Si1000/Si1010 WIRELESS MCU QUICK-START GUIDE

1. Introduction

This application note will help you get a quick start on demonstration, evaluation, or code development with the Si10xx products.

1.1. Choose between Evaluation, Demonstration, or Code Development

■ **Evaluate the radio performance or experiment with register settings:**

1. Get one Si1000/10 radio card and one Si1000-MB motherboard.
2. Download the demonstration host firmware to the Si1000/10 MCU.
3. Install WDS and connect.
4. Skip to "1.2. WDS" on page 2.
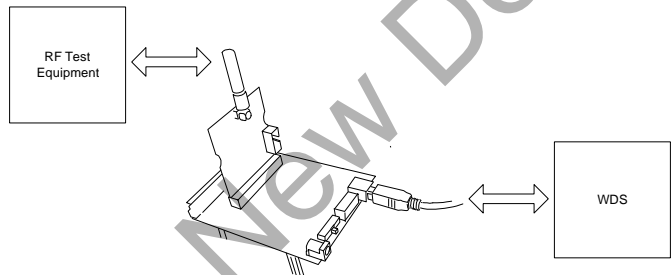
■ **Compile and Download RF demonstration firmware:**

1. Get one Si1000/10 radio card and one Si1000-MB motherboard.
2. Install the Silicon Labs Integrated Development Environment (IDE).
3. Install an evaluation version of a C compiler.
4. Connect the Si1000/10 to the Si1000 MB.
5. Open→modify→build→download→go.
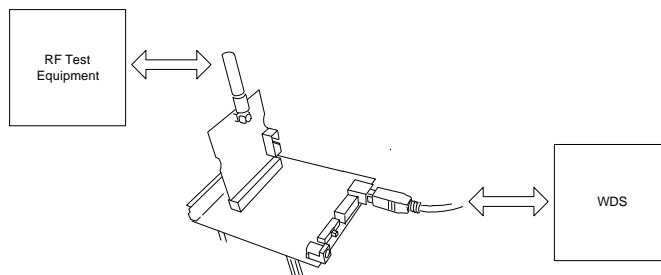6. Skip to "1.3. Code Development" on page 7.
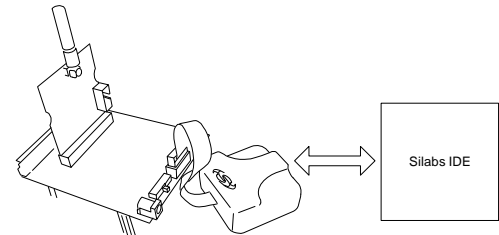
■ **Demonstrate a wireless link between two nodes:**

1. Get two Si1000/10 radio cards and two Software Development Boards.
2. Download bypass code to the Si1000/10's onboard MCU.
3. Configure the radio via the onboard LCD.
4. Skip to "1.4. Portable Demo Quick Start" on page 13.
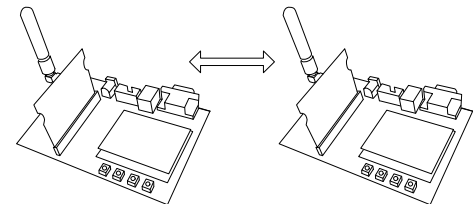
Si1000/10 QSG

1.2. WDS

Using the WDS Chip Configurator software is the best way to evaluate the RF performance in the lab with a PC in various configurations. The WDS GUI provides a convenient way to run configuration scripts and to change the radio settings bit-by-bit.

1. Install the WDS Chip Configurator either from the supplied CD or from www.silabs.com

2. Connect an Si10xx or Si101x RF card to the Si1000-MB motherboard.

3. Ensure jumpers/ switches are in the correct position:
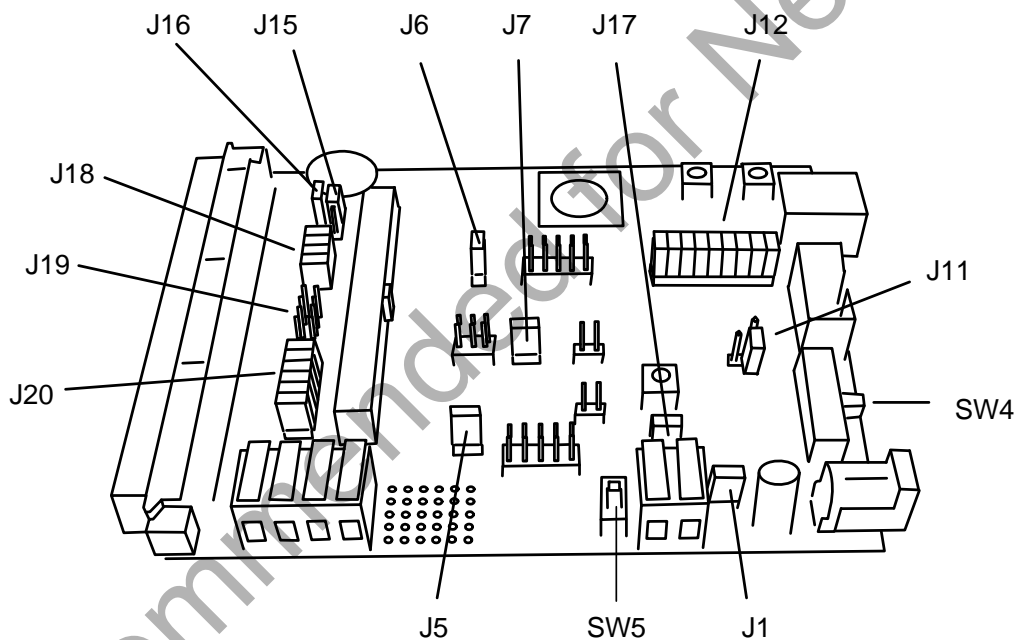
- SW4 in "2 CELL"
- J11 in WALL_PWR
- Jumpers shorted:
  - J1
  - J5
  - J6
  - J7
  - J12 (all)
  - J15
  - J16
  - J17
  - J18 (all, if using Si1000, 1, 2, 3, 4,or 5)
  - J19 (all, if using Si1010, 1, 2, 3, 4,or 5)
 - J20 (all)

4. Connect the USB cable (which will supply power and USB communications).

5. Turn on power: SW5 → ON

6. Download the LoadBoard Light code to each. (See "3. Silicon Laboratories IDE Code Download" on page 16).
    File location: C:\SiLabs\MCU\Examples\Si100x\EZRadioPRO\WDS_Support\lb_light.hex (Si100x) or
    C:\SiLabs\MCU\Examples\Si101x\EZRadioPRO\WDS_Support\lb_light.hex (Si101x)
    (Files installed automatically with the Silicon Labs IDE)

    Note that the red LED, DS3, blinks when the LoadBoard Light firmware is running.

7. Launch the WDS Chip Configurator application on your PC (Start → Silicon Laboratories → WDS3)

8. WDS should automatically detect the Si1000 connected via USB. The following screen will appear:
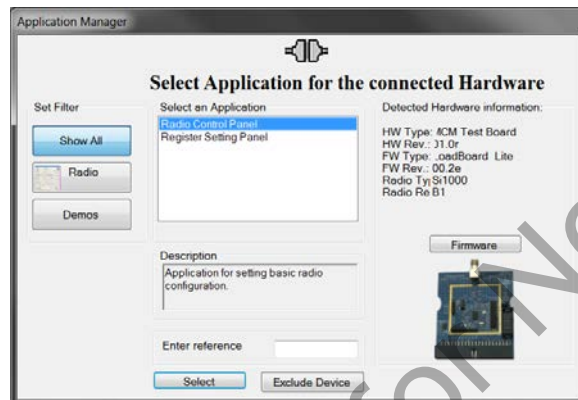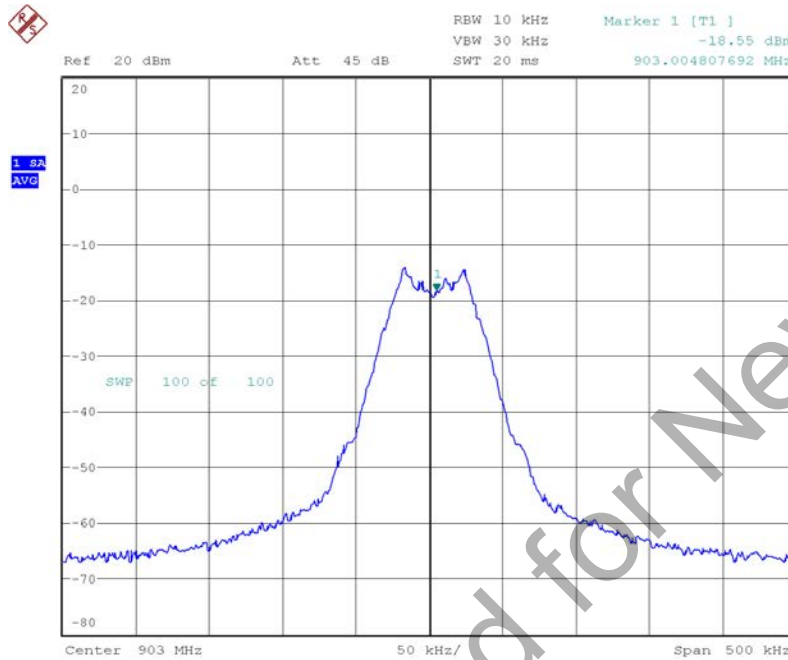

9. Click Radio Control Panel and Select.

10. Configure the radio to transmit a GFSK-modulated PN9 test message:
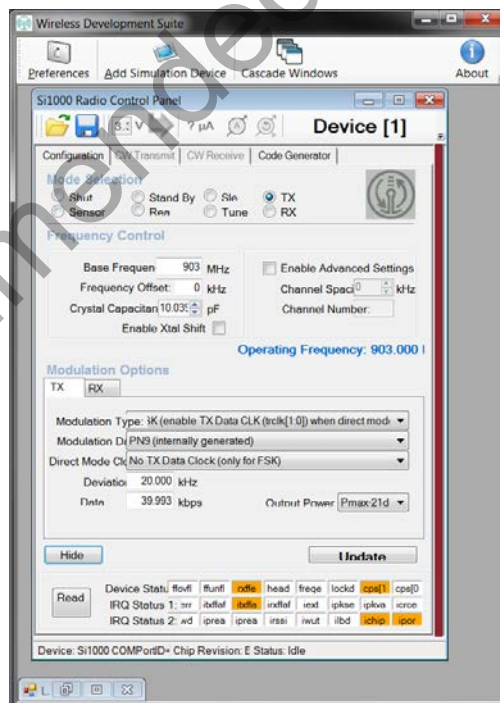
   a. Select the TX state by clicking the TX button,.
   b. Set the frequency (903 MHz shown).
   c. Set the crystal load capacitance to 10.039 pF.

     d.   Select GFSK from Modulation Type.

     e.   Select PN9 from Modulation Data.

     f.   Click Update to write these values to the radio.

11. Connect a spectrum analyzer to the antenna output:
   You should see a GFSK-modulated test signal at 903 MHz.

Date: 25.AUG.2010 17:17:36

12. Use the Register Setting panel to adjust the Transmit Power register:
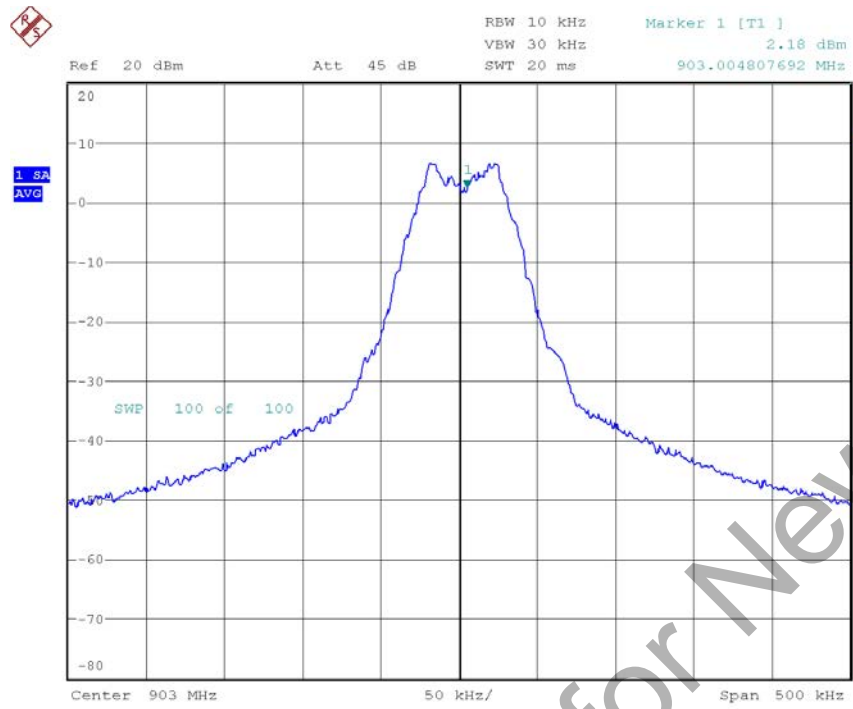   Close the Radio Control panel. The Application Select panel will open:
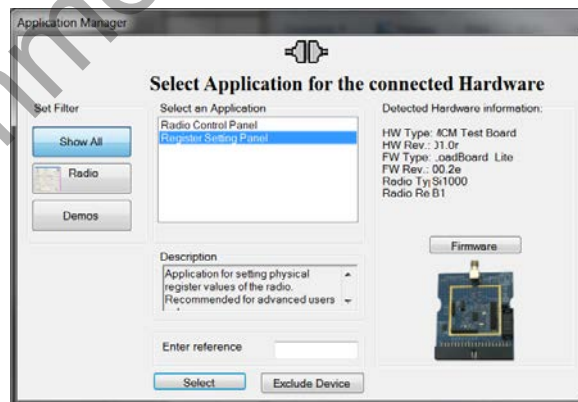
a. Choose Register Setting Panel and Select.

b. Scroll down to register 6D, the TX Power register. Set bits TXPOW[2:0] to 1. Click the W icon to write this register.
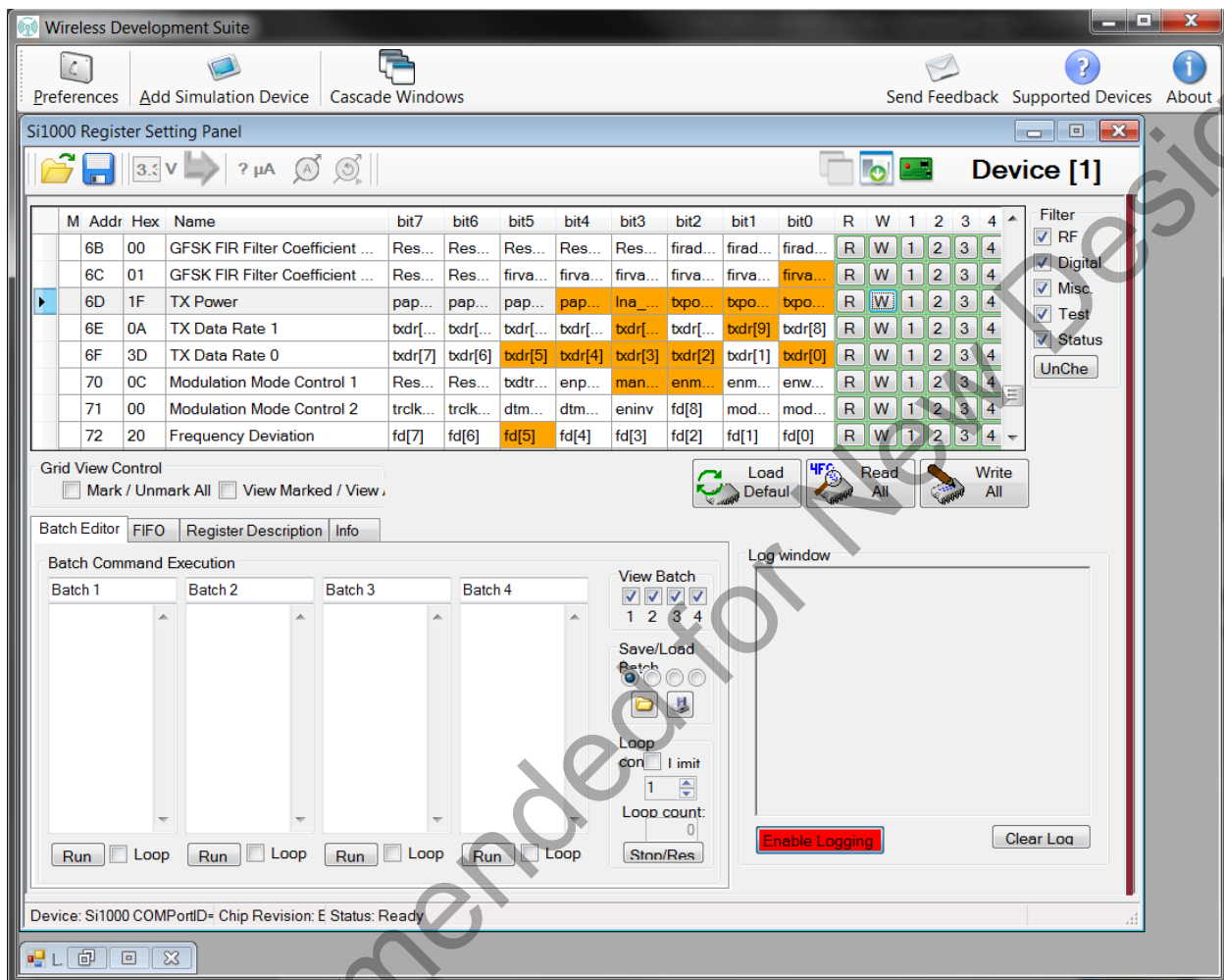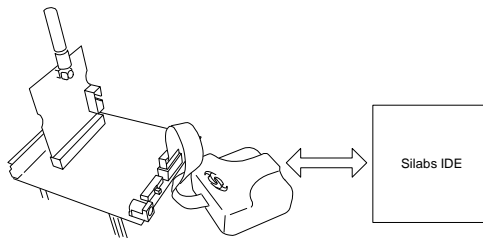
c. Verify that the transmitter power has increased by checking the spectrum analyzer:


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1.3. Code Development

A number of RF programming examples are included with the standard Silicon Laboratories IDE installation. This section will get you started building and running one of those examples.
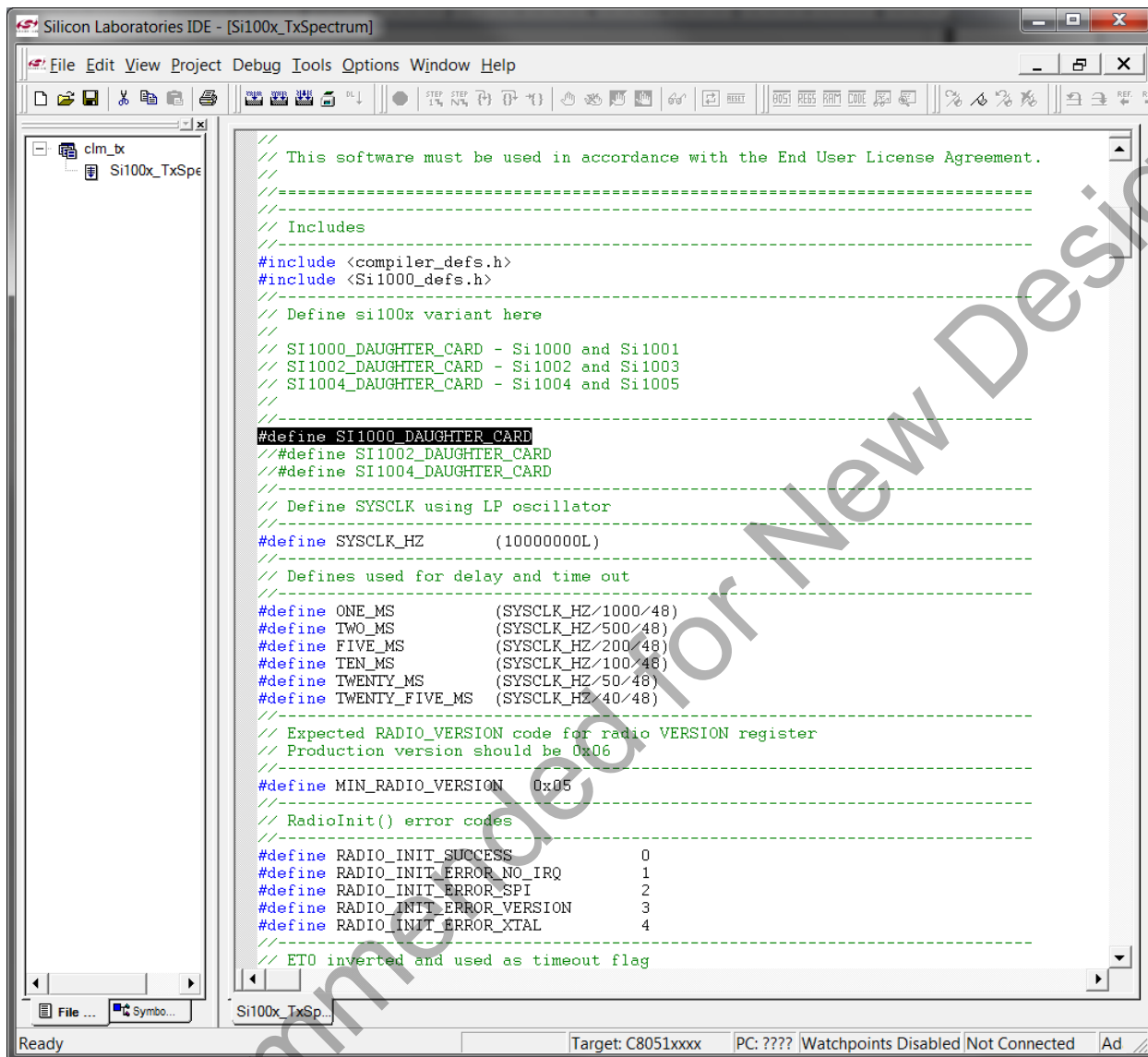
1. Install the Silicon Labs IDE software. Use the included CD or download from www.silabs.com.

2. Install a C compiler. This example uses SDCC. A list of compiler links is at
   http://www.silabs.com/products/mcu/Pages/DevelopmentTools.aspx

3. Connect the USB Programming Adapter to your computer.

4. Plug a Si1000 915 MHz radio card in to the Software Development Board or Si1000-MB.

5. Connect power.

6. Connect the USB Programming Adapter ribbon cable to J1 on the radio card.

7. Launch the Silicon Labs IDE software: All Programs → Silicon Laboratories -> Silicon Laboratories IDE

8. Select the SDCC compiler.

    a. Project →Tool Chain Integration …

    b. Select the SDCC preset.

    c. Click OK.
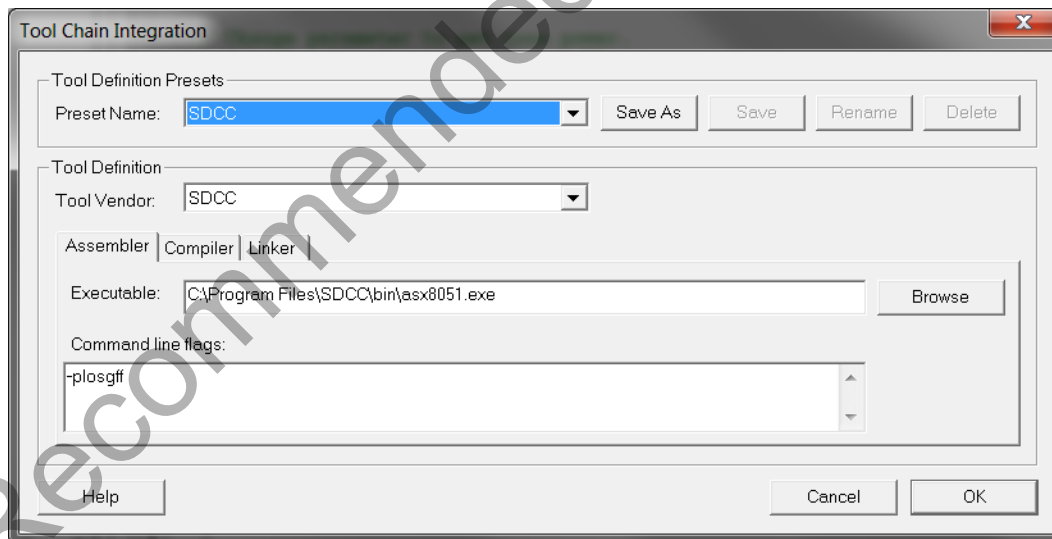
9. Establish a connection to the Si1000 device: Debug → Connect

10. Open the Si100x_TxSpectrum.c file
    (path: C:\SiLabs\MCU\Examples\Si100x\EZRadioPRO\TxSpectrum Si100x_TxSpectrum.c)

Si1000/10 QSG

11. Ensure the Si1000 EVB is selected as a target:

12.Change the frequency to 913 MHz:

13. Fine-tune the EVB's crystal frequency. Scroll down to the RadioInit function and add a phyWrite command:

14. Build project and download the project
    a. Press ctrl-shift-F7 to compile and build.
    b. Press the [DL⬇] Icon to download.
    c. Ensure Download Successful appears in the Output Window.

15. Run: F5

16. Connect spectrum analyzer to antenna port and verify modulated spectrum.
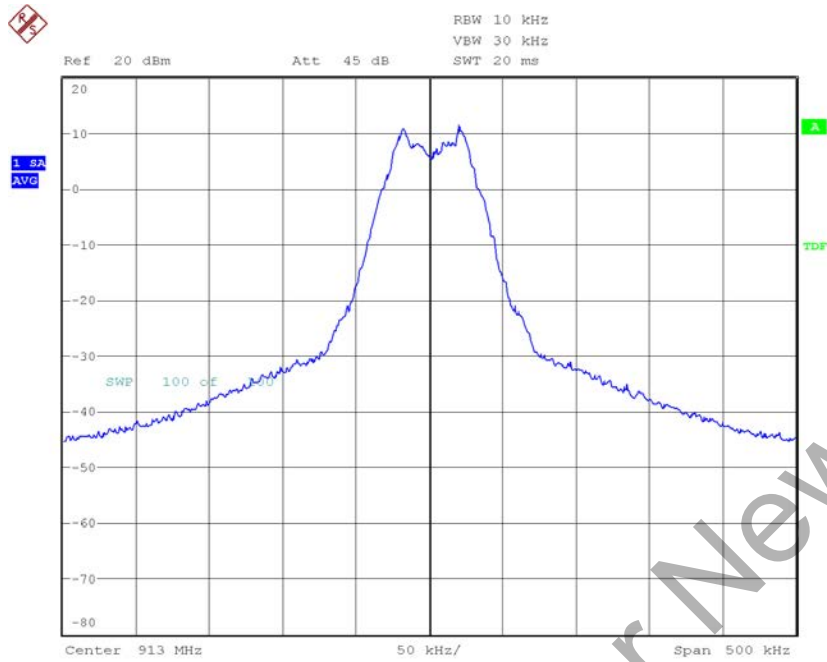
Date: 26.AUG.2010 10:54:56

1.4. Portable Demo Quick Start
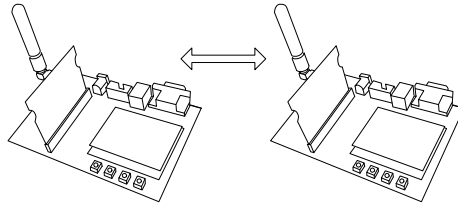
Note: This demo available with Software Development Board firmware v3.74 and later.

This demo will configure two Si10xx devices to ping-pong a message back and forth.   One node will send a packet to the second. If the second receives it, it will reply with an ACKnlowledgement. The transmitting node will compute the packet error ratio (PER) as the ratio of packets sent and acknowledged to the total number of packets sent.

1. Connect the two Si1000 wireless MCU daughtercards to their respective software development boards.

2. Connect power to each.

3. Download the SPI_PassThrough code to each. (See "3. Silicon Laboratories IDE Code Download" on page 16).

   File location: C:\SiLabs\MCU\Examples\Si100x\EZRadioPRO\SPI_PassThrough.
   (Installed automatically with the Silicon Labs IDE)

   Select the appropriate version:
   - SPI_PassThrough_Si101x.hex: For all Si101x devices
   - SPI_PassThrough_Si1000.hex: For Si1000
   - SPI_PassThrough_Si1004.hex: For Si1004

4. Press reset on each node; the Welcome message should appear:

5. On menu page 1/4, Select the DEMO function, TRx mode, press GO.
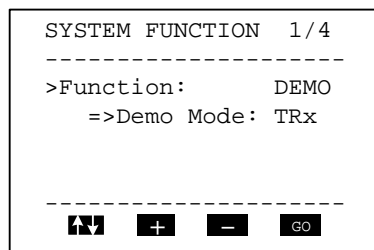
6. On page 2/4, select 2.4 kbps, GFSK, 903.0 MHz, and GO:

```
RF   PARAMETERS  2/4
--------------------
>Data Rate:  2.4kpbs
 Modulation: GFSK
 Frequency: 903.00MHz


--------------------
  [⚏]   [+]   [–]   GO
```

7. On page 3/4, select output power +8 dBm and GO:

```
RF   PARAMETERS  3/4
--------------------
>Output power: +8dBm



--------------------
  [⚏]   [+]   [–]   GO
```

8. On page 4/4, change ID: Destination to match the other card's ID: Self:
   - Choose Packet length =5 and Max. Packets: 1000
   - Select GO

Node 1:   Node 2:

```
NODE PARAMETERS  4/4        NODE PARAMETERS  4/4
--------------------        --------------------
 ID: Self:       111         ID: Self:       176
>ID: Destination: 176       >ID: Destination: 111
 Packet length:    5         Packet length:    5
 Max. Packets:  1000         Max. Packets:  1000
--------------------        --------------------
  [⚏]  [+]  [–]  GO           [⚏]  [+]  [–]  GO
```

9. Press TXON on Node 1.
   - This will send a packet to Node 2.
   - Node 2 will reply with an ACK.
   - Node 1 will update its PER count (a missed ACK counts as an error).
   - Repeat sending a packet to Node 2.

Node 1:   Node 2:

```
 TX   RX   Y1                 TX   RX   Y1

--------------------        --------------------
Si4432  GFSK  176-111       Si4432  GFSK  111-176
2.4k/903.0M  TX/RX-SW       2.4k/903.0M  TX/RX-SW
0025/0025 PER 0.00%
ACK RECEIVED!               ACK SENT
  TX ON      SETTINGS         TX ON      SETTINGS
```

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2. For More Information

Device data sheets

- Si1000
- Si1010

Evaluation board information

- Si10xx-DK User's Guide
- SDBC-DK3 User Guide Revision 0.4
- RF card schematics and PCB layout (www.silabs.com)

Register information, programming guides, and examples

- AN440: Si4430/31/32 Register Descriptions
- AN474: Si1000 Code Examples
- AN415: EZRadioPRO® Programming Guide
- AN417: Si4x3x Family Crystal Oscillators
- Si1000/Si1010 MCU Example Code (included as part of the IDE installer)

Lab testing and evaluation

- AN439: EZRadioPRO® RF Testing Quick-Start Guide
- AN437: Si4432 RF Performance and FCC Compliance Test Results
- AN445: Si4431 RF Performance and ETSI Compliance Test Results
- AN459: Measurement Results for Si4430-B and 950 MHz ARIB STD-T96 Compliance

Design

- AN435: Si4032/4432 PA Matching
- AN436: Si4030/4031/4430/4431 PA Matching
- AN463: Raw Data Mode with EZRadioPRO®

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3. Silicon Laboratories IDE Code Download

1. Install the Silicon Labs IDE software. Use the included CD or download from www.silabs.com.
2. Connect the USB Programming Adapter to your computer.
3. Plug the radio card in to the Software Development Board or Si1000-MB.
4. Connect power
5. Connect the USB Programming Adapter ribbon cable to J1 on the radio card.
6. Launch the Silicon Labs IDE software: All Programs→ Silicon Laboratories → Silicon Laboratories IDE
7. Establish a connection to the Si1000 device: Debug → Connect
8. Select the hex file to download: Debug → Download Object File. Choose the file, then select Download to initiate the programming.
9. Verify the successful download.
10. Disconnect the connection from IDE to Si1000 device: Debug → Disconnect
11. Disconnect the USB Programming Adapter ribbon cable.
12. Reset by cycling the power.

4. Contact Information

Please visit the Silicon Labs Technical Support web page:
https://www.silabs.com/support/pages/contacttechnicalsupport.aspx
and register to submit a technical support request.

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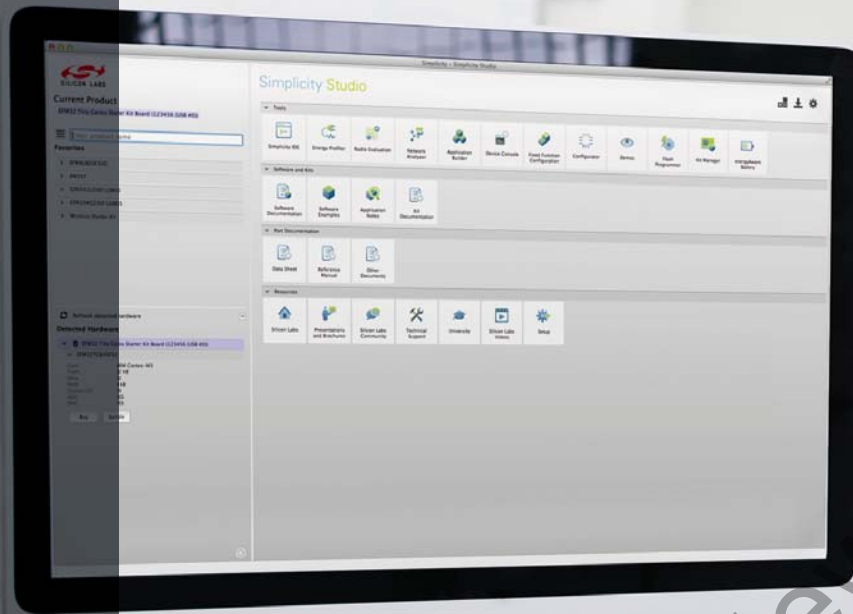
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