SEMTECH

WIRELESS & SENSING PRODUCTS

SX1261/SX1262

Long Range, Low Power Sub-GHz Transceiver

# User Guide for the SX1261 and SX1262 Development Kits



UG.DEV.SX126x.W.APP
Rev 1.1
March 2018

# Table of Contents


1. Contents of Delivery ..... 4
2. First Use ..... 5
   - 2.1 Connect the SX1261/SX1262 Development Kit ..... 5
   - 2.2 Welcome Display ..... 5
   - 2.3 How to Navigate with the Touch Screen ..... 5
   - 2.4 Check and Upload the Firmware File ..... 6
3. Ping Pong Demo ..... 7
4. PER Demo ..... 8
5. Radio Test Modes ..... 9
6. Radio Settings ..... 10
   - 6.1 LORA Modulation ..... 10
   - 6.2 GFSK Modulation ..... 10
   - 6.3 Frequency Setting ..... 11
7. Utilities ..... 11
8. Revision History ..... 11

# List of Figures

Figure 1: From left to right: touch screen, RF module and MBED board ..... 4
Figure 2: Touch screen, RF module and MBED board correctly assembled ..... 4
Figure 3: Welcome Display ..... 5
Figure 4. PING PONG Demo Slave Display ..... 7
Figure 5: PING PONG Demo Master Display ..... 7
Figure 6: PER Demo Slave Display ..... 8
Figure 7: PER Demo Master Display ..... 8
Figure 8: Radio Test Modes Display ..... 9
Figure 9: LORA Radio Settings Display ..... 10
Figure 10: GFSK Radio Settings Display ..... 10
Figure 11: Frequency Setting Display ..... 11
Figure 12: Utilities Display ..... 11

# 1. Contents of Delivery

The Development Kit for a SX1261 or SX1262 transceiver is delivered with the following contents:

- 2 SX126xMB1xAS RF modules including a microcontroller ST Nucleo MBED board and a touch screen
- 2 connection cables Mini-USB / USB
- 2 868/915 MHz antennas
- 2 Mini-USB cables
- 2 touch screen styluses
- 1 Read-Me Note

Before powering the kit, make sure to assemble the three parts shown in the image below:

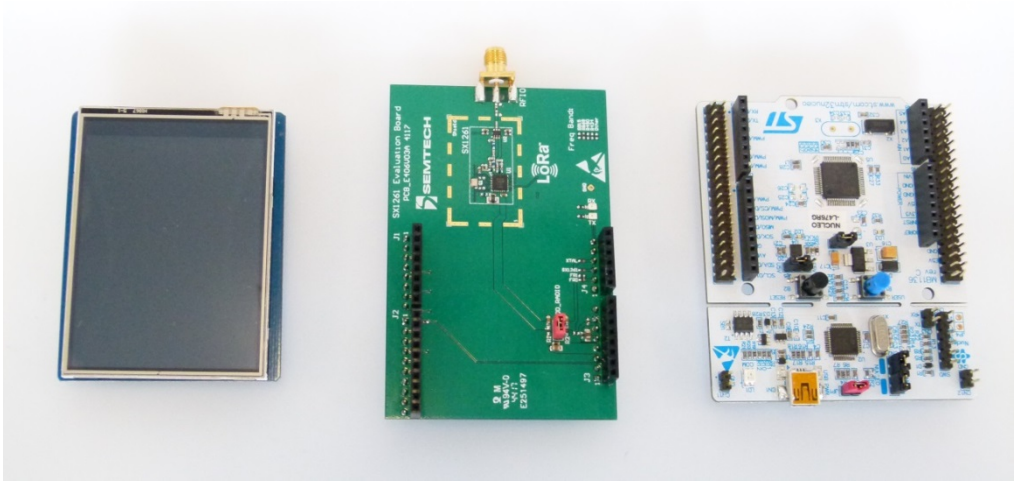

**Figure 1: From left to right: touch screen, RF module and MBED board**

When you assemble the parts, make sure that they are correctly oriented, as shown below:

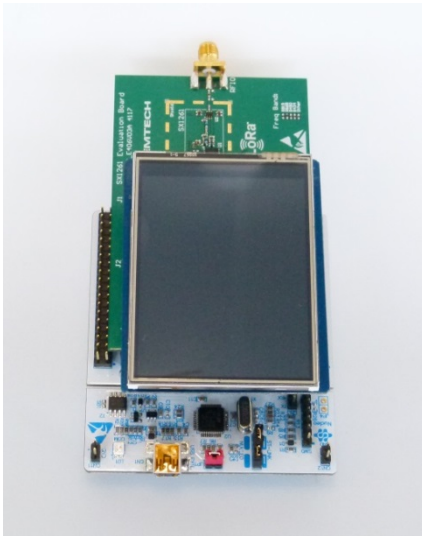

**Figure 2: Touch screen, RF module and MBED board correctly assembled**

# 2. First Use

## 2.1 Connect the SX1261/SX1262 Development Kit

1. Plug the mini-USB / USB cable into the mini-USB socket of the SX1261/SX1262 Development Kit
2. Plug the mini-USB / USB cable into the USB socket of your PC

The SX1261/SX1262 Development Kit will power on and connect to your PC.

The type of device (SX1261 or SX1262) is automatically detected by the kit.

## 2.2 Welcome Display

The welcome screen with the top menu is visible upon power-on.

You can access the following test modes:

- **DEMO Ping Pong**

  This performs a bidirectional range test between a pair of radio units.

- **DEMO PER**

  This performs a unidirectional packet error rate test between user-defined Master and Slave units.

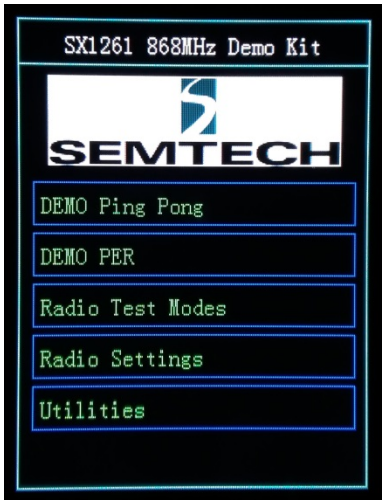


**Figure 3: Welcome Display**

Additionally, you can access the **Radio Test Modes**, which provide access to the basic operating modes of the radio. The **Radio Settings** allow you to modify the communication and modem settings used in the demos.

The **Utilities** menu provides information about the peripherals and version of the installed firmware.

## 2.3 How to Navigate with the Touch Screen

On the touch screen of the kit the following conventions are adopted:

- Menus, functions and configuration of settings are indicated in Green
- Data that cannot be modified is indicated in White
- Result data from tests are indicated in Yellow

# 2.4 Check and Upload the Firmware File

Before using the SX1261/SX1262 Development Kit, make sure to have the latest firmware:

- Go to the **Utilities** *section 7*
- Check the **Firmware Version**
- If it is not the latest version, download the firmware from *www.semtech.com* and save it to your PC

The firmware can then be uploaded to the SX1261/SX1262 Development Kit.

**To upload the firmware file:**

- Connect the SX1261/SX1262 Development Kit as explained in *Section 2*
- Allow your computer to display the kit as an extra device
- Drag and drop the .bin file that has been provided to you or that has been downloaded from the Semtech website
- The kit will initialize and eventually ask you to calibrate the screen, simply follow the on-screen instructions

# 3. Ping Pong Demo

A Ping Pong Test is a bidirectional test between a pair of SX1261/SX1262 kits. One kit needs to be configured as the Ping Pong Master and the other kit as the Ping Pong Slave. Communication is initiated by the Master whose packet is received by the Slave from which the PER may be calculated.

In response to this packet the Slave sends an acknowledgement, which also contains statistical information about the link calculated by the Slave. The Master, upon receiving this response, will then display both the PER for the Master to Slave and the Slave to Master packet exchanges.

Press on **Demo Ping Pong** from the Welcome Display to access this test.

You can change the radio settings from this menu:

➔ Press **SETTINGS** to adjust the same radio settings on the Master and the Slave units. See *Section 6* for more details on the radio settings.

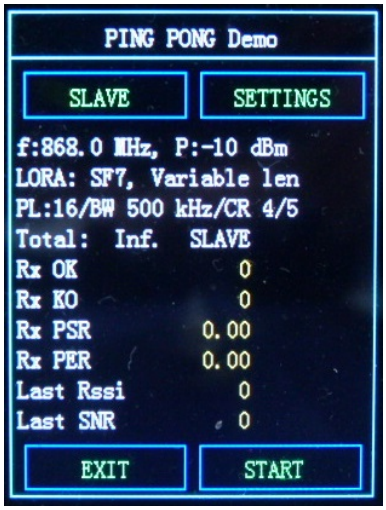


Figure 4. PING PONG Demo Slave Display

Before starting the test:

- Place the Slave unit into the desired position
- Place the Master unit into the desired position

➔ Press **SLAVE** to toggle a unit to **MASTER** and vice-versa

To start the Ping Pong test:

➔ Press **START** first on the Slave unit then on the Master Unit

- Both units will exchange data until you press **STOP** on either unit.

  The reception and transmission of data are indicated by LEDs on each unit.
- The result of the test is displayed on the screen of the Master unit:
  - Rx OK : number of packets completely received
  - Rx KO: number of packets not completely received
  - Rx PSR: Percentage Packet Success Rate for the last packet exchange
  - Rx PER: Percentage Packet Error Rate for the last packet exchange
  - Last RSSI: Received Signal Strength Indication [dBm]
  - Last SNR: Signal to Noise Ratio for the last packet exchange [dB]

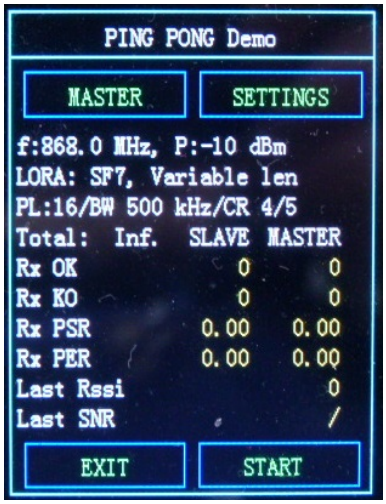


Figure 5: PING PONG Demo Master Display

# 4. PER Demo

A Packet Error Rate (PER) test is a unidirectional test where one kit is configured as a Master and the other as a Slave. In this case the Master will assume the role of transmitter and the Slave that of receiver. The aggregate PER of the packets received by the Slave, expressed as a percentage, is calculated and displayed on the receiver (Slave). Given that this is a unidirectional test, the packet error rate is not displayed on the transmitter (Master).

Press on **Demo PER** from the Welcome Display to access this test.

You can change the radio settings from this menu:

➔ Press **SETTINGS** to adjust the same radio settings on the Master and the Slave units. See *Section 6* for more details on the radio settings.

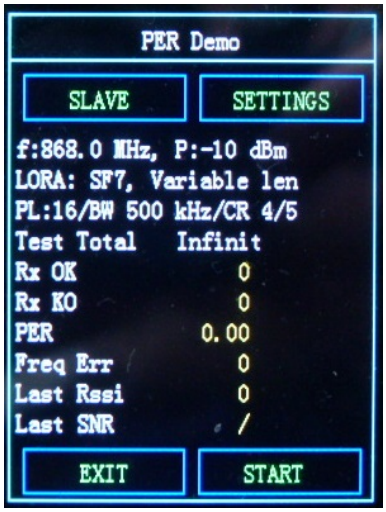


**Figure 6: PER Demo Slave Display**

Before starting the test:

- Place the Slave unit into the desired position
- Place the Master unit into the desired position

➔ Press **SLAVE** to toggle the unit to **MASTER** and vice-versa

To start the PER test:

➔ Press **START** first on the Slave unit then on the Master Unit

- Both units will exchange data until you press **STOP** on either unit.

  The reception and transmission of data are indicated by LEDs on each unit.
- The result of the Demo is displayed on the screen of the Slave unit:
  - Rx OK : number of packets completely received
  - Rx KO: number of packets not completely received
  - Rx PSR: Percentage Packet Success Rate for the last packet exchange
  - Rx PER: Percentage Packet Error Rate for the last packet exchange
  - Last RSSI: Received Signal Strength Indication [dBm]
  - Last SNR: Signal to Noise Ratio for the last packet exchange [dB]

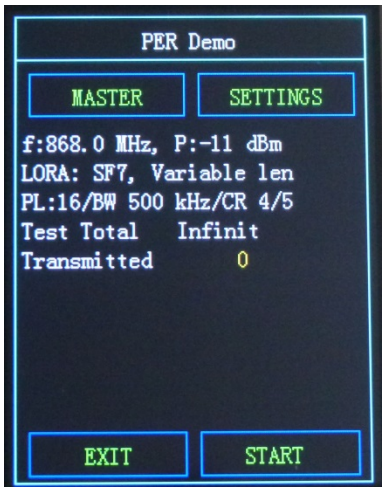


**Figure 7: PER Demo Master Display**

# 5. Radio Test Modes

The **Radio Test Modes** menu allows you to select certain preset test modes. These test modes permit the test of consumption of the radio in the respective modes, additionally that can be of use to test the specification claims of the datasheet or various modem performances without the need to create custom firmware.

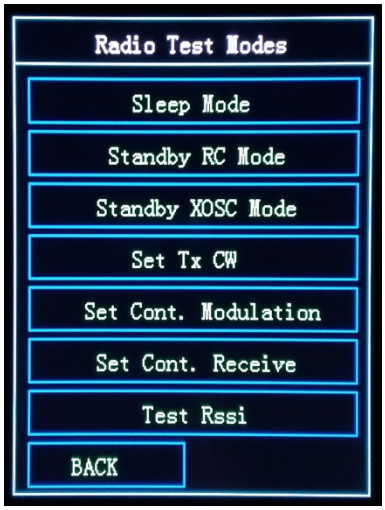


**Figure 8: Radio Test Modes Display**

# 6. Radio Settings

The radio settings available depend upon the modulation, denoted **Mod** in the sub-menu **Radio Settings**. For each modem you can modify the modulation and power parameters. Registered settings are proper to each modulation.

## 6.1 LORA Modulation

The radio settings available for **LORA** modulation are:

- Frequency (**Freq**) as described in *Section 6.3*
- Payload **(PL)**: size of the payload between 1 and 64 bytes
- Transmission Power (**Tx Pow**): in steps of 1 dBm
    - from -17 dBm to +15 dBm for the SX1261
    - from -10 dBm to +22 dBm for the SX1262
- **Param 1**: Spreading Factor between SF5 and SF12
- **Param 2**: BandWidth (**BW**) from 7 kHz to 500 kHz
- **Param 3**: Coding Rate (**CR**) of the Forward Error Correction applied to the packet of either CR 4/5, 4/6, 4/7 or 4/8
- **Param 4**: Packet type of either Variable length or Fixed length

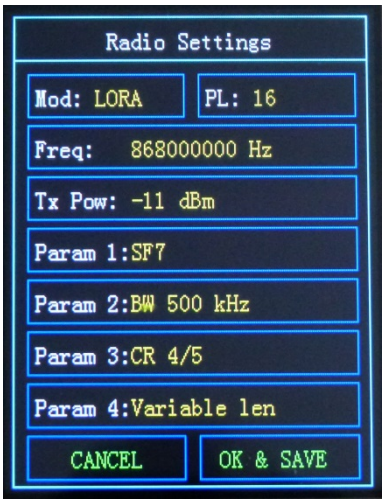


**Figure 9: LORA Radio Settings Display**

## 6.2 GFSK Modulation

The radio settings available for **GFSK** modulation are:

- Frequency (**Freq**) as described in *Section 6.3*
- Payload **(PL)**: size of the payload between 1 and 64 bytes
- Transmission Power (**Tx Pow**): in steps of 1 dBm
    - from -17 dBm to +15 dBm for the SX1261
    - from -10 dBm to +22 dBm for the SX1262
- **Param 1**: Bitrate from 0.1 kbps to250 kbps
- **Param 2**: Frequency deviation (**Fd**) between 5 and 150 kHz.
  This must be set realistically in accordance with the bitrate
- **Param 3**: Tx Modulation Filtering (Gaussian, RC, RRC) with BT from 0.3 to 1
- **Payload**: BandWidth (**BW**) from 4.8 kHz to 467 kHz

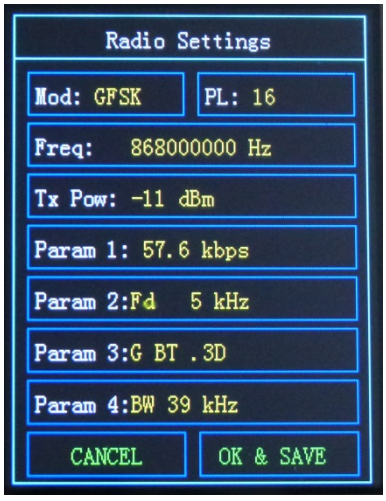


**Figure 10: GFSK Radio Settings Display**

**Note:**

Certain settings will appear in **red** if they are not compatible and cannot be handled by the radio. Refer to the SX1261/2 Data Sheet to see the relationship details between bitrate, frequency deviation and bandwidth.

# 6.3 Frequency Setting

In this menu you can set the frequency for each modulation:

- Select the frequency **Step** that you wish to tune: from 1 Hz to 10 MHz
- With **-** and **+** change the value of the step of your tuned frequency
- The resulting frequency in displayed in **Freq**
- Additionally you can select one of the three **Preset** frequencies by simply pressing the desired frequency value.

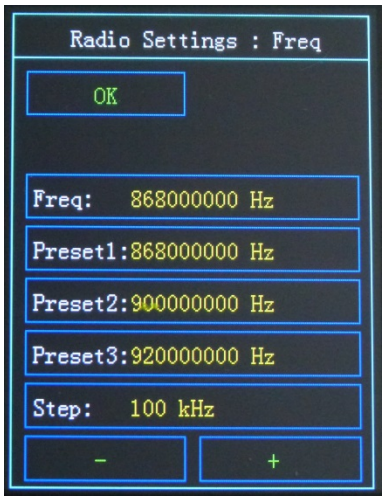


**Figure 11: Frequency Setting Display**

# 7. Utilities

In this menu you can reset the SX1261/SX1262 Development Kit to its factory settings:

➔ Press on **Fact. Reset**

The **Utilities** section is also useful to check the **Firmware Version**

You can modify:

- the **RxBoost** mode: On (True) or Off (False)
- the power regulation mode (**DC Reg)**: either DCDC or LDO
- the **Packets** limit: Infinite, 100, 200, 500 or 1000

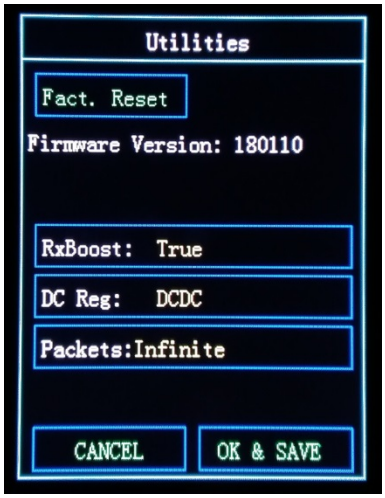


**Figure 12: Utilities Display**

# 8. Revision History

| Version | Date | Modifications |
|---|---|---|
| 1.0 | October 2017 | First Release |
| 1.1 | March 2018 | Update of the contents of delivery<br>Update of the display illustrations<br>Update of the LoRA and GFSK Modulation settings |

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## Contact Information

Semtech Corporation
Wireless & Sensing Products
200 Flynn Road, Camarillo, CA 93012
E-mail: sales@semtech.com
Phone: (805) 498-2111, Fax: (805) 498-3804
**www.semtech.com**

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001
Адрес: 105318, г.Москва, ул.Щербаковская д.3, офис 1107

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**Офис по работе с юридическими лицами:**

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:
moschip.ru
moschip.ru_4
moschip.ru_6
moschip.ru_9