![Texas Instruments logo]

CC1101EMK 868/915 MHz Quick Start Guide

Opening the box and using the modules with SmartRF04EB

1. Kit Contents

2 x CC1101EM-868-915
2 x W5017 Pulse Antennas

The hardware in this kit is FCC/IC certified and complies with ETSI/R&TTE over temperature from 0 to +35°C.

The W5017 whip antenna from Pulse has a gain of 2 dBi.

2. How to use the modules

The CC1101EM boards can be plugged into several development boards from Texas Instruments. Most notably, you can use SmartRF04EB, which is included in the CC1101DK, or the SmartRF TrxEB (included in CC1120DK). These boards let you run a packet error rate (PER) test, control the device from SmartRF™ Studio and it can be used as a general purpose development platform.

The board can also be plugged into the MSP430 Experimenter's Boards, both the MSP-EXP430F4618 and MSP-EXP430F5438.

For prototyping with other microcontrollers, plug the EM into the "SoC Battery Board" (www.ti.com/tool/soc-bb).

This guide will show how to use the modules together with SmartRF04EB.

3. Plug EM into SmartRF04EB

Insert a CC1101EM (EM) with an antenna into the SmartRF04EB (EB). The connectors will only fit in one position, so that the EM cannot be inserted the wrong way.

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.

4a. Power: Battery

There are three different ways of applying power to the EB:

The first method involves using a battery, for instance a 9V battery (not included in the kit) connected to the connector on the bottom side of the board.

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.

4b. Power: DC/External
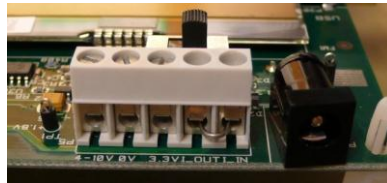
The second method applies DC power (max 10 V, min 4 V, 1500 mA) using the DC input jack (right in picture, centre is +, sleeve is ground), or by connecting a 4 - 10 V voltage source between the 4 - 10 V and 0 V terminals of the power connector (left in picture). It is also possible to connect a 3.3 V voltage source between the 3.3 V and 0 V terminals. The on-board voltage regulators will be bypassed if the 3.3 V input terminal is used.

4c. Power: USB
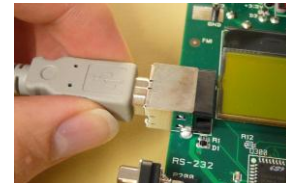
The EB can also be powered from the USB bus.

Note that there should only be one active power source at any one time

5. Set Power Switch

If a 3.3 V source is used as described in 4b above, the switch should be set to the leftmost position. For all other cases, the switch should be set to the rightmost position. This switch can be used to turn off the EB by switching it to the opposite position of that used to turn it on.

6. Packet Error Rate Test

When power is applied to the board, the PER test program will start. You should see the text shown above on the LCD display on both evaluation boards.

Press the button marked S1 (lower right corner) to continue.

7. Set Frequency Band

Select the desired frequency band of operation by using the joystick. The frequency should match the evaluation module and antenna you are using.

Note that the value shown in the display is also the selected value. There is no need to press a button to select or activate the selection.

8. Set Network ID
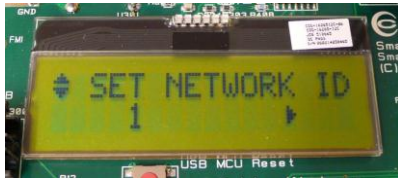
Push the joystick down to display the screen shown above. This lets you set the ID of the node in case you need to run several PER tests simultaneously and you have multiple development kits. Leave this set to 1 for now.

9. Packet Length
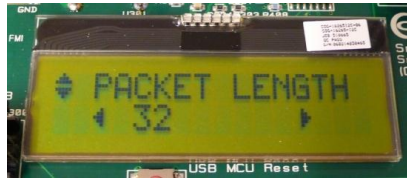
Push the joystick down to display the screen shown above. This lets you set the length of the packets to be transmitted. The packet length will affect the measured packet error rate. Push the joystick left or right to select the packet length you want to use.

10. Number of Packets

Push the joystick down to display the screen shown above. This lets you set the number of packets to be transmitted. Set this to the desired value using the joystick.

11. Select RF Settings

Push the joystick down to display the screen shown above. This lets you select preset RF configurations, including modulation and data rate
Preset 0: GFSK, 1.2 kBaud
Preset 1: GFSK, 10 kBaud
Preset 2: GFSK, 38.4 kBaud
Preset 3: GFSK, 250 kBaud

12. Select Mode

Push the joystick down to display the screen shown above. Use the joystick to select master mode. The EB you have configured now will be the master in the PER test.

13. Configure 2nd EB

Perform steps 3 through 11 on the second EB. Push the joystick down until you get the display shown above. Leave this EB in slave mode.

14. Start PER

Push the joystick down on both EBs, and the screen shown above is displayed. Push the joystick right on the slave EB first, and then push the joystick right on the master EB. The PER test will start when the two nodes have successfully connected.

Note that the PER test uses 10 dBm as default output power, so the EBs should be placed at least 1m apart to avoid saturation of the receiver.

15. Run PER Test

The uppermost line of the LCD will show the PER for packets transmitted from the slave to the master, while the second line will show the PER for packets transmitted from the master to the slave.

The PER test will end when the number of packets you selected in step 10 is reached or if 100 consecutive packets are lost.

16. References

Please visit www.ti.com and

www.ti.com/tool/cc1101emk433

www.ti.com/tool/cc1101emk868-915

Download the CC1101DK User Manual, the SmartRF™ Studio software, examples, as well as datasheets, reference designs and application notes.

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 CC1101 device.

SmartRF™ Studio

1. Download and Install

Before connecting the EB to your PC, download SmartRF™ Studio from www.ti.com/smartrfstudio. Install the program and follow the instructions in the wizard.
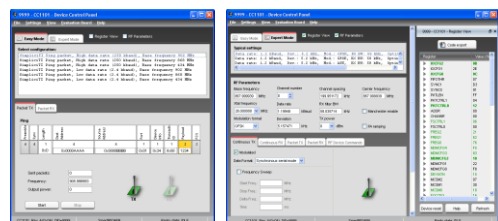
Connect the EB with a CC1101EM to the PC using the USB cable and install the USB driver as described in the manual.

2. Launch SmartRF Studio

Launch SmartRF Studio and double click on the highlighted CC1101 device icon to get complete control of the device from the PC.

3. Configure the Radio

You can now configure the radio, run tests, export register settings and run link tests with another CC1101 on a SmartRF04EB connected to the PC.

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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 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 this Product 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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EVALUATION BOARD/KIT/MODULE (EVM)
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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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