requirements:

Nom Voltage: 4 to 20 VDC
Max Current: 1500 mA
Efficiency Level V

Warning! Never use rechargeable batteries to power the board. This can cause personal injury or damage to the board.

2. Hardware Requirements

To run the PER test described in this Quick Start Guide, you would need either two CC2543EMs mounted on SmartRF05 Evaluation Boards (SmartRF05EB - Rev 1.8.1 or later) or one single CC2543EM mounted on a SmartRF05EB and a CC2544 Dongle (powered through USB). Both the dongle and SmartRF05EB are included in the CC2543-CC2544DK.



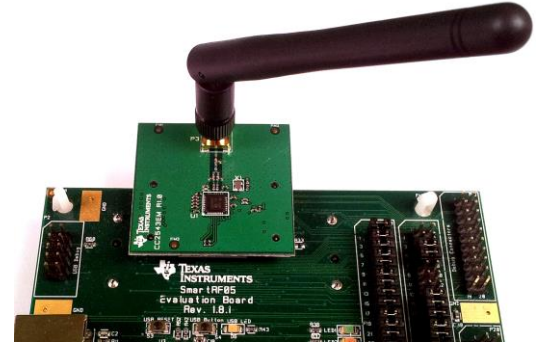
More information about the SmartRF05EB can be found in www.ti.com/lit/swru210.

The CC2543EM boards can also be plugged into a battery board (see www.ti.com/tool/soc-bb) for standalone operation.

The source code for the PER test can be downloaded from the CC2543-CC2544DK product page (www.ti.com/tool/cc2543-cc2544dk).

3. Hardware Setup

Connect the antenna to the SMA connector on the CC2543EM. Tighten the antenna's screw firmly on to the SMA connector. If not properly connected, you might get reduced RF performance.



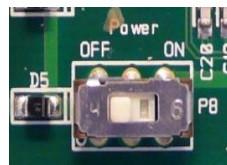
Next, mount the CC2543EMs firmly on to connectors P5 and P6 on the SmartRF05EB.

The CC2544 Dongle can be connected to any USB port to power the device.



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.

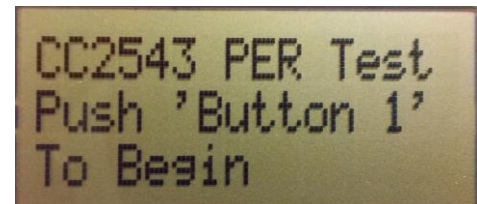


Once you have set P11, find switch P8 just next to the DC jack on the EB. To power up the boards, flip the switch from the "OFF" position to "ON".

Do not leave the EVM powered when unattended.

6. Start-up Screen

The CC2543EMs and the CC2544 Dongle will be pre-loaded with a Packet Error Rate (PER) test application. The LCD screens on the two SmartRF05EBs should display the messages below:

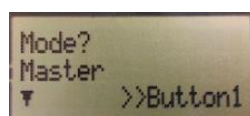
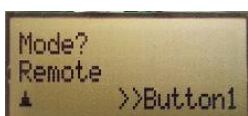


A green led (LED2 on CC2544Dongle, LED1 on SmartRF05EB) will be lit on power on. For a master device in beacon mode the led will blink at a slow pace.

7. Choosing Mode

The application can be used between two CC2543EM's or between a single CC2543EM and the CC2544 Dongle. 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. *The CC2544 Dongle is set to master by default as it is the only option for this device in this application.*



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)

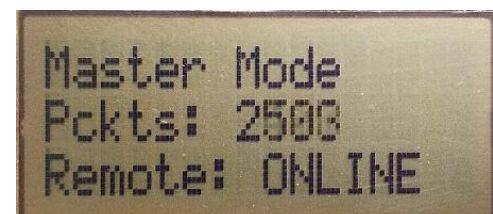
In "Master" mode, the radio will repeatedly (once every 10 milliseconds) send out a "beacon" signal (250 kbps, GFSK modulation, 160 kHz deviation, 2402 MHz) and listen for a response from the remote device. The Green LED1 will blink continuously.



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.

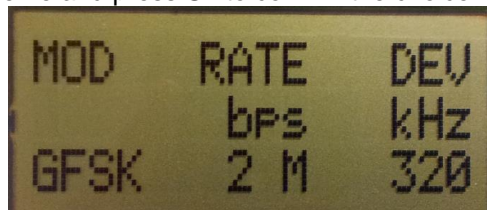
10. Frequency Selection

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.



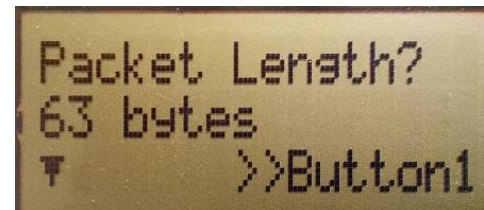
11. Modulation Setup

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.



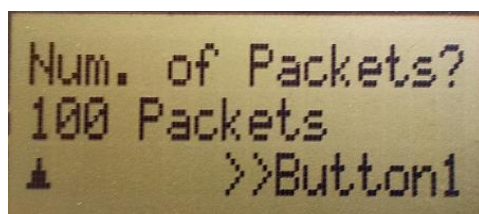
12. Packet Length

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.



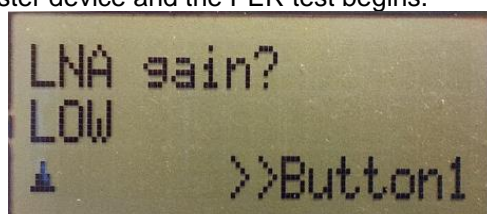
13. Number of Packets

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.



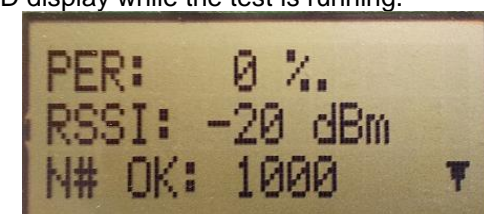
14. LNA Gain

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.



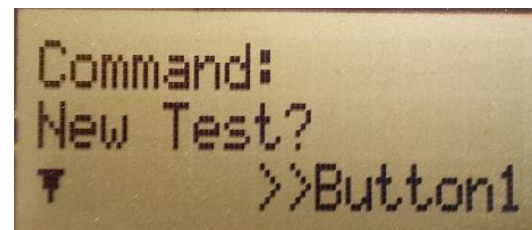
14. Repeat Test

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

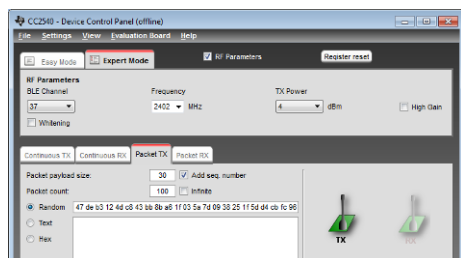
If "New Test" is chosen the application will return to setting up the configuration for a new test, starting at frequency selection. The test can also be stopped at any time during the test by pushing on the joystick like a button.



Additional Tools and Links

SmartRF™ Studio

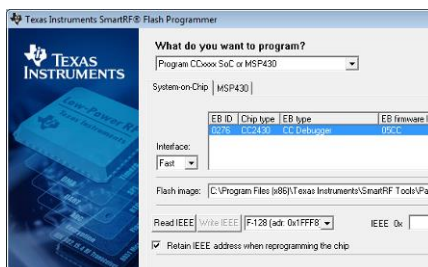
SmartRF Studio allows you to configure the radio, run RF performance tests, and run link tests between two SmartRF05EBs with CC543EMs.



SmartRF Studio can be downloaded from www.ti.com/smartrfstudio

SmartRF Flash Programmer

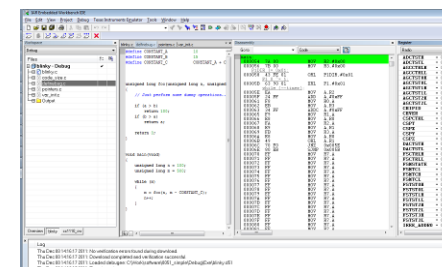
Texas Instruments has a simple tool which can be used to program the flash on the CC2543 and CC2544 devices.



SmartRF Flash Programmer can be downloaded from www.ti.com/tool/flash-programmer

IAR Embedded Workbench

To develop software, program, and debug the CC2543 and CC2544, 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

CC2543-CC2544DK Product Page:
www.ti.com/tool/cc2543-cc2544dk

CC2543-CC2544DK User's Guide:
www.ti.com/lit/swru318

CC2543/44/45 User's Guide:
www.ti.com/lit/swru283

More Useful Links

CC2543 Product Page:
www.ti.com/product/cc2543

CC2544 Product Page:
www.ti.com/product/cc2544

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

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 - 3.1 *United States*
 - 3.1.1 *Notice applicable to EVMs not FCC-Approved:*

This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.
 - 3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

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http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page

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1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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