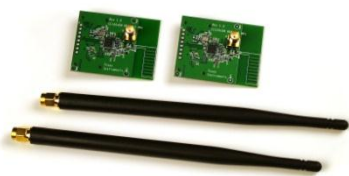# Texas Instruments

CC1200 Evaluation Module Kit Quick Start Guide

Opening the Box and Running the Packet Error Rate Test

1. Kit Contents

2 x CC1200 Evaluation Modules
2 x Antennas (type depending on frequency)

The EMK is an add-on kit to supplement the CC1200DK with evaluation boards supporting additional frequency bands. This document covers the CC1200EMK.

The 868-930 MHz RF boards in this kit are FCC and IC certified and both 868-930 MHz and 420-470 MHz RF boards are tested to comply with ETSI/R&TTE over temperatures from 0 to +35°C.

The W5017 whip antenna from Pulse has a gain of 2 dBi and the SPWH24433TI whip antenna from Pulse has a gain of 0 dBi.

Antenna types:
  868-930 MHz: Pulse W5017
  420-470 MHz: Pulse SPWH24433TI

2. How to use the Modules

The CC1200EM boards can be plugged into several development boards from Texas Instruments. Most notably, you can use the SmartRF Transceiver EB, which is included in the CC1200DK. This board lets you run a packet error rate (PER) test, control the device from SmartRF™ Studio and it can be used as a development platform.

It is also possible to connect the EM to other TI development boards with the appropriate connectors or to the basic "SoC Battery Board". The latter can be used as a carrier board for the EM to simplify the connection to other boards with a microcontroller. See:

http://www.ti.com/tool/soc-bb

This guide will show how to use the modules together with SmartRF Transceiver EB (TrxEB).

3. Plug the EM into the TrxEB

Insert a CC1200EM into the TrxEB. The connectors will only fit in one position so that the EM cannot be inserted the wrong way. Do not use excessive force on the EM. Remember to mount the antenna.

Caution! The kit contains ESD sensitive components. Handle with care to prevent permanent damage. To minimize risk of injury, avoid touching components during operation if symbolized as hot.

4. Select Board Mode

Use the switches S1 and S2 to select the operating mode of the board. For the sake of this quick start guide, please select "Enable" and "UART". This configuration will make it possible to communicate directly with the MSP430 over a virtual COM port on the PC.
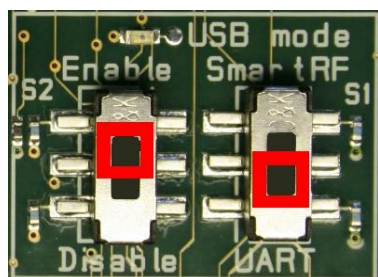

5. Power Options

There are several ways of applying power to the TrxEB.

- 2 x 1.5 V AA batteries
- USB
- External Power Supply
- MSP430 Debugger

For the batteries and USB, there are voltage regulators on the TrxEB that will set the on-board voltage to 3.3 V. The external power supply should set a voltage that does not exceed 3.3 V. By default, the MSP430 debugger supplies 3.0 V. **Note that there should only be one active power source at any one time.**

Warning! To minimize risk of personal injury or property damage, never use rechargeable batteries to power the board. Do not leave the EVM powered when unattended.

6. Select Power Source
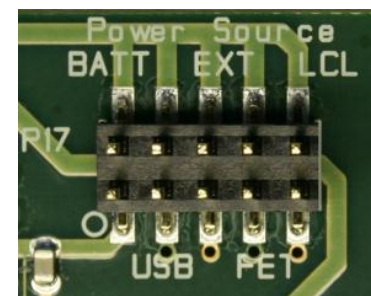
Depending on the power source, make sure you connect jumpers to the appropriate pins on the "Power Source" header. For instance, if you use batteries, use a jumper to short-circuit pin 1 and 2 on the header. The last jumper in the row (pin 9-10) should always be mounted, unless the MSP430 FET is used as the power source.
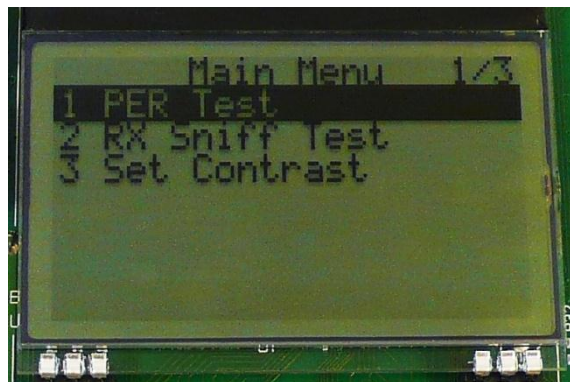
7. Welcome Screen

Turn on power with the Main Power switch. You should now see the Texas Instruments logo and a short description of the buttons on the LCD. Pushing any of the five buttons on the board will take you to the main menu.
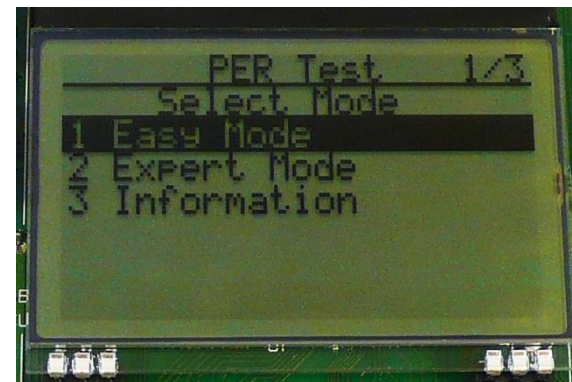
NB! If you don't see anything on the screen make sure the mode switches are in the correct positions (see step 4 above).

8. Packet Error Rate Test

Select the PER (Packet Error Rate) test by highlighting the selection using the up/down buttons. Confirm your selection by pressing Enter (right button).
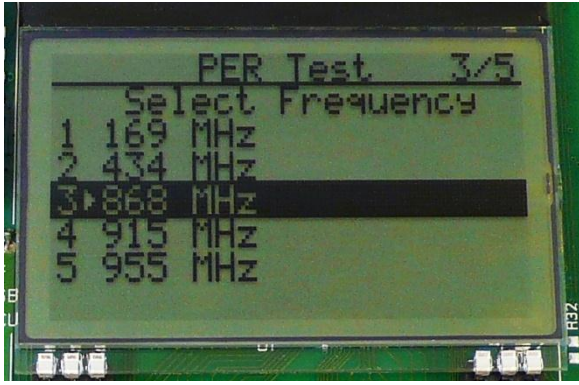
9. Select Test Mode

The PER test can be run is several modes. Easy Mode sets up a one-way test and uses default settings. This test is convenient for practical range testing.

The other test modes are described in the "**TrxEB RF PER Test Software Example User's Guide**".

To proceed, highlight "Easy Mode" and press Enter (right button).

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Web sites: www.ti.com/lprf
E2E Forum: www.ti.com/lprf-forum

Make sure to subscribe to the Low-Power RF Newsletter to receive information about updates to documentation, new product releases, and more. Sign up on the TI web pages.
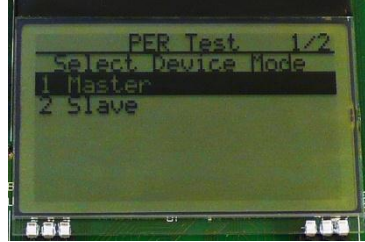
10. Select Frequency

Select which frequency to use for the test. Make sure that the evaluation modules you have match the selected frequency.

11. Select Mode

One of the boards must operate as the slave (transmitter) and the other as master (receiver). Select Slave on one board…

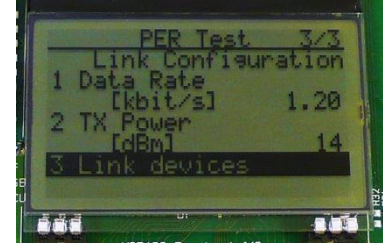

…and Master on the other board.

12. Establish Link

The slave node will now wait for a configuration package from the Master. The configuration contains the parameters used for the PER test.
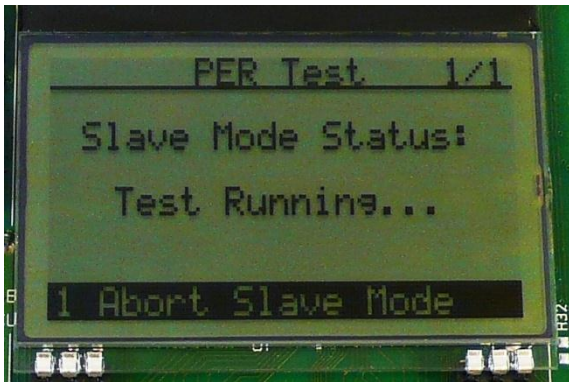

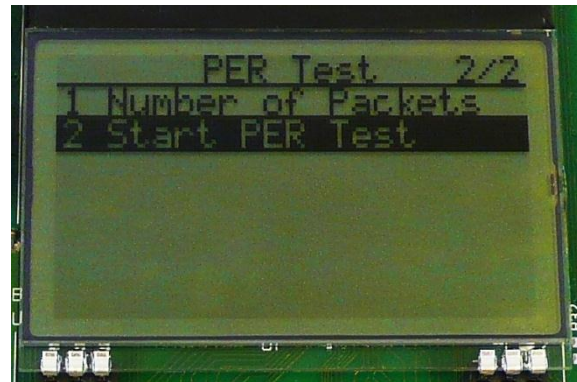The configuration package will be sent when you select "link devices" on the master node.

13. Link Established

When the initial linking has completed, the slave node will start the test by continuously transmitting packets to the master.


14. Start the Receiver (master)

On the master node, you can select the number of packets you want to receive in order to calculate the packet error.

When selecting "Start PER Test", the master (receiver) will begin to count the number of received packets and provide some statistics.

15. PER Test Results

The master will display a window that plots the received signal strength (RSSI) for each packet.

Press the "Up" button to go to the detailed statistical window.
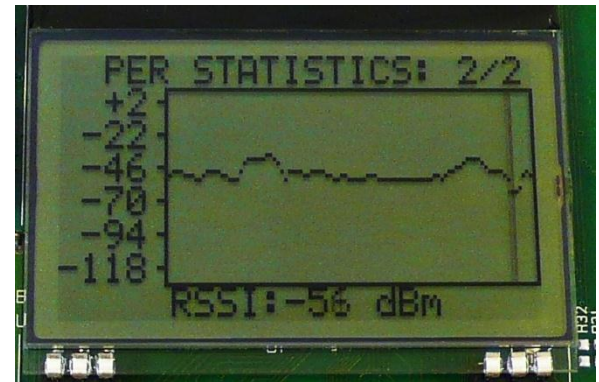
16. PER Test Results

The statistics window will show the error rate based on the number of lost or erroneous packets divided by the total number of packets that should have been received.
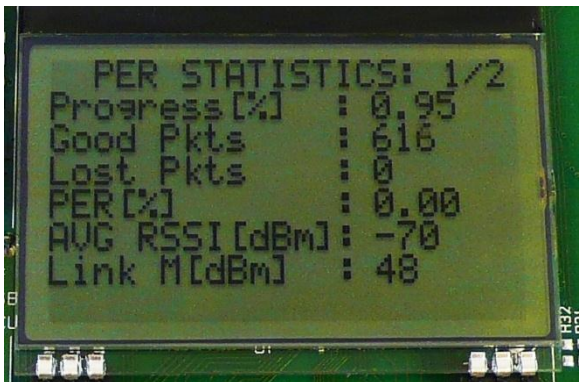
17. Troubleshooting

It you are experiencing problems with this test, please check the following:

- Nothing is shown in the display! Make sure the mode switches are in the correct positions (see step 4 above).
- Please visit the kit web page and check for updated SW and documentation. Updated SW can be downloaded to the device using IAR EW430 or SmartRF Flash Programmer.
- If you get poor PER results at short distances, try to move the transmitter and receiver further apart. The CC1200 receiver may be saturated if it is too close to the other CC1200 transmitting at full output power.

18. References

Please visit www.ti.com and

http://www.ti.com/tool/cc1200emk-420-470
http://www.ti.com/tool/cc1200emk-868-930

On the kit product page, you will find additional documentation, links to other related kits and devices, updated software examples and software tools like SmartRF Studio.

You will also find a lot of information on the TI E2E forum at http://e2e.ti.com

We hope that you will enjoy working with the CC1200 device.

SmartRF™ Studio

1. Download and Install
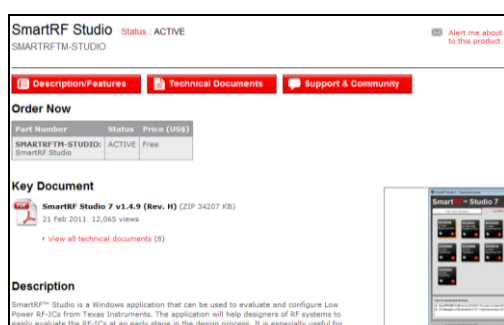
Before connecting SmartRF TrxEB to your PC, download and install SmartRF Studio from www.ti.com/smartrfstudio.

2. Launch SmartRF Studio
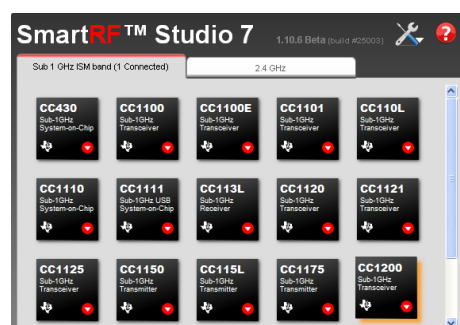
After installing the tool, connect the EB to the PC using the USB cable and start SmartRF Studio. Select the "Sub 1 GHz" tab and double click the highlighted CC1200 device icon.

3. Test the Radio
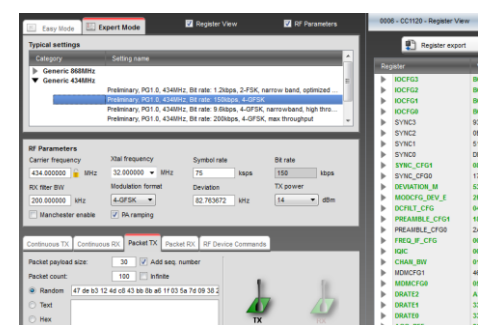
You can now configure the radio, run performance tests, export register settings and run link tests with another CC1200 on a SmartRF TrxEB connected to the PC.

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Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please visit www.ti.com/esh or contact TI.

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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.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

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.

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 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 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 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.

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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.

Texas Instruments Japan Limited
(address) 24-1, Nishi-Shinjuku 6 chome, Shinjuku-ku, Tokyo, Japan

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日本テキサス・インスツルメンツ株式会社

東京都新宿区西新宿6丁目24番1号

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http://www.tij.co.jp

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1.   You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.

2.   You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard.

3.   You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.

4.   You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

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