1. Kit Overview

This user’s guide describes Silicon Labs’ Si4455 EZRadio® Two-Way Link demo kit. The kit contains two RF nodes based on the RFStick board to support evaluation and development of sub-GHz RF links with the Si4455 EZRadio IC. The kit has three versions: one for the 434-MHz band, one for the 868-MHz band, and one for the 915-MHz band. The content of the different kits are listed in Table 1. These kits are built with the B1A version of the Si4455 IC. RFSticks that are built with the latest C version of the Si4455 ICs can be ordered from Silicon Labs individually under the part numbers Si4455CLED-434-PER, Si4455CLED-868-PER, and Si4455CLED-915-PER.

- The RFStick has four LEDs to display information and four push-buttons to receive user commands. Additionally, the Silicon Labs’ Toolstick Base Adapter is provided in the kits to connect the RFStick to the PC for downloading and debugging user applications.
- The kits support use of the Wireless Development Suite (WDS) for setting radio parameters and managing sample codes.
- The kits support the use of the Silicon Labs Integrated Development Environment (IDE) for software debugging and the use of the Keil C compiler, assembler, and linker toolchain.

Table 1. Kit Contents

<table>
<thead>
<tr>
<th>Qty</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>4455-LED-434-PER</td>
<td>Si4455 EZRadio transceiver board</td>
</tr>
<tr>
<td>2</td>
<td>Toolstick_BA</td>
<td>Toolstick Base Adapter</td>
</tr>
<tr>
<td>2</td>
<td>USB-XTEN-01</td>
<td>USB extender cable (USBA-USBA)</td>
</tr>
<tr>
<td>4</td>
<td>AAA</td>
<td>AAA alkaline battery</td>
</tr>
<tr>
<td>2</td>
<td>4455-LED-868-PER</td>
<td>Si4455 EZRadio transceiver board</td>
</tr>
<tr>
<td>2</td>
<td>Toolstick_BA</td>
<td>Toolstick Base Adapter</td>
</tr>
<tr>
<td>2</td>
<td>USB-XTEN-01</td>
<td>USB extender cable (USBA-USBA)</td>
</tr>
<tr>
<td>4</td>
<td>AAA</td>
<td>AAA alkaline battery</td>
</tr>
<tr>
<td>2</td>
<td>4455-LED-915-PER</td>
<td>Si4455 EZRadio transceiver board</td>
</tr>
<tr>
<td>2</td>
<td>Toolstick_BA</td>
<td>Toolstick Base Adapter</td>
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</tr>
<tr>
<td>4</td>
<td>AAA</td>
<td>AAA alkaline battery</td>
</tr>
</tbody>
</table>
2. Software Setup

There are two software tools provided by Silicon Labs to aid in EZRadio® software development: the Wireless Development Suite (WDS) and the Silicon Labs Integrated Development Environment (IDE). The recommended starting point for EZRadio development is the WDS software tool. This tool is able to identify the connected boards by reading their identification memories (EBID) and provides valuable help by greatly simplifying radio configuration, evaluation, and application development.

2.1. Hardware and Software Requirements for WDS

- Windows XP® or later
- Microsoft .NET framework 3.5 or later
- Silicon Labs CP210x VCP driver
- WDS v3.1.9.0 or later

The lack of the .NET framework and VCP driver are recognized during the WDS installation. The install wizard will install the missing components after prompting the user for permission.

2.2. Download WDS

WDS can be obtained from the Silicon Labs web site free of charge. For more information, see link in Chapter 4. "Useful Documents" on page 3.

2.3. Installation Steps

Note: Before installing this software, local administration rights must be obtained from your network administrator.

1. Start WDS3-Setup.exe
2. Click "Next" to start the installation process
3. Accept the license agreement by clicking the check box, and then press the “Next” button.
4. Select the installation folder. Using the default folder is recommended, C:\Program Files\Silabs\WDS3
5. When your settings are confirmed, click "Install" to continue.
6. Click “Finish” to close the WDS Installer.

3. Hardware Setup

After checking the kit contents against Table 1, the kit can be put into operation by performing the steps listed below for both nodes.

1. Select the USB port as power source by setting the S6 power selector switch to the “Adapter” position.
2. Connect the J1 connector of the RFStick to the Toolstick Base Adapter.
3. Start the WDS on your PC.
4. Connect the Toolstick Base Adapter to a USB port of the PC.
5. Wait for Windows to install the driver of the Toolstick Base Adapter, if necessary.
6. WDS must identify the connected board and open an Application Manager window that lists information about the identified board.
7. Select “Radio Configuration Application” and click “Select Application”.
8. From the Radio Configuration Application window, select “Standard Packet TX” for one node and “Standard Packet RX” for the other node.
9. Leave the default parameter settings untouched; simply click “Download project”.

Now, the simple TX/RX sample project is running on the boards. When pressing one of the SW1 to SW4 buttons on the TX board, packets are sent, and the corresponding LED of LED1 to LED4 lights up during the transmission. On the RX side LED1 is always on, while different combinations of LED2 to LED4 lights up during successful packet reception, according to the button pressed.
4. Useful Documents

For general information on the EZRadio® Si4455 IC, see the data sheet:

Si4455 Data Sheet

For detailed information on example codes and how to program the EZRadio ICs, refer to the following documents:

AN692: Si4355/4455 Programming Guide and Sample Codes
EZRadio API Documentation

Available Tools:

8-bit Microcontroller Studio (including Silabs IDE)
WDS3 installer

For hardware design guidance, see the following application notes:

AN685: Layout Design Guide for the Si4455/4355 RF ICS
AN686: Antennas for the Si4455/4355 RF ICs
AN693: Si4455 Low-Power PA Matching

For detailed information on lab measurements, data sheet parameter verification and how sample codes can be configured and downloaded to the RFStick from WDS, refer to the following documents:

AN655: Range Test Application for the EZRadio and EZRadioPRO devices
AN796: Wireless Development Suite General Description
AN797: WDS User's Guide for EZRadio Devices

More useful documents can be accessed via the EZRadio web pages
5. The RFStick Platform

The RFStick is a basic demo system for the evaluation of the EZRadio chips. The board has two main parts, the MCU part and the radio part. The MCU part of the board contains a Silicon Labs C8051F930 MCU and basic human interface devices (four push-buttons, four LEDs, four switches and a buzzer). The radio part contains the EZRadio chip, the matching circuit, and the antenna. The RF output is selectable via a 0 Ω resistor between a PCB antenna and an optional (unpopulated) 50 Ω SMA output connector. The MCU is connected to the EZRadio chip via an SPI bus and some other GPIOs (see Table 2). The RF section of the board can be broken off along a perforation between the two rows of J3 and installed in the user’s own hardware as a radio module by utilizing the remaining row of J3.

Table 2 contains the signal connections between the EZRadio chip and the MCU:

<table>
<thead>
<tr>
<th>Si4355, Si4455</th>
<th>RFStick</th>
<th>C80C51F930</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pin Number</strong></td>
<td><strong>Pin Name</strong></td>
<td><strong>Pin Function</strong></td>
</tr>
<tr>
<td>EP, 1, 6, 9</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>7, 8</td>
<td>VDD</td>
<td>Supply Voltage input</td>
</tr>
<tr>
<td>12</td>
<td>NIRQ</td>
<td>Interrupt output, active low</td>
</tr>
<tr>
<td>2</td>
<td>SDN</td>
<td>Shutdown input, active high</td>
</tr>
<tr>
<td>16</td>
<td>NSEL</td>
<td>SPI select input</td>
</tr>
<tr>
<td>13</td>
<td>SCLK</td>
<td>SPI clock input</td>
</tr>
<tr>
<td>15</td>
<td>SDI</td>
<td>SPI data input</td>
</tr>
<tr>
<td>14</td>
<td>SDO</td>
<td>SPI data output</td>
</tr>
<tr>
<td>10</td>
<td>GPIO_0</td>
<td>General Purpose I/O</td>
</tr>
<tr>
<td>11</td>
<td>GPIO_1</td>
<td>General Purpose I/O</td>
</tr>
<tr>
<td>19</td>
<td>GPIO_2</td>
<td>General Purpose I/O</td>
</tr>
<tr>
<td>20</td>
<td>GPIO_3</td>
<td>General Purpose I/O</td>
</tr>
</tbody>
</table>

The four GPIO signals’ primary function is push button input to the MCU (PB1–PB4), so these signals are not

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Table 2. Connections between the EZRadio Chip and the MCU
connected to the EZRadio chip by default (represented by x in the table above). The user can connect them by soldering in jumpers across the appropriate pins of J3.

5.1. Setting up and Connecting the RFStick to a PC

The power source of the board can be selected with the power-supply selector switch (S6). If S6 is in the Adapter position, supply voltage is provided by a Toolstick Base Adapter that is connected to the J1 PCB edge connector. If S6 is in the Battery position, the supply voltage is provided by two AAA batteries in the battery holder on the bottom side of the board. Current consumption of the RF part (RFVDD) can be measured on J6. Since J6 is shorted by a PCB track on the bottom side of the board, the user must cut the track if this feature is used.

![Figure 2. How to Connect the RFStick to the PC](image)

Steps for connecting to a PC:

- Select the desired power source with S6 power selector switch.
- Connect the J1 connector of the RFStick to the Toolstick Base Adapter.
- Connect the Toolstick Base Adapter to the USB port of the PC.
- Wait for Windows to install the driver of the Toolstick Base Adapter, if necessary.

The RFStick is available in three different frequency band versions from Silicon Labs as part of several EZRadio kits.
6. Schematics

Schematics of the RFstick boards of the kit can be seen on the following pages. Complete manufacturing file pack with CAD/CAM files and BOMs can be found at silabs.com.

Figure 3. Si4455-LED-434 Schematic 1
Figure 4. Si4455-LED-434 Schematic 2
DOCUMENT CHANGE LIST

Revision 0.1 to Revision 0.2
- Changed Figure 6 from RF section to MCU section.

Revision 0.2 to Revision 0.3.
- Added description of software setup.
- Added details to hardware description.
- Removed description of obsolete range test demo code.
- Added links to other documents

Revision 0.3 to Revision 0.4
- Updated Kit Overview paragraph on page 1.
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