Texas Instruments

SimpleLink™ CC1310 Evaluation Module Kit Quick Start Guide

Opening the Box and Running the Range Test
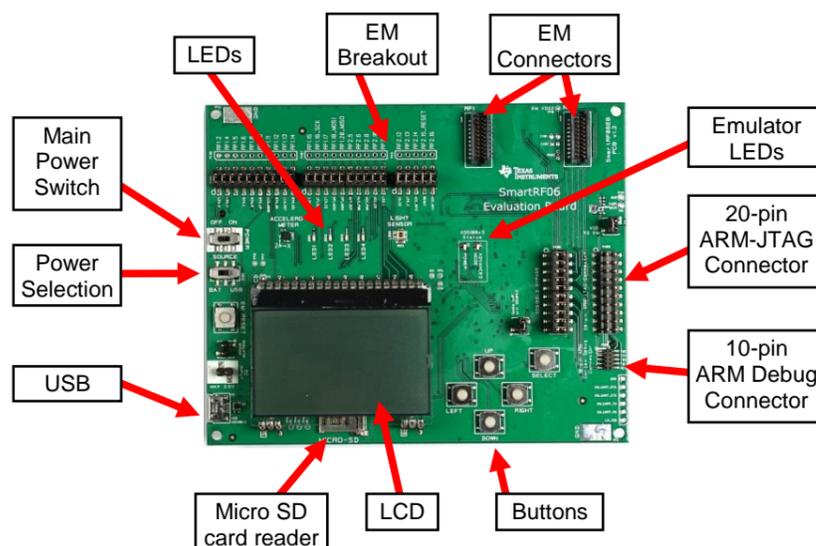
1. Kit Contents

- 2 x CC1310 Evaluation Modules 779-930 MHz (CC13xxEM-7XD-7793-4L)
- 2 x W5017 Pulse Antennas (2 dBi[1] gain)
- Documentation

Note! The pre-programmed range test on the CC1310EM can only be used when the board is plugged into a SmartRF06EB. Go to TI Store (store.ti.com) to purchase the SmartRF06EBK.

The CC1310 evaluation boards included in version 2.x of this kit are based on An RF design, using a 4-layer PCB, which is compliant to ETSI and FCC regulations up to +14 dBm (max output power from the CC1310). For FCC 15.247 compliance at +14 dBm, the transmit time must be shorter than 44 ms in any 100 ms window. No duty cycle limitations apply at +11 dBm. This reference design can be found on the CC1310 product page www.ti.com/product/cc1310.

2. SmartRF06EB Overview

For additional information about the SmartRF06EB, refer to the User Guide www.ti.com/lit/swru321.

3. Plug the EM into the 06EB

Insert a CC1310EM board into a SmartRF06EB and connect the antenna to the SMA connector on the EM. Note that the PCB antenna on the board can be used instead of the whip antenna. Refer to the CC1310 schematics to see how to enable it.

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

4. Power Options

The CC1310EM should be powered through the SmartRF06EB, which will supply a voltage from 2.1 V to 3.6 V to the daughter card. The SmartRF06EB can be powered in several different ways:
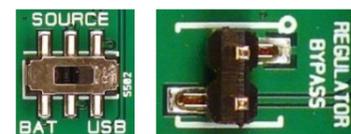
- USB (5 V through USB plug)
- 2 x 1.5V AAA non-rechargeable alkaline batteries
- External regulated power supply

External Regulated Power Supply Requirements[2]:
- Nominal voltage: 2.1 to 3.3 VDC
- Maximum voltage 3.6 VDC
- Max Current: 1000 mA
- Efficiency Level V

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

5. Select Power Source

The power source is selected using the Source switch on the left hand side of the SmartRF06EB.

In the "USB" position, the EM is powered over USB and runs at **3.3V**.

In the "BAT" position, the board is powered from batteries or an external source and runs at **2.1V**.

The 2.1V regulator can be bypassed by shorting the pins on the "regulator bypass" jumper. In this case, the EM is powered directly from the external source or batteries.

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

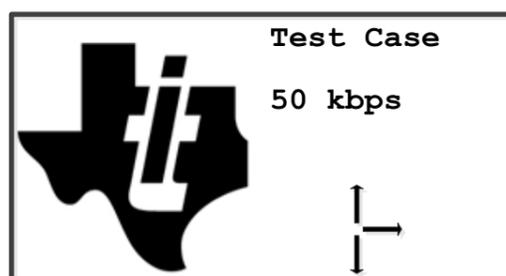### 6. Start the Range Test and Select Frequency

Turn on power with the "POWER" switch to start the pre-programmed Range Test.

First, you need to select the frequency band. Use the "RIGHT" button to switch between the available frequencies: 868, 915, and 920 MHz.

Push the "DOWN" button to go to the next step in the range test configuration ("Test Case").

Note! If nothing is displayed on the LCD make sure the board is correctly powered (see step 4 and 5 above) and that the CC1310 is running the range test (see section 12 in this guide).
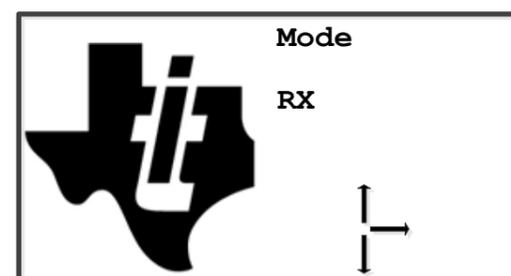
7. Select Test Case

The next step is to select a test case. Two test cases are supported:

- 50 kbps GFSK
- LRM (Long Range Mode)[3]

Use the buttons to navigate in the menu:

- "RIGHT" or "LEFT" switches between the test cases
- "UP" takes you back to the frequency selection
- "DOWN" takes you to the next step ("Mode")

8. Select Mode (RX or TX)

The next step is to select the whether the board should operate as transmitter (TX) or receiver (RX). One of the boards must be set up in RX mode and the other in TX mode.

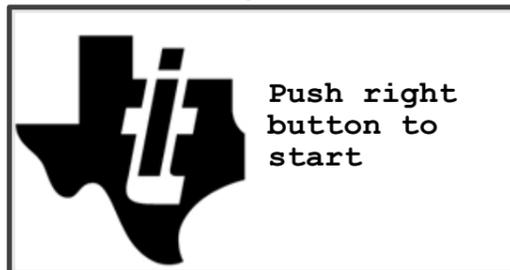Use the buttons to navigate in the menu:

- "RIGHT" or "LEFT" switches between RX and TX
- "UP" takes you back to the test case selection
- "DOWN" takes you to the final step ("Start test")

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[1] dBi = dB isotropic. Antenna gain compared with a hypothetical isotropic antenna.
[2] 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
[3] Long Range Mode: FSK with FEC ½, K=7 and DSSS 4

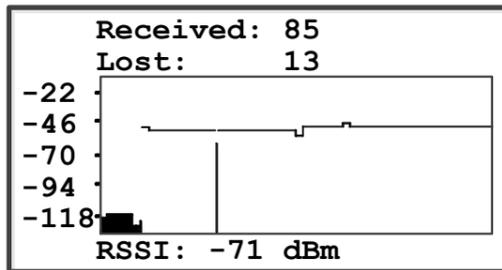## 9. Start the Range Test

Push right button to start

Push the "RIGHT" button on the transmitter to start the range test. Then start the receiver in the same way.

It is recommended to start the transmitter before the receiver.

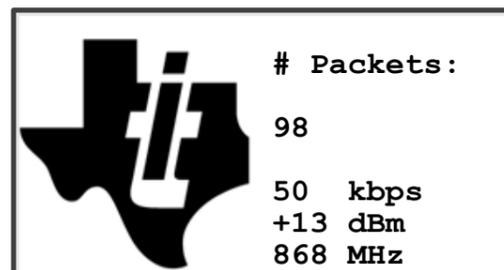Push the UP" button to get back to the previous menus ("Freq. Band", "Test Case", and "Mode")

10. RX

Received: 85
Lost: 13
-22
-46
-70
-94
-118
RSSI: -71 dBm

In RX mode, the LCD displays the number of received packets, lost packets, and RSSI as shown above.

A timer generates a timeout at the same rate as the transmitter sends packets. When the timeout occurs, the number of received packets is incremented by one if the CRC is OK and the RSSI of the packet is displayed. If no packets have been received, or the CRC was not OK, the number of lost packets is incremented and the current RSSI is read.

RX mode can be terminated by pushing any button.

11. TX

Packets:

98

50 kbps
+13 dBm
868 MHz

Running TX mode will transmit packets at a given rate. The LCD will show the number of packets transmitted together with info about the test case, output power (rounded) and frequency band.

Packet info
4 bytes preamble (5 bytes for LRM)
4 bytes sync word
11 bytes payload (including 1 length byte)
2 bytes CRC

TX mode runs infinitely or until one of the buttons is pushed.

12. Troubleshooting

If problems with the Range Test occur, please check the following:

- Nothing is shown in the display! Make sure the board is powered correctly (see step 4 and 5).
- Check for updated SW and documentation. Updated SW can be downloaded to the device using SmartRF Flash Programmer 2.

Note 1: If you get poor results at very short distances, try to move the transmitter and receiver further apart. The CC1310 receiver may be saturated if it is too close to the other CC1310 when transmitting at full output power.

Note 2: If you need to reprogram the range test on the CC1310EM, you will find the firmware image here: C:\Program Files (x86)\Texas Instruments\SmartRF Tools\Firmware\EMK. Requires SmartRF Studio version 2.2.0 or later.

13. Current Measurements

The SmartRF06EB has a current measurement header, J503, marked "VDD to EM". Remove the jumper and connect an ampere meter between the two pins.

It is also recommended to isolate the EM from the SmartRF06EB by removing the breakout jumpers and XDS100v3 bypass jumpers.

Note that the current depends on several factors, such as RF load, supply voltage, pin configuration, external connections, and software.

14. Next Steps

Evaluate the radio with SmartRF Studio. See the next section in this quick start guide for some guidance.

To develop your own software, download TI's Code Composer Studio (or IAR for ARM) and TI-RTOS for SimpleLink (www.ti.com/tool/ti-rtos). The TI-RTOS bundle comes with all the software you need, including examples that can serve as a starting point for your own application.

For additional information, visit the CC1310 product page www.ti.com/product/cc1310

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

We sincerely hope that you will enjoy working with the CC1310 device.

SmartRF™ Studio

1. Getting Started

SmartRF Studio can be used to test the radio interface on the CC1310 via an XDS debugger from TI. The SmartRF06EB has an onboard XDS100v3 debugger and can serve this purpose.

- Download and install SmartRF Studio from www.ti.com/smartrfstudio
- Connect the SmartRF06EB with the CC1310EM to your PC with a USB cable
- Start SmartRF Studio

2. Launch the Control Panel

When SmartRF Studio starts, it will detect all supported connected evaluation boards and display them in the "List of connected devices" in the lower part of the startup panel. Relevant devices will also be highlighted.

Select the "Sub-1 GHz" tab and double click on the highlighted CC1310 device icon. This will start the control panel
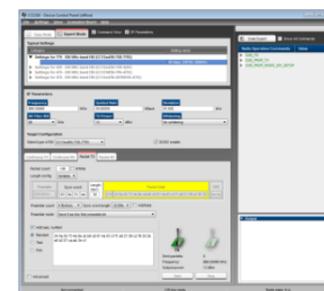

If no boards are detected, press the refresh button ("Refresh list") in the lower right corner of the window.

3. Test the Radio

From SmartRF Studio you can configure the radio, run performance tests and export radio operation commands to your code project.

You can also run link tests with another CC1310 device in one of the following ways:

- Both devices are connected with SmartRF Studio,
- The other device runs the built in range test.
- The other device runs a stand-alone Easylink code example.

4. Note regarding current measurements and SmartRF Studio

For demonstration of minimal current consumption in TX/RX with the CC1310EM, it is recommended to use embedded FW designed for this purpose and not SmartRF Studio. The current consumption measured on the device controlled from SmartRF Studio might be higher than the nominal datasheet current consumption for several reasons:

- SmartRF Studio uses JTAG for communication with the device, so the JTAG power domain is always kept on. The peripheral domain is kept on since SmartRF Studio needs control of IO pins on some of the EM versions. The CM3 CPU is put in sleep when idle.
- In Packet RX and Continuous RX mode, SmartRF Studio periodically polls a RAM area and register values for RSSI and packet updates. This polling adds current consumption.
- The DC/DC converter is enabled to save power, but the supply voltage to CC1310 from SmartRF06EB is 3.3 V (when powered from USB). Run the EM at a higher voltage, for instance 3.6V, to reduce the current.
- The performance and the current consumption vary with the load at the SMA port on the EM. For current consumption measurements, a broadband 50 ohm load (for example an antenna) is recommended.

IMPORTANT NOTICE

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