

CC2533EMK Quick Start Guide

1. Kit Contents



2 x CC2533EM with PCB antennas
 2 x Pulse W1010 2.4 GHz antennas
 Documentation

The RF boards in this kit are FCC and IC certified and tested to comply with ETSI/R&TTE standards over temperature from 0 to +35°C. The antenna, W1010 from Pulse, is a ¼ wave dipole antenna with 2 dBi gain.

FCC/IC Regulatory Compliance
 FCC Part 15 Class A Compliant
 IC ICES-003 Class A Compliant

2. Plug EM into SmartRF05EB



In order to run the pre-programmed packet error rate test on the device, you need 2 SmartRF05 Evaluation Boards. The SmartRF05EB is included in the CC2533 Development Kit **Error! Reference source not found.**

Note that you DO NOT need the SMA antenna, as the PCB antenna is used by default.

3. Power Options

There are several ways of applying power to the SmartRF05EB;

- USB (5V through USB plug)
- External Power Supply (requirements 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 Supply¹ Requirements:
 Nom Voltage: 4 to 20 VDC
 Max Current: 1500 mA
 Efficiency Level V

Warning! To minimize risk of personal injury or property damage, never use rechargeable batteries to power the board.

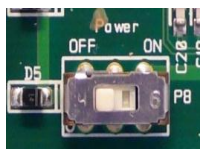
4. Select Power Source

Locate the power source header P11 just above the LCD on the SmartRF05EB



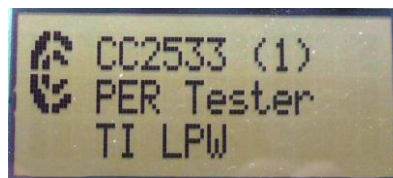
Connect pins 1 and 2 if you are using batteries to power the board. Connect pins 2 and 3 if you are using USB or external power supply.

Once you have set P11, find switch P8 just next to the DC jack on the SmartRF05EB.



To power on the board, flip the switch from "OFF" to "ON".

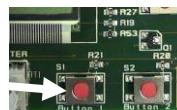
4. Packet Error Rate (PER)



When power is applied to the SmartRF05EB, the preprogrammed PER test on the CC2533 will start running.

The LCD will display the screen as shown in the picture above. The number in the parentheses is the revision of the CC2533.

Press Button 1 to continue.



5. Select Channel

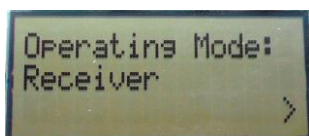


Select one of the 16 IEEE 802.15.4 channels, with channel number from 11 to 26 (2405-2480 MHz, 5 MHz channel spacing). Select the same channel for both boards.

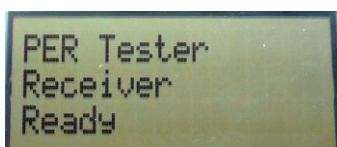
The channel number is increased by moving the joystick in any direction.

Press Button 1 to confirm the selection.

6 Set up the Receiver

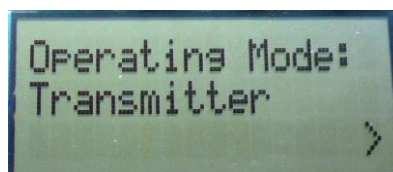


Set one of the boards to operate as receiver. Use the joystick to select mode. Confirm by pressing Button 1.



The receiver will now wait for packets from the transmitter.

7. Set up the Transmitter



Set the other board to operate as transmitter. Use the joystick to select mode. Confirm the selection by pressing Button 1.

On the transmitter node, additional parameters have to be set. On the next screen, select the TX output power (signal strength). Use the joystick to select between -3 dBm, 0 dBm, 4.5 dBm or 7 dBm. Confirm the selection with Button 1.

8. TX: Packets and Packet Rate



Next, select burst size (number of packets to send) by using the joystick, either 1000, 10K, 100K or 1M packets. Confirm the selection with Button 1.

After selecting burst size, select packet rate; 100, 50, 20 or 10 packet per second. Confirm the selection with Button 1.

¹ When using an external power supply, make sure it meets the listed requirements in addition to complying with applicable regional product regulatory and safety certification requirements such as UL, CSA, VDE, CCC, and PSE.

9. TX: Start PER Test



The transmitter is now configured for the PER test. The PER test is started and stopped by moving the joystick (in any direction). The transmitter will display the number of packets sent during the PER test.

After stopping the test, it will start from the beginning if the test is restarted.

10. RX: Observe PER

The PER test receiver will display the PER value (number of lost and erroneous packets divided by the number of packets sent, displayed as a fraction of 1000).



The receiver will also display the number of received packets and an average RSSI value based on the last 32 packets.

By pressing button 1, all counters on the receiver will be reset and the receiver will restart the PER calculations.

11. SmartRF Studio

After running the PER test, the next recommended step is to install SmartRF Studio and to connect the evaluation board to the PC.



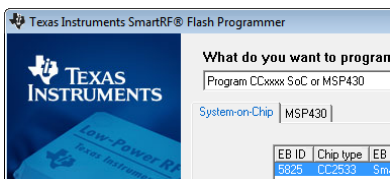
When installing SmartRF Studio, you will also install the USB drivers required for Studio and other tools to communicate with the radio and the SmartRF05EB board.

SmartRF Studio can be used for RF testing and evaluation of CC2533

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

12. Flash Programmer

Texas Instruments has a simple tool which can be used to program the flash on the CC2533.



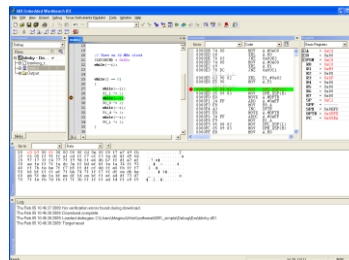
The Flash Programmer application, available on the kit web page [2], can be used to program Intel HEX files, read the contents of flash and several other operations.

Programming of a CC2533 can be done with a SmartRF05EB or a CC Debugger.

Production programming tools are available from TI's developer network [4].

13. IAR Embedded Workbench

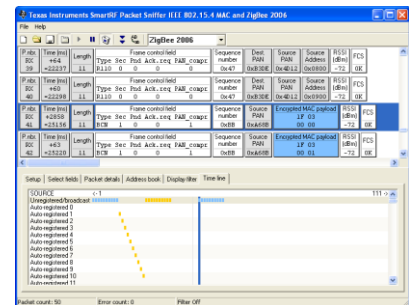
To develop software, program and debug the CC2533, you should use IAR Embedded Workbench for 8051.



A free, code size limited version can be downloaded from the web. See www.iar.com/ew8051.

14. Packet Sniffer

In order to debug RF protocols, it is possible to use TI's SmartRF Packet Sniffer.



You can use a CC2531 USB dongle or the SmartRF05EB with a CC2530EM to capture packets.

A. Available Software

CC2533 Software Examples

Source code for the PER test and other simple examples for the CC2533 [1].

RemoTI™ Network Protocol

TI's implementation of the ZigBee RF4CE standard: www.ti.com/remoti

TIMAC Software

TI's IEEE 802.15.4 medium-access-control stack: www.ti.com/timac

B. More information

On Texas Instruments' Low-Power RF web site you will find all our latest products, application and design notes, FAQ section, news and events updates, and much more. Just go to www.ti.com/lprf

The Low Power RF Online Community has forums, blogs and videos. Use the forums to find information, discuss and get help with your design. Join us at www.ti.com/lprf-forum

The TI LPRF eNewsletter keeps you up to date on e.g. new products, application notes, software and events. Sign up at www.ti.com/lprfnewsletter

C. References

[1] **CC2533 product web page**
<http://www.ti.com/product/cc2533>

[2] **CC2533EMK kit web page**
<http://www.ti.com/tool/cc2533emk>

[3] **CC2533DK kit web page**
<http://www.ti.com/tool/cc2533dk>

[4] **LPRF Developer's Network**
<http://focus.ti.com/general/docs/gencontent.tsp?contentId=98994>

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As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

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General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

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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

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

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.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

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

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-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.

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.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

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.

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.

【Important Notice for Users of EVMs for RF Products in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product 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 this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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