

F143-MINI-X-GEVK Quick Start Guide

F143 Mini DVK Introduction

The F143-MINI-x-GEVK (also referred to as the F143 Mini DVK) is designed as quick start solution for the development of applications with the AX8052F143 RF System-on-Chip (SoC). This SoC combines the AX8052 ultra-low power microcontroller with the AX5043 ultra-low power RF transceiver in a single IC package. This development kit is optimized for 868 MHz, however it can be easily configured in software to operate at 915 MHz with only a small decrease in RF performance. The F143 Mini DVK is compatible with AX-RadioLab and AxCode::Blocks development software for the PC.



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APPLICATION NOTE



Figure 1.

The F143 Mini Kit comes with:

- 1x F143-MINI-A-MOD-GEVB (SMA, no battery holder)
- 1x F143-MINI-B-MOD-GEVB (Chip antenna, LR44 button cell battery holder)
- 1x AXDBG debug adapter
- 1x Mini USB cable
- 1x Debug cable

Getting Started With the F143 Mini DVK

To begin configuration of the radio and application development, the following steps should be completed in order:

1. Download and install the required software for the desired combination of main board and add-on modules.
2. Configure AXCode::Blocks to use the SDCC compiler

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3. Connect one of the boards to the debug adapter with the debug cable as shown in the image below. Connect the AX debug adapter to the PC.

4. Launch AX–RadioLab or AXCode::Blocks to begin configuring the application.

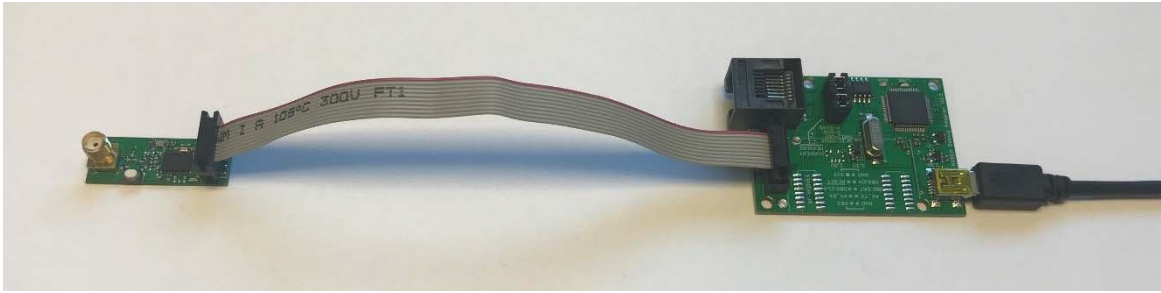


Figure 2.

F143–MINI–A–MOD–GEVB Overview

The F143–MINI–A–MOD–GEVB mainboard is the first of two boards in the F143–MINI–x–GEVK. It features the AX8052F143 ultra–low power SoC, as well as an LED, button, and a 50 Ω SMA port. In addition to the antennas

shipped with the kit, various 50– Ω antennas with male SMA connectors can be used. The SMA port can also be used to connect the DVK to RF measurement equipment for conducted–mode testing.

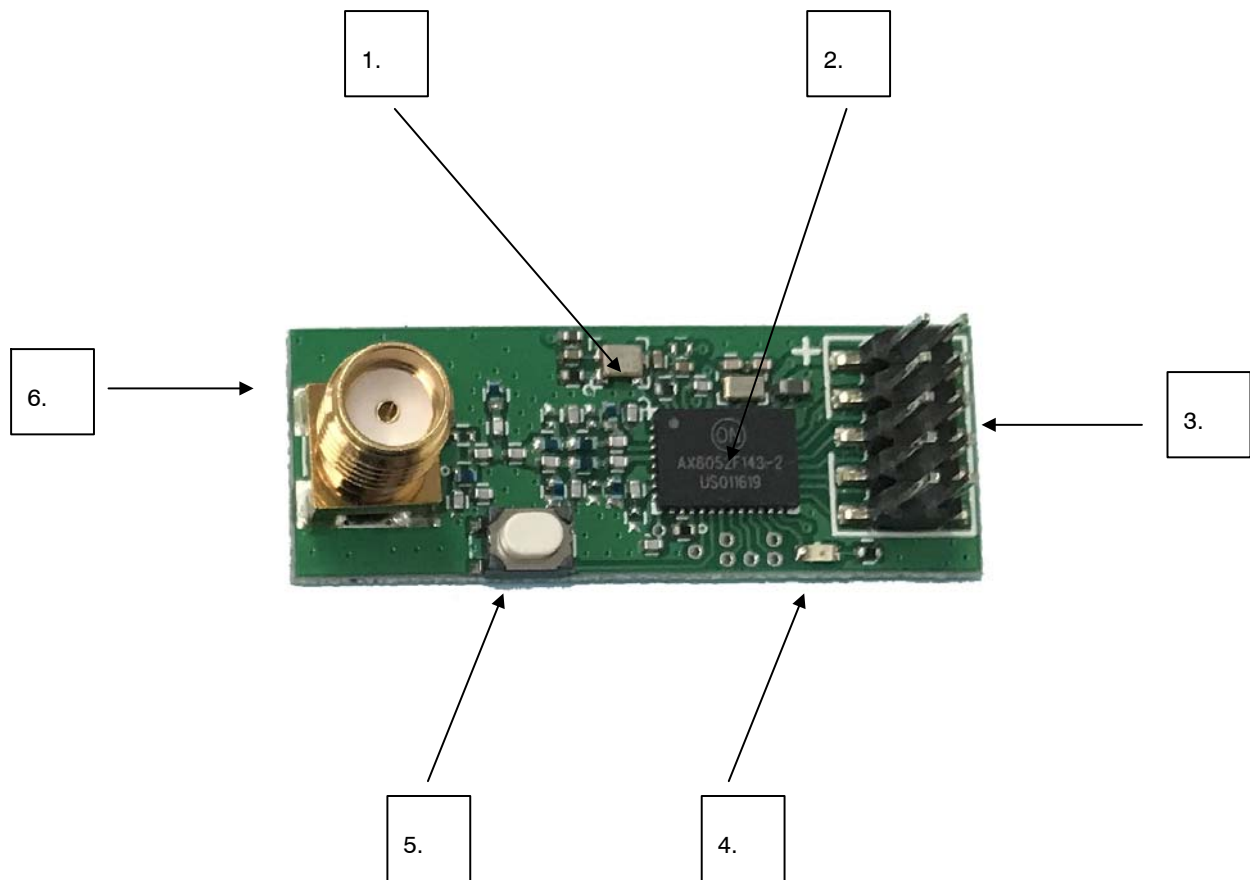


Figure 3.

The F143–MINI–A–MOD–GEVB is equipped with the following components:

1. 48 MHz TCXO
2. AX8052F143 ultra–low power RF SoC

3. AX debug link connector
4. Programmable LED
5. Programmable button
6. 50 Ω SMA connector

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F143-MINI-B-MOD-GEVB Overview

The F143-MINI-B-MOD-GEVB mainboard is the second of two boards in the F143-MINI-x-GEVK. It

features the AX8052F143 ultra-low power SoC, as well as an LED, button, battery, and chip antenna.

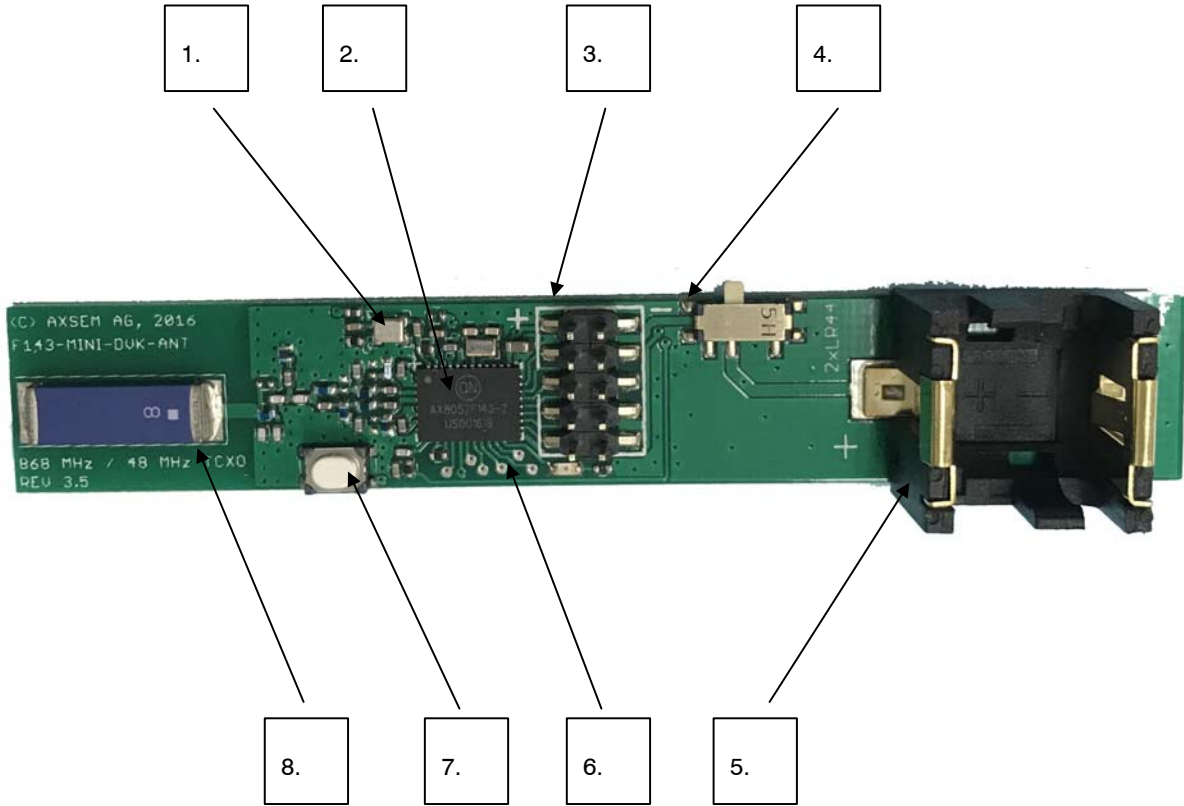


Figure 4.

The F143-MINI-B-MOD-GEVB is equipped with the following components:

1. 48 MHz TCXO
2. AX8052F143 ultra-low power RF SoC
3. AX debug link connector
4. Power supply switch (select between debug link and battery powered operation)
5. LR44 Button cell battery holder
6. Programmable LED
7. Programmable button
8. 868 MHz Chip antenna

AXDBG Debug Adapter Overview

The AXDBG debug adapter is the interface between the PC and the mainboards. It can be used for programming and debugging the AX8052F1xx family of micro-controllers. It interfaces with the PC via windows drivers and the AXSDB software interface, which is then used by other AX software products. The AXSDB can also be used in mass production with the scriptable AXSDB software.

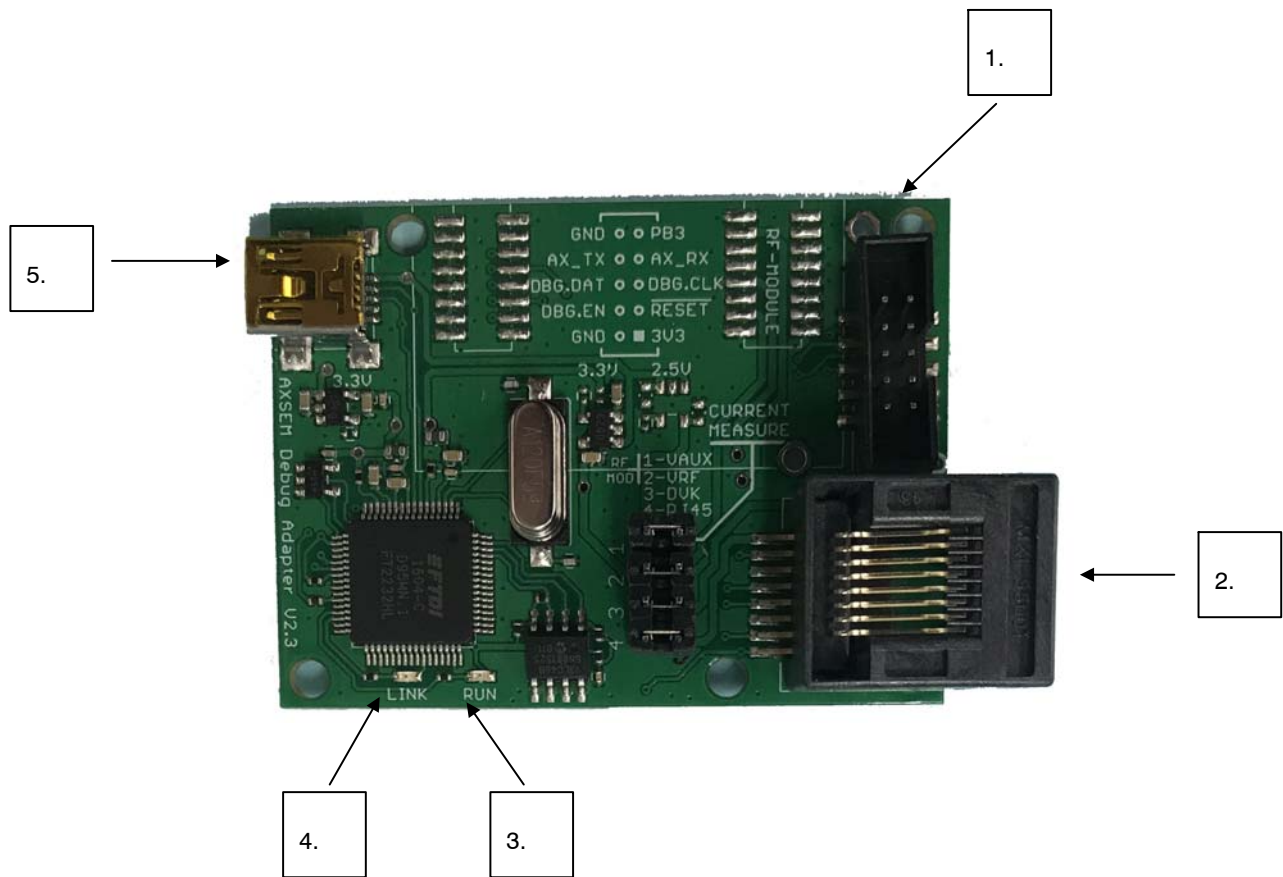


Figure 5.

The AXDBG has the following interfaces and indicators:

1. Debug link connector
2. RJ45 Connector or legacy AX DVK systems
3. LED green indicating a program is executed on the MCU
4. LED red indicating the debug link is active, MCU in debug mode
5. Mini USB PC interface

Software Installation

To build applications and configure the AX8052F143 with the F143-MINI-x-GEVK, AX-RadioLab and AXCode::Blocks are required. They can be found on the AX8052F143 Product page as a single package which installs both software applications.

(<http://www.onsemi.com/PowerSolutions/product.do?id=AX8052F143>)

To install:

First, download the software package specified above. It installs the AxCode::Blocks IDE, the SDCC C-compiler, the LibMF support libraries, the AXSDB command line debugger and windows drivers, as well as AX-RadioLab.

NOTE: The installer requests reboots of the computer, which is not necessary.

The default location for AX-RadioLab, AxCode::Blocks and AXSDB is in the c:\program files\AXSEM directory. LibMF and the supporting libraries are installed in the AXSDB directory. The SDCC C-compiler is typically installed directly into the c:\program files directory.

Please check the respective documentations for further detail. (Available on AX8052F143 product page linked above)

Configuration of AxCode::Blocks

After starting AxCode::Blocks for the first time, the user has to select SDCC as the default compiler. The following

window will pop-up. After this configuration process you are ready to go.

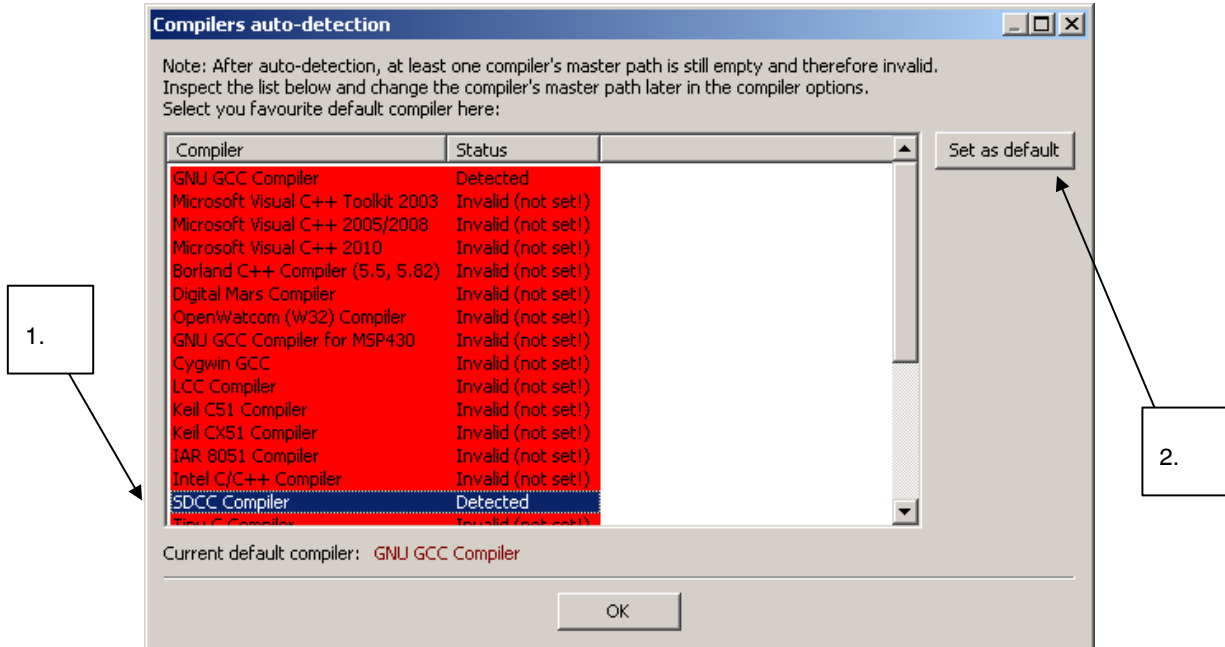


Figure 6.

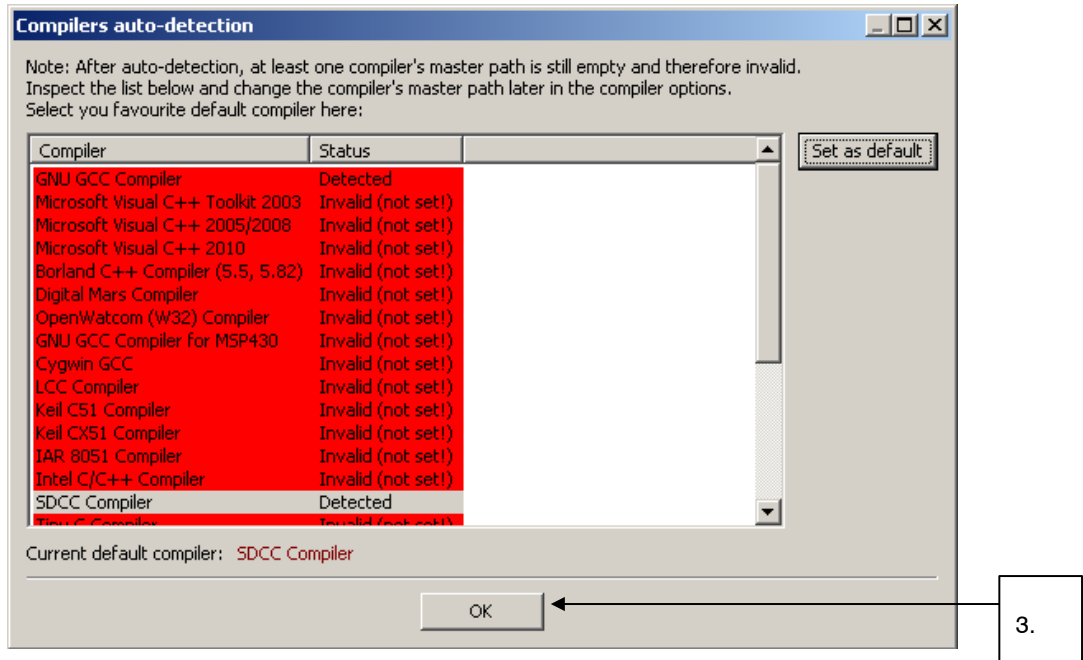


Figure 7.

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Connecting the F143 Mini DVK to a PC

- Step 1: Verify the proper software is installed and configured, as detailed in the previous sections.
- Step 2: Connect the AXDBG via the USB cable to the computer. Since the driver is already installed, the

computer should report 2 “USB Serial Converters” as well as a “USB Serial Port” in your Device Manager.

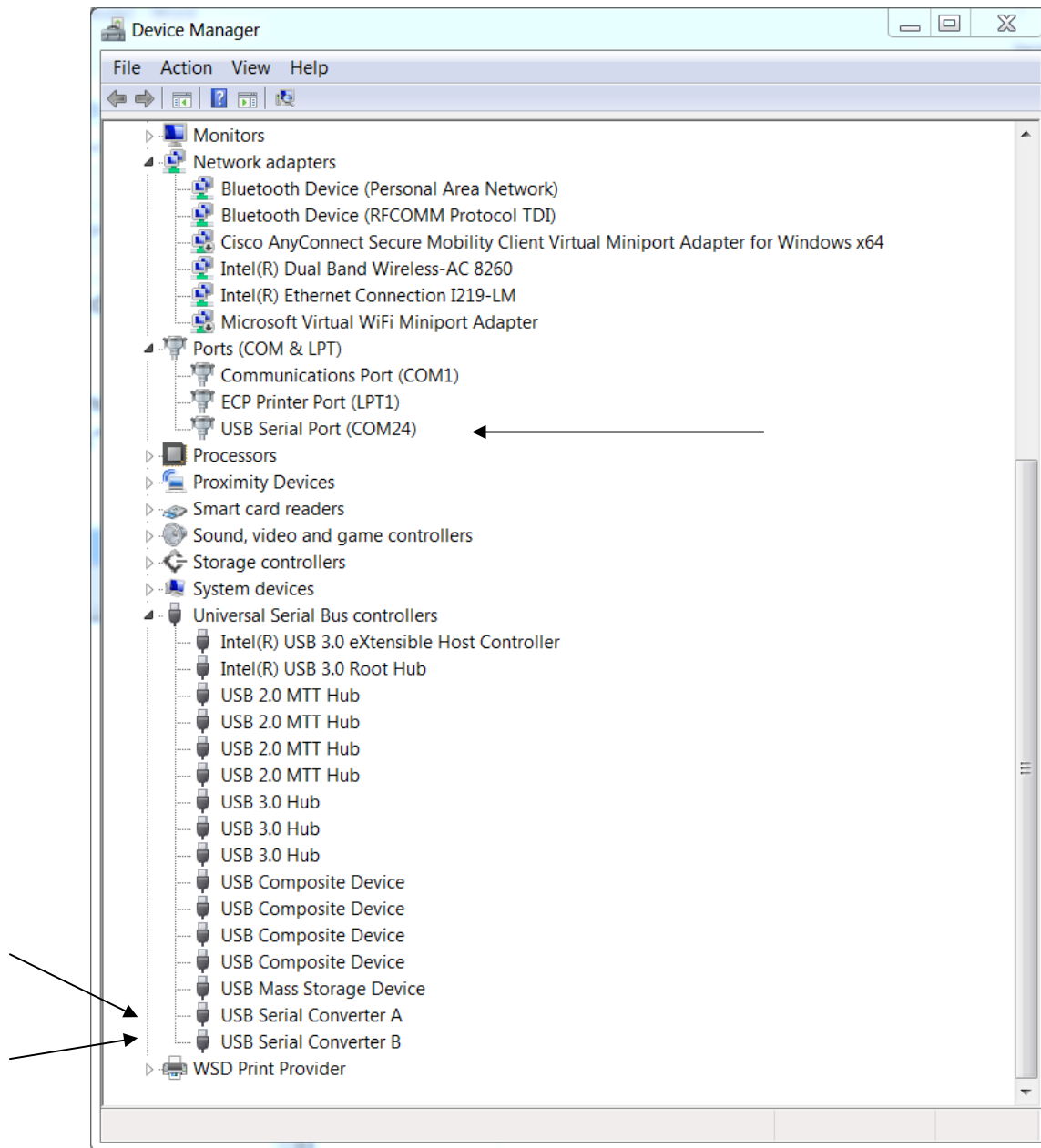


Figure 8.

- Step 3: Connect a F143 Mini DVK via the debug cable to the AXDBG debug adapter.

NOTE: If either the Serial Converter or Serial Port do not appear as shown above, see the “AX Development Systems – Troubleshooting Guide.”
(<http://www.onsemi.com/pub/Collateral/AND9621-D.PDF>)

Working With AX–RadioLab

AX–RadioLab is the most advanced development tool for SDR radio applications. It offers a variety of transmitter and receiver options such as

- Periodic transmission of packets timed with the RC oscillator of the AX5043
- Periodic transmission of packets timed with the 32 kHz XTAL oscillator of the MCU

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- Transmit on push-button
- Wake-on-radio reception with programmable wake-up interval
- Synchronous transmit and receive with programmable wake-up interval
- Optional acknowledge package send for all modes

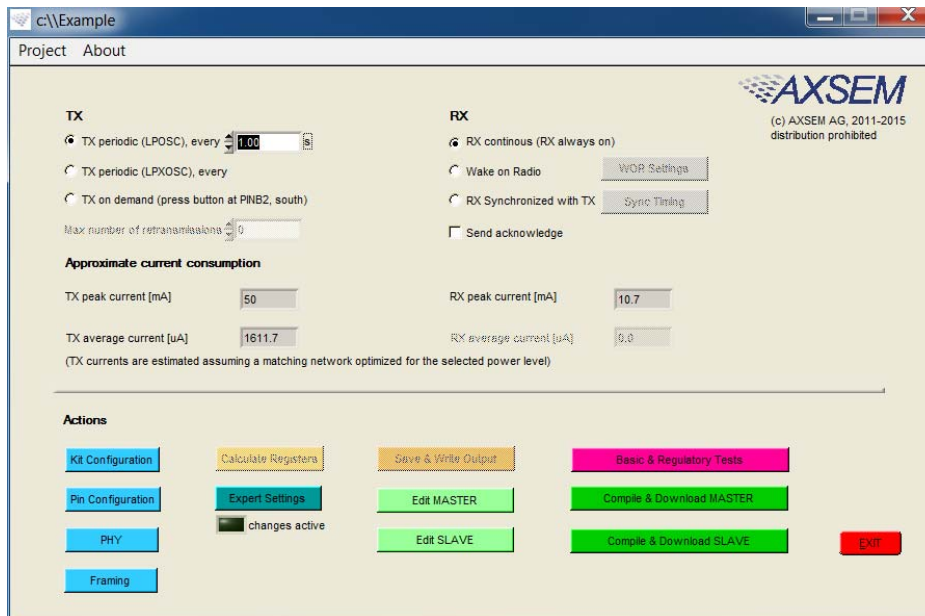


Figure 9.

Additionally, AX-RadioLab allows the user to configure the packet format, as well as PHY parameters.

Since AX-RadioLab is a source code generator, the developer can use the generated C code example project as a robust foundation upon which to build the end application.

AX-RadioLab also estimates the power consumption of the radio device. For most modes the AX8052F100 power consumption is negligible. Average and peak currents are indicated for transmitter and receiver.

Additional documentation for AX-RadioLab can be found on the AX8052F143 product page.

(<http://www.onsemi.com/PowerSolutions/product.do?id=AX8052F143>)

Working With AxCode::Blocks

AxCode::Blocks is the graphical IDE for code development on AX micro-controllers. It enables the developer to access all the debugging features of the AX micro-controllers, in particular:

- Unlimited (limited only by memory size) number of break points
- Access to all AX8052F1xx MCU registers as well as to all AX radio chip registers
- Debug link UART in a window for debugging printf-style without the need of extra hardware
- SDCC C-compiler pre-installed and ready to go

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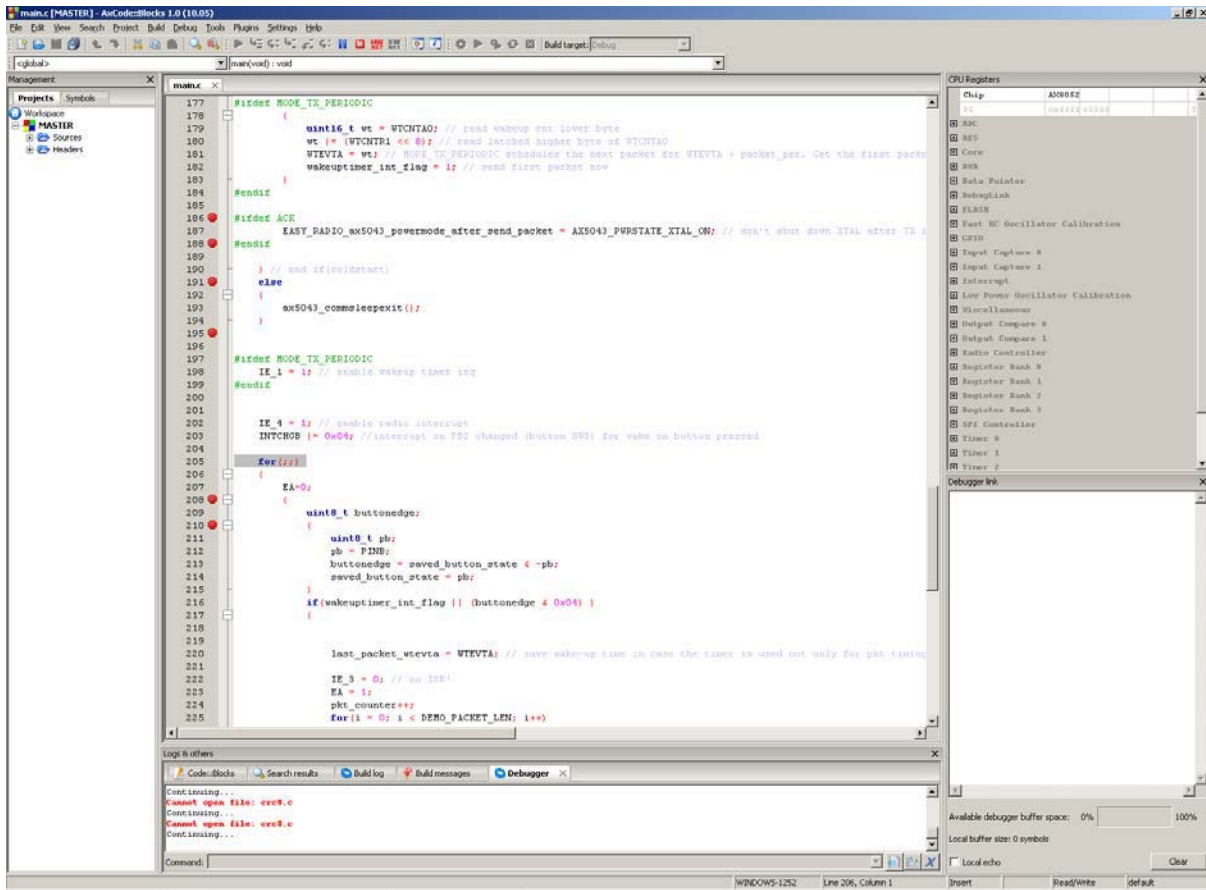


Figure 10.

Additional documentation for AXCode::Blocks can be found on the AX8052F100 product page.

<http://www.onsemi.com/PowerSolutions/product.do?id=AX8052F100>)

Interaction Between Development Tools

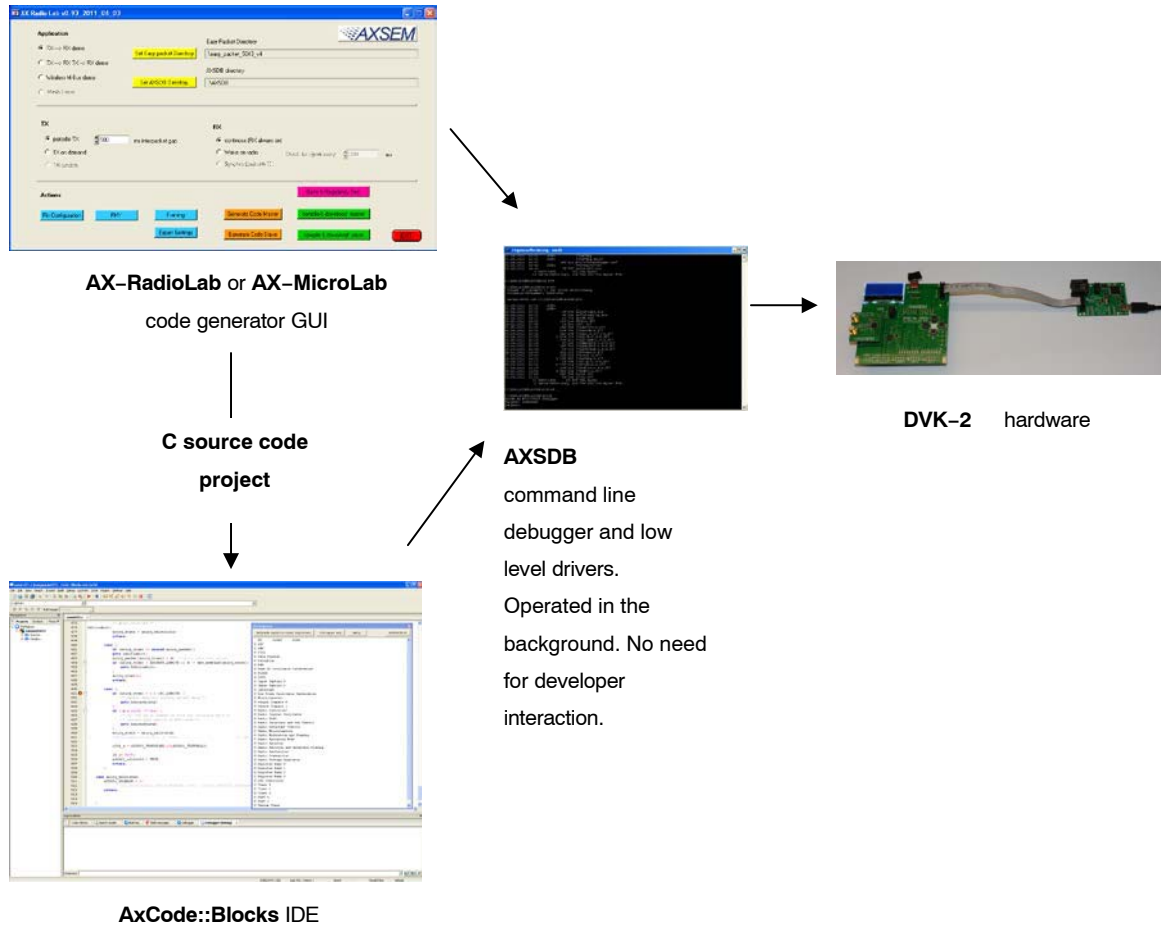


Figure 11.

The AX8052-IDE-setup.exe contains all tools for developing and debugging C source code applications for the AX8052F1xx family of micro-controllers.

The AX-RadioLab GUI is a code generator, which configures C code, which can then be compiled and downloaded directly from the AX-RadioLab or it can be edited, modified and debugged in the AxCode::Blocks IDE.

The user normally starts in the AX-RadioLab GUI, which generates all necessary configuration and program files. The project can optionally be viewed and modified in AxCode::Blocks. Be aware that there are no protective mechanisms in the AxCode::Blocks to prevent malfunction of modified C code.

For details look into the documentation of AX-RadioLab and AxCode::Blocks.

Saving Factory Calibration Data

The AX8052F1xx MCU contains factory calibration data. This data is stored in the topmost sector of the flash memory (address 0xFC00). When programming the MCU using the axsdb command line debugger, the AxCode::Blocks IDE or

AX-RadioLAB, the calibration data is automatically saved and written back to the flash memory. However, experience shows that in a laboratory environment the calibration data occasionally gets lost due to software crashes, removing a cable in the wrong moment etc. It is recommended to back up the calibration data to a file, so it can be recovered in the case of accidental loss. The calibration data can be saved by opening a windows command window (enter cmd) in the windows start menu and entering the command

axsdb --savecalib=caldata_board1.txt

Repeat this for the second F143 Mini DVK board:

axsdb --savecalib=caldata_board2.txt

Please mark the F143 Mini boards (board1, board2), so you know which file belongs to which board.

The calibration data can be restored from the file using

axsdb --loadcalib=caldata_board1.txt

NOTE: For further documentation, see the AXSDB user manual.

(<http://www.onsemi.com/pub/Collateral/AND9370-D.PDF>)

Glossary

AxCode::Blocks: An IDE for AX8052F1xx micro-controllers

AX-RadioLab: An application C code and settings generator for the AX5043 radio chip running on the AX8052F100 micro-controller, as well as the AX8052F143 SoC

Debug link: The interface between AXDBG debug adapter and AX8052F1xx micro-controllers

AXDBG: The USB debug adapter for AX8052F1xx micro-controllers

AXSDB: A command line debugger using AXDBG. It is also fully suitable for use in mass production

SDCC: A C-compiler for AX8052F1xx micro-controllers


F143 Mini DVK: (A.K.A. F143-MINI-x-GEVK) Mini DVK

AX8052F143: System on Chip (SoC) that combines the AX8052F100 and the AX5043 into a single IC package.

AX8052F100: The ultra-low-power micro-controller co-packaged with the AX5043 transceiver in the AX8052F143

LibMF: Support libraries for the AX8052F100 and the F143 Mini Kit It normally includes the libraries libax5031, libax5031, libax5042, libax5051, libax5043, which are in separate directories

LibMFCrypto: A library which enables the use of the AES or DES functionality of the AX8052F1xx micro-controllers

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