ADuCRF101 Get Started Guide

A Tutorial Guide for use with the ADuCRF101 Development Systems

Version 0.3

CONTENTS:

Introduction **pg 3**

(1) Hardware **pg 4**

(2) Installation **pg 5**

(3) Demo code **pg 6**

(4) Windows Serial Downloader **pg 21**

(5) Radio Evaluation Tool **pg 22**

(6) Documentation **pg 23**

INTRODUCTION

EVAL-ADuCRF101MK1ZU1 is a development system for evaluation of ADuCRF101 first samples. It includes a Mini-Board and a CD.

The CD contains the following:
- demo code
- documentation
- software tools

The software tools discussed during this Get Started tutorial guide are as follows:

TOOL	EXECUTABLE	FUNCTION
IAR EMBEDDED WORKBENCH IDE	IarIdePM.exe	The IAR Embedded Workbench IDE provided on this CD is a complete IDE (Integrated Development Environment) integrating all the tools necessary to edit, assemble/compile/link and debug assembly code and C code, via the serial wire debug port. Non-intrusive emulation is done through serial wire debug using the Jlink lite available in USB-SWD/UAR-CONVZ kit.
KEIL UVISION4	UV4.EXE	The Keil uVision4 IDE provided on this CD is a complete IDE (Integrated Development Environment) integrating all the tools necessary to edit, assemble/compile/link and debug assembly code and C code, via the serial wire debug port. Non-intrusive emulation is done through serial wire debug using the Jlink lite available in USB-SWD/UAR-CONVZ kit.
CM3WSD	CM3WSD.exe	Windows serial downloader
RADIO EVALUATION TOOL	ADUCRF101.EXE	Labview based executable for controlling the radio.

Warning: This kit contains unreleased material, layout, features and performance subject to change.

(1) HARDWARE

EVAL-ADuCRF101MK1ZU1 is a Mini-Kit for ADuCRF101 first samples. It features a Mini-Board (EVAL-ADUCRF101MKXZ) and comprehensive development tools included on the CD.

The Mini-Board facilitates performance evaluation of the device with a minimum of external components. The board schematic is available on the CD in the documentation folder.

It is recommended to use the ADuCRF101 mini-board in conjunction with the Interface board (USB-SWD/UART-CONVZ) for non-intrusive Serial Wire Emulation.

The USB-SWD/UART-CONVZ kit includes a J-Link Lite from Segger as well as the interface board.

The interface board interfaces a PC USB port to the ADuCRF101 mini-board, providing supply, UART communication and debug capability. The board schematic is also available on the CD in the documentation folder.

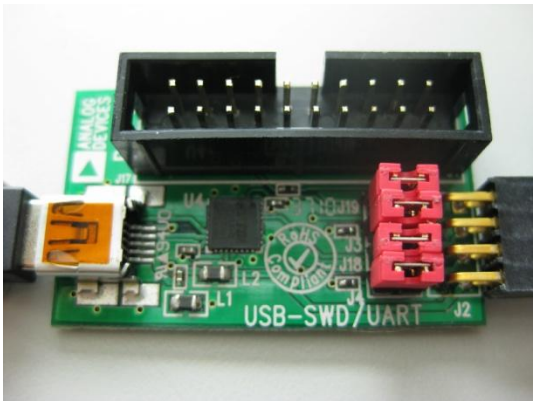


Figure 1. Interface board.

Required software for the USB-SWD/UART-CONVZ is included on the CD in the ADuCRF101 Mini-Kit.

This GetStarted Guide covers tools installation in the following sections.

(2) INSTALLATION

2.1 Installing from CD:

- It is recommended to close all your applications.
- Insert the CD ROM into your CD ROM drive and copy the Beta_ADuCRF101v0.3 folders to your hard drive. This document assumes it is copied on the C drive.

2.2 USB Driver Installation:

The following steps should be performed BEFORE plugging any USB devices into the PC.

Jlink Lite installation: (For USB-SWD/UART-CONVZ)

- To install the Jlink Lite drivers, extract Setup_JLinkARM_V428c.zip on your computer and run the executable Setup_JLinkARM_V428c.exe.
- Follow the on screen instructions.

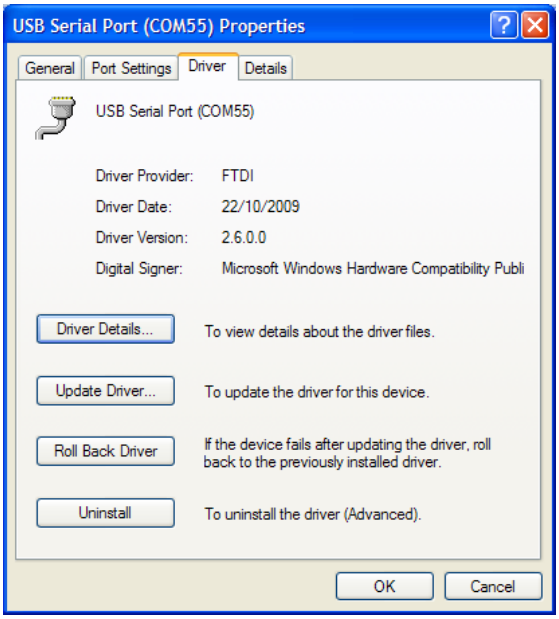
USB driver installation: (For USB-SWD/UART-CONVZ)

Note that the mini-board can be powered via USB without installing the driver.

It is necessary to install the USB driver in order to be able to communicate with the ADuCRF101 serial port via the USB device included on the board.

Extract the files from CDM 2.06.00 WHQL Certified.zip situated under software tools/USB drivers.

- Plug in the mini-board. When the "found new hardware" window appears, select the extracted file. In case of previous installed drivers, ensure that the driver version is as shown below.



2.3 IAR Tools installation:

IAR Embedded Workbench installation:

An evaluation version of IAR Embedded Workbench is included on the CD.

Note that IAR Embedded Workbench 6.10 (or above) is required as previous versions of this package do not support the ADuCRF101.

IAR Embedded Workbench is required for building the supplied examples, and also for download and debug of applications via the Serial Wire interface.

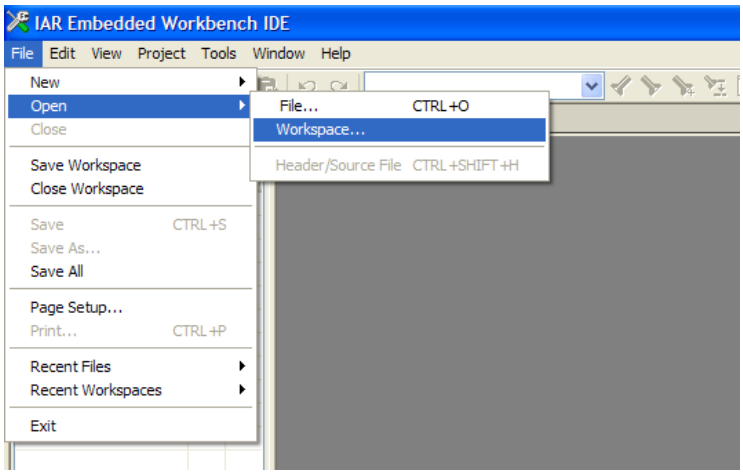
- To install the IAR Embedded Workbench, double click on the file "EWARM-KS-CD-6101.exe" under the IAR folder on the CD.
- Follow the on screen instructions. IAR Embedded Workbench will require registering on IAR website to obtain a free license key.

(3) DEMO CODE

An IAR workspace is provided - C:\Beta_ADuCRF101v0.3\demo code\EVAL-ADuCRF101MKxZ\Examples\ADUCRF101Examples.eww - including three projects: "Blink" and "PowerDown" and "Simple1".

- "Blink" demonstrates the use of the UART and blinks an LED on the ADuCRF101 mini-board.
- "PowerDown" demonstrates the low power consumption of the ADuCRF101 device.
- "Simple1" provides a demonstration of the radio operation.

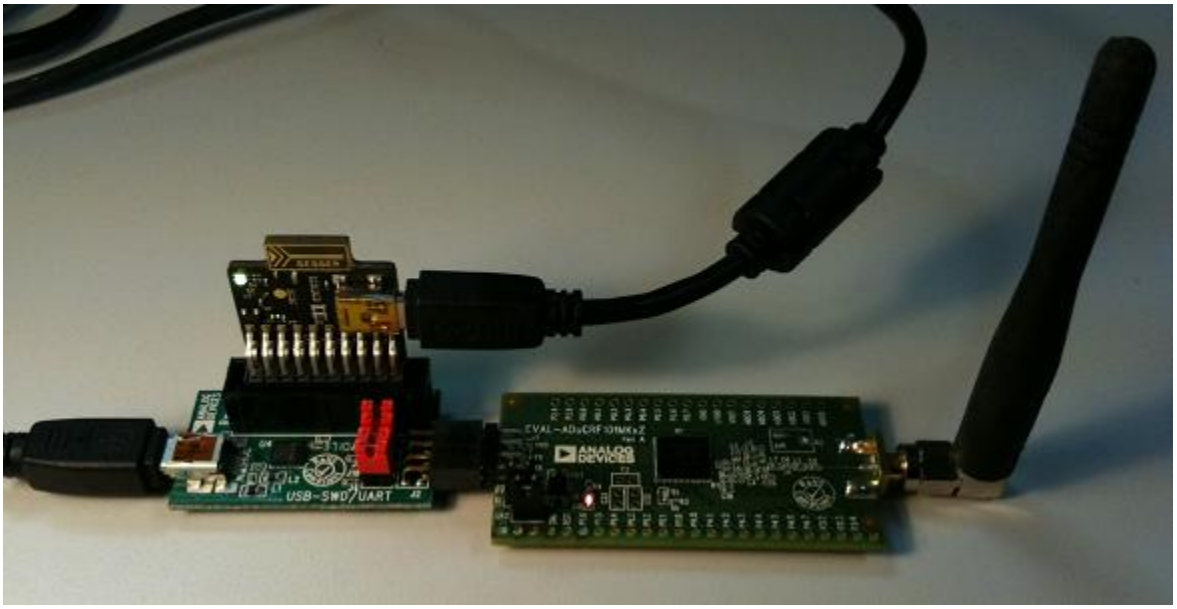
Open this workspace by selecting File->Open->Workspace… and navigating to this workspace file.



Periodically check the ADuCRF101 product page on the Analog Devices website where additional example programs will be posted from time to time.

3.1 Preparing the hardware

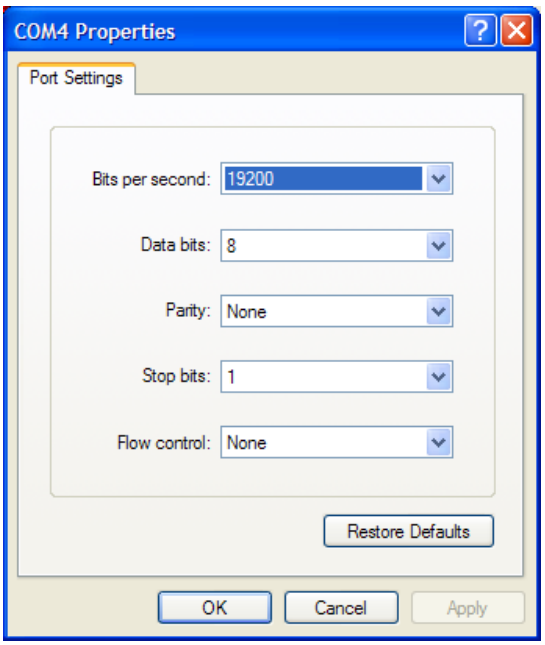
- Connect the ADuCRF101 mini-board to the interface board.
- Connect the interface board to your PC using the USB cable .
- Connect the interface board to the J-Link Lite emulator.
- Connect the J-Link Lite to your PC using the 2nd USB cable.



The USB cable provides supply and allows UART communication between the mini-board and the PC.
Links LK1 and LK2 must be inserted on the ADuCRF101 mini-board. Links LK1, 2 3, and 4 should be inserted on the interface board.

3.2 Serial communication with the PC

Open HyperTerminal, select the COM port corresponding to the USB serial converter and configure it as follow:



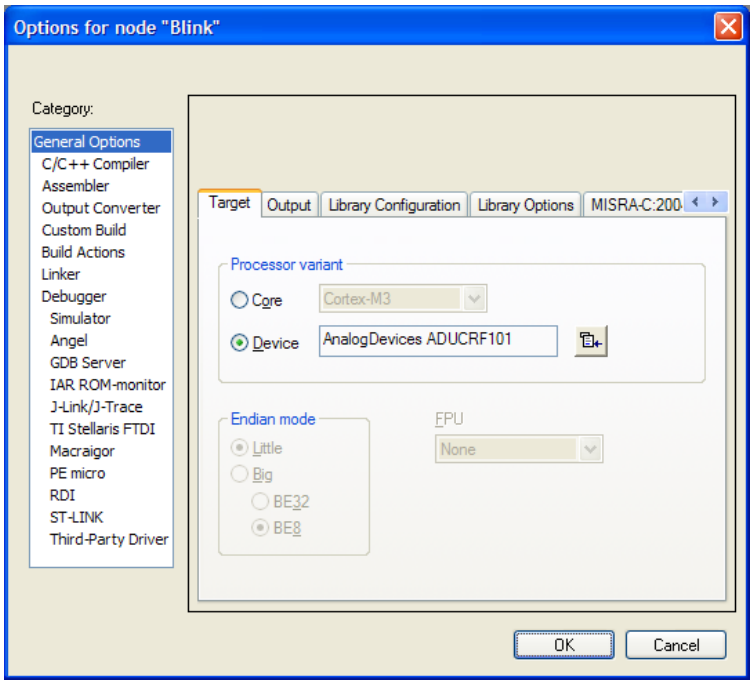
3.3 Using IAR

Open the IAR project "ADUCRF101Examples.eww" under C:\Beta_ADuCRF101v0.3\demo code\EVAL-ADUCRF101MKXZ\Examples. The "Blink" project should be active.

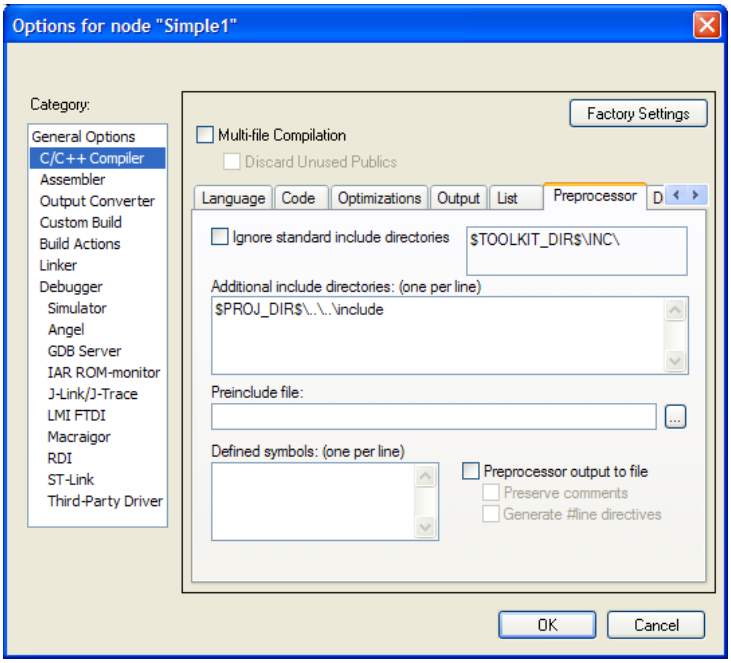
Project configuration:

The project configuration is accessible by right clicking on the project name in the workspace area or in the project pull down.

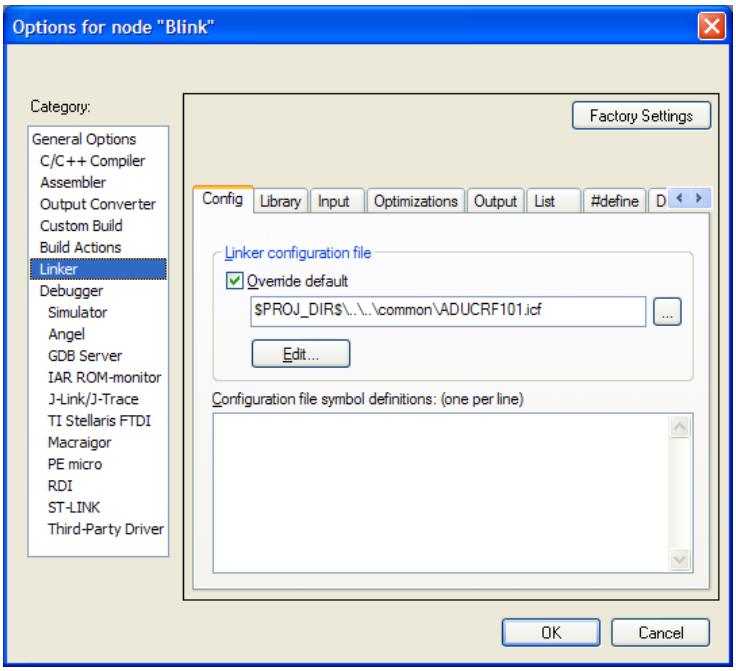
- In the "General Options" category, "Target" panel, the device selected should be "AnalogDevices ADuCRF101" as shown in the screenshot below.



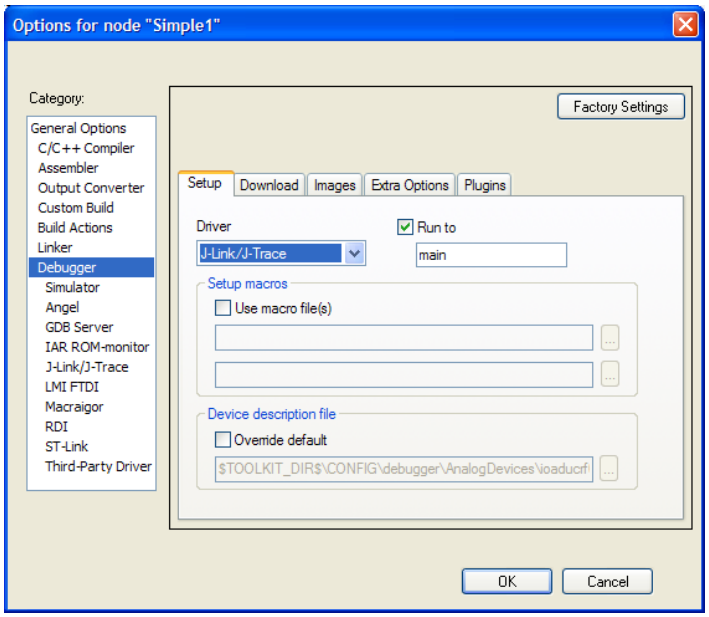
- In the “C/C++ Compiler” category, “Preprocessor” panel, the include directory should be specified as shown below.



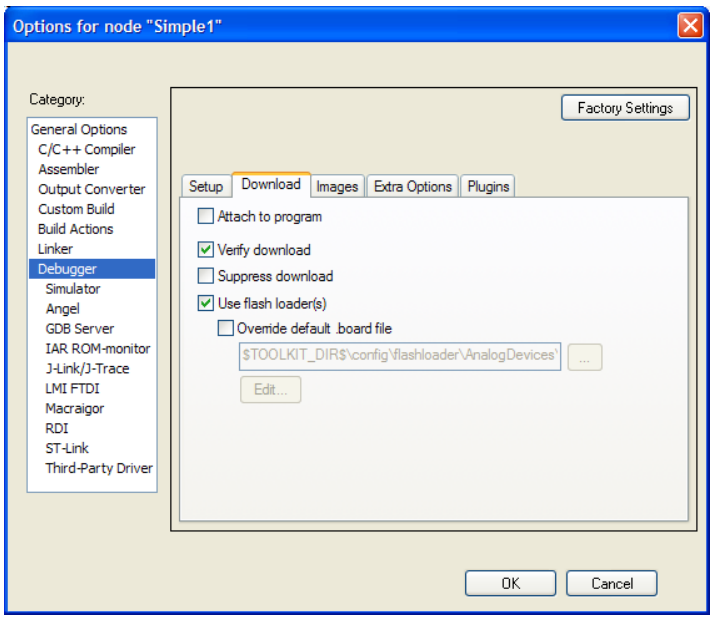
- In the “Linker” category, in the “Config” panel, the “Linker configuration file” should be overridden using the file as shown below.



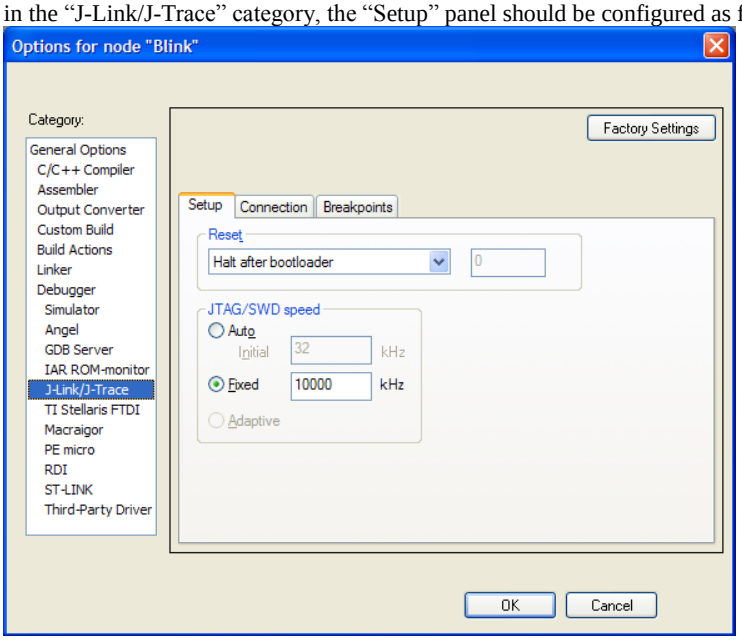
- In the “Debugger” category, setup panel, J-Link/J-Trace Driver should be selected, as well as run to main option ticked.



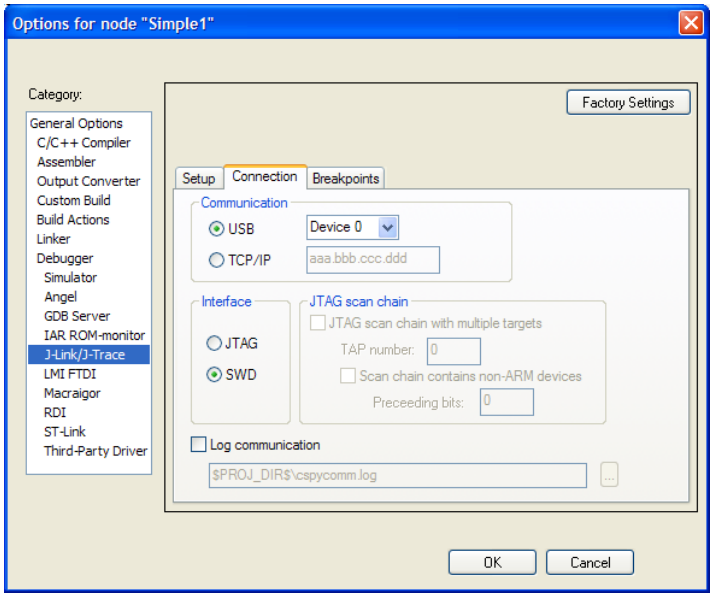
- In the “Download” panel, “Verify download” and “Use flash loader(s)” should be selected.



- Finally in the “J-Link/J-Trace” category, the “Setup” panel should be configured as follow.



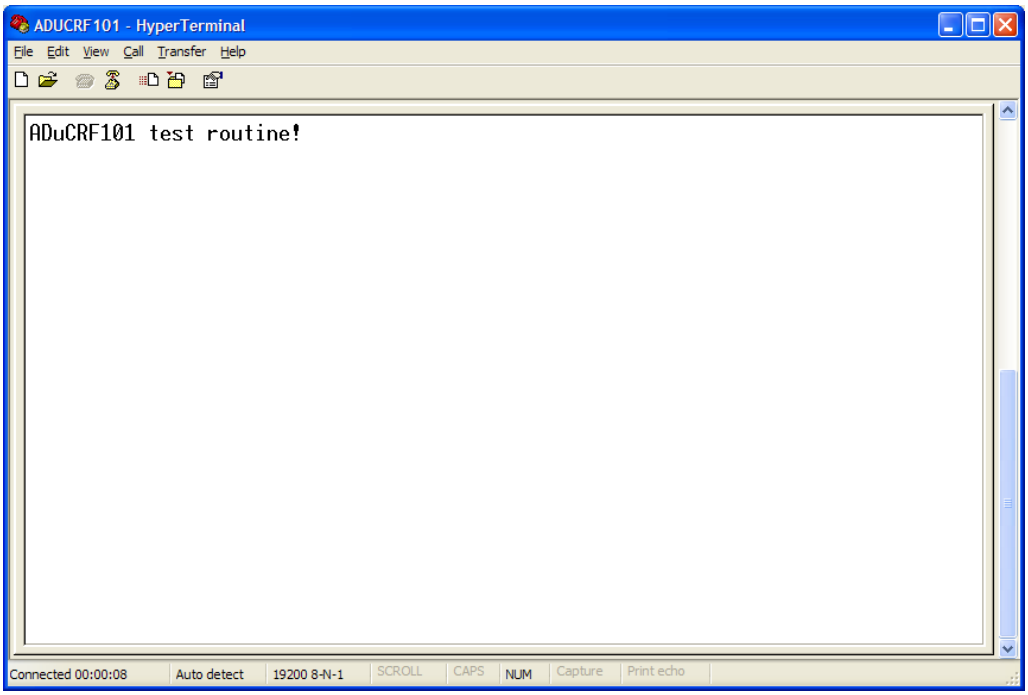
- The “Connection” panel should be configured as follow.



Downloading and debugging the project:

Download/debug by pressing the debug button  . Debugging of the code execution will start at the start of the main function.
The following debug features can be used: single step, step over, breakpoint etc.

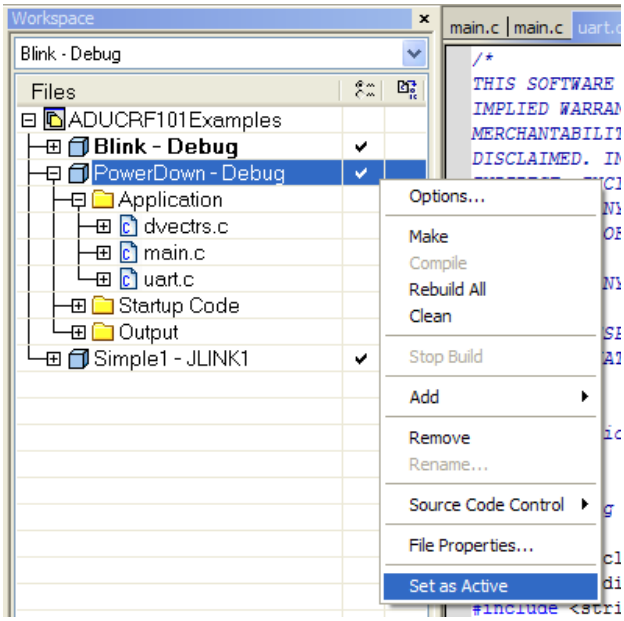
Press the go button  and in the HyperTerminal window, see the message displayed.



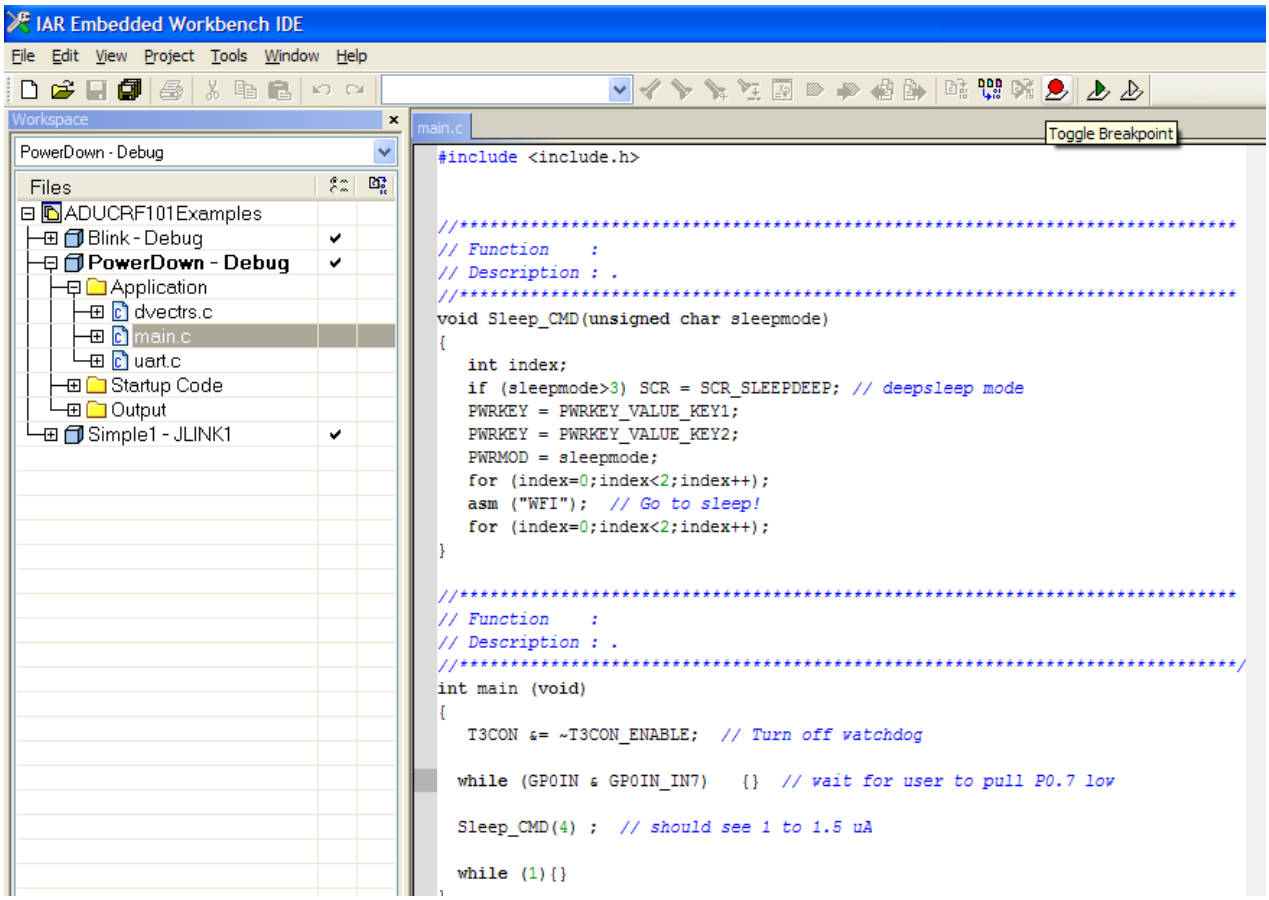
Modifying the project:
Change the message to display on the HyperTerminal.

The make button  allows recompiling the project. Press the debug button and press Go. Our new message should display on HyperTerminal.

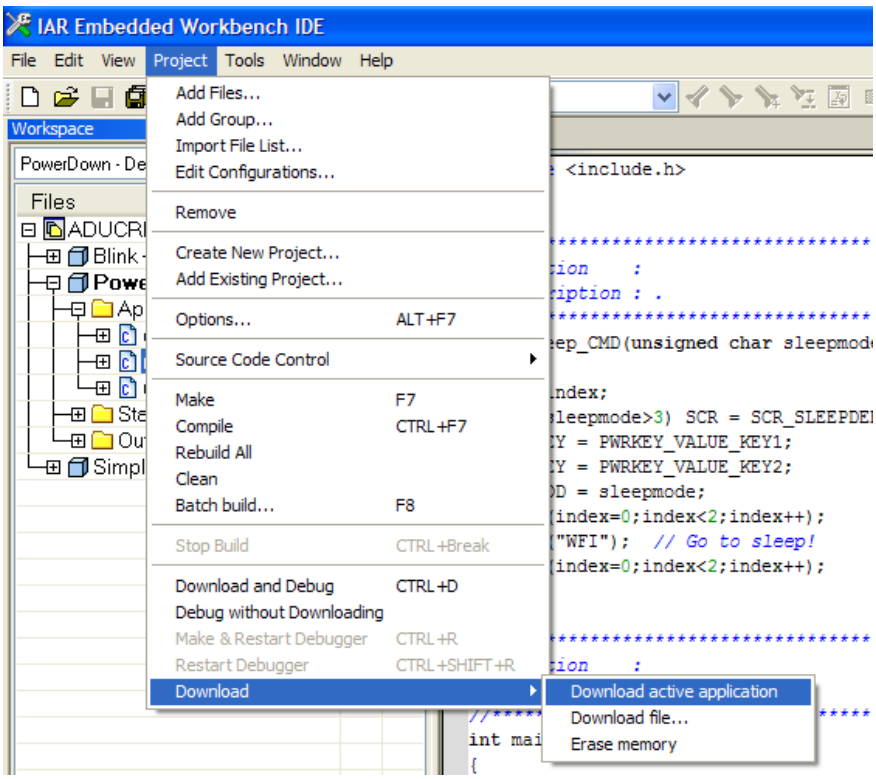
Changing project:
Right click on the PowerDown project in the workspace and click “Set as active”.



Close main.c from the previous project and open the main.c file belonging to the PowerDown project.



Download this project, by selecting “download active application” in the drop down menu

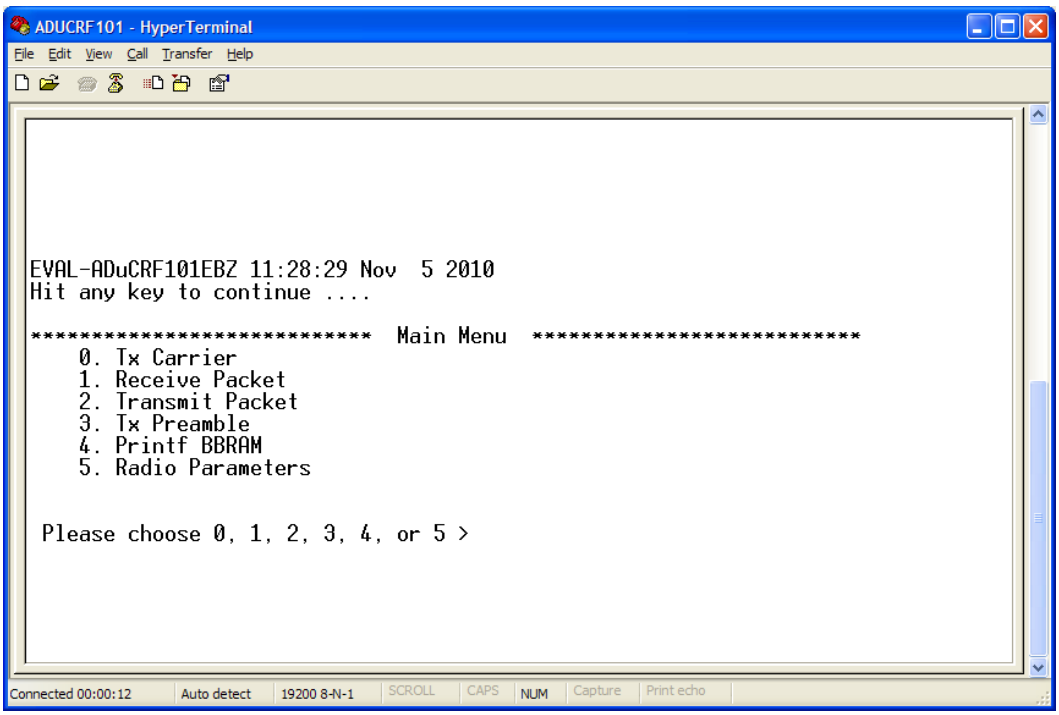


This project demonstrates how to achieve low power consumption on the ADuCRF101. An amp meter and power supply are required.

Disconnect the ADuCRF101 mini-board from the interface board. Remove LK1 And LK2. Connect J1-3 (IOVDD) to a 3V supply, and J1-4 (GND) to the amp meter. Connect the amp meter to the GND of the power supply. Consumption should be around 8mA.
Once the device is in low power mode, serial wire debug is not available. Therefore a delay must be included in user code to allow connecting via serial wire before entering low power mode. In this example, the delay is replaced by waiting on P0.7 to be pulled low. Pull P0.7 low and observe the current consumption dropping.

Changing project:
Right click on the "Simple1" project in the workspace and click "Set as active"

Download this project, by selecting "download active application" in the drop down menu as described previously.



Download this project, by selecting “download active application” in the drop down menu as described previously.

This project demonstrates some simple operations involving the radio via a Hyperterminal based menu system.

This includes the following

- Transmitting a packet.
- Reception of a packet.
- Transmission of a carrier signal.

3.4 Keil Tools installation:

Keil uVision4 installation:

An evaluation version of Keil uVision4 is included on the CD.

Note that the ADuCRF101 support is not currently included by default in current Keil uVision4 toolchains.

An add-on installer is required to be executed after the Keil uVision4 installer to add in the necessary support files.

ADuCRF101 support will be available by default in future Keil uVision4 versions.

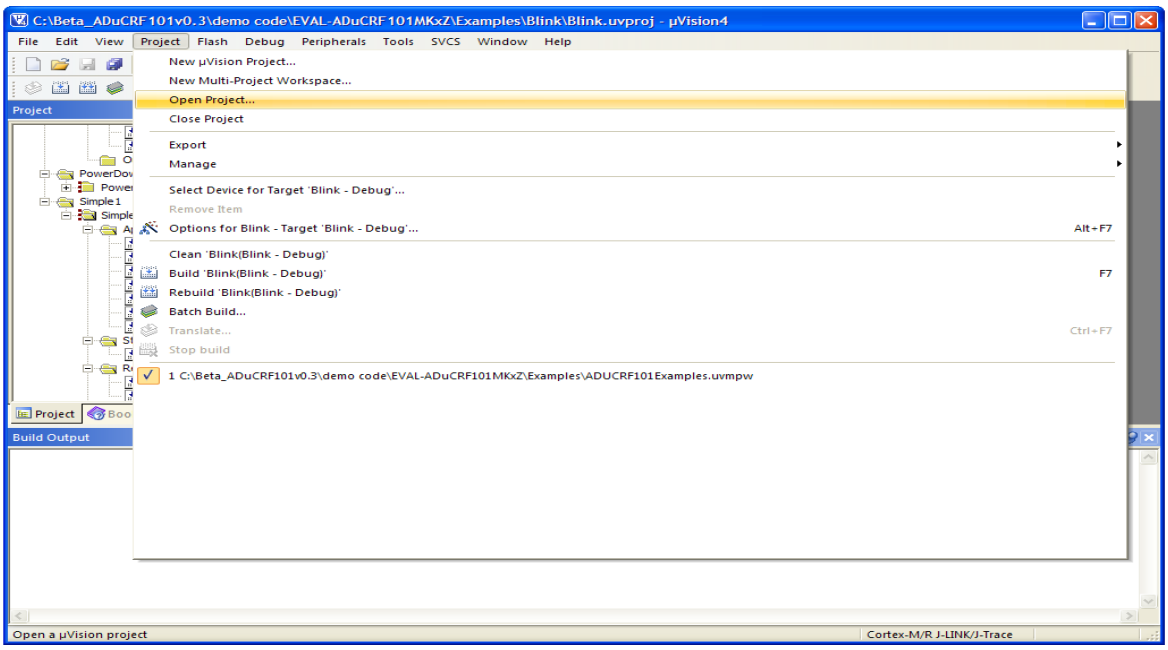
Keil uVision4 (OR the IAR toolchain) is required for building the supplied examples, and also for download and debug of applications via the Serial Wire interface.

- To install the Keil uVision4, double click on the file “MDK414.exe” under the Keil folder on the CD.
- To install the ADuCRF101 add-on patch for Keil uVision v414, double click the “AnalogDevicesKeilMDK414Update.EXE” under the Keil folder on the CD.
- Follow the on screen instructions.

A Keil workspace is provided - C:\Beta_ADuCRF101v0.3\demo code\EVAL-ADuCRF101MKxZ\Examples\ADUCRF101Examples.uvmpw - including three projects: “Blink” and “PowerDown” and “Simple1”.

- “Blink” demonstrates the use of the UART and blinks an LED on the ADuCRF101 mini-board.
- “PowerDown” demonstrates the low power consumption of the ADuCRF101 device.
- “Simple1” provides a demonstration of the radio operation.

Open this workspace by selecting Project->Open Project->Workspace… and navigating to this workspace file.



Periodically check the ADuCRF101 product page on the Analog Devices website where additional example programs will be posted from time to time.

3.5 Preparing the hardware

Connect the ADuCRF101 mini-board to the interface board and follow the instructions listed at 3.1 and 3.2

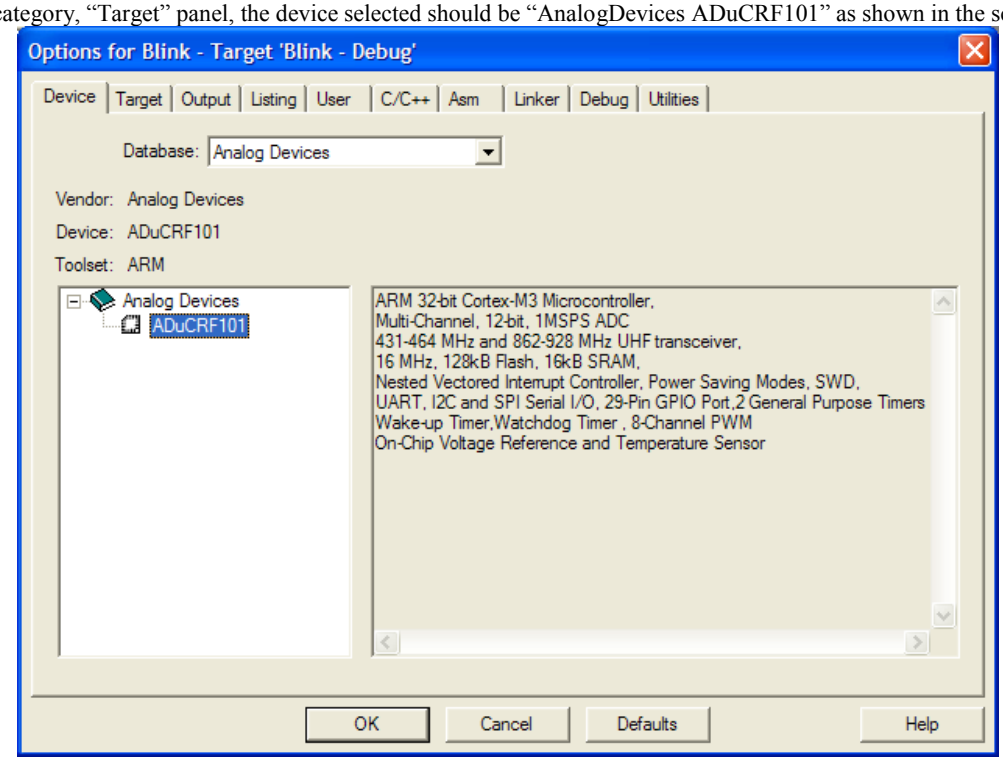
3.6 Using Keil uVision4

Open Keil uVision4 project "ADUCRF101Examples. uvmpw" under C:\Beta_ADuCRF101v0.3\demo code\EVAL-ADUCRF101MKXZ\Examples. The "Blink" project should be active.

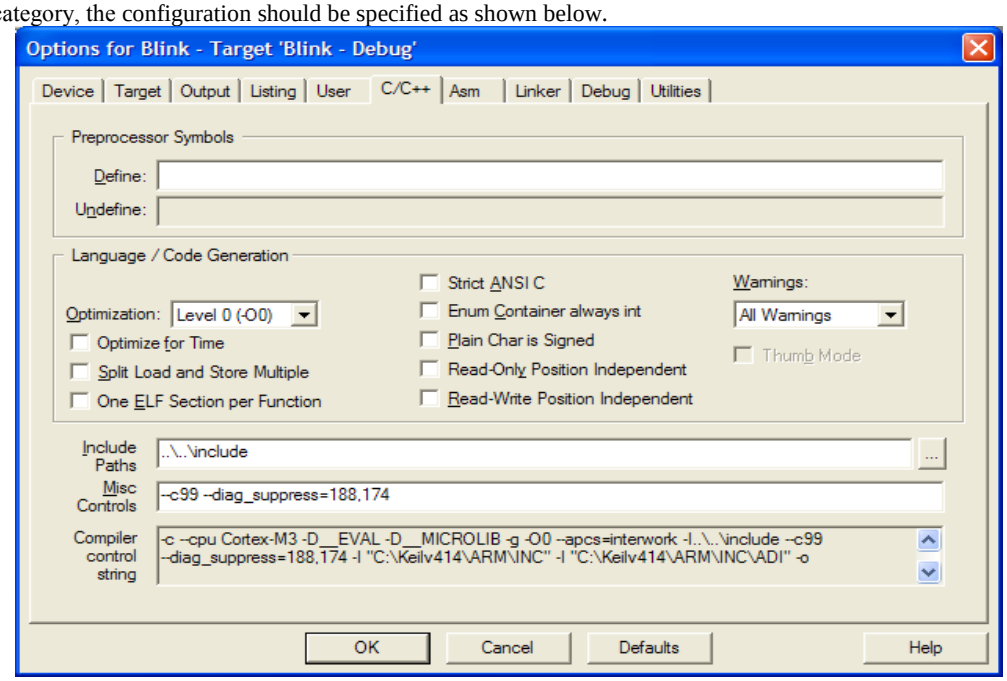
Project configuration:

The project configuration is accessible by clicking on the project name in the workspace area and selecting "Options for <NAME OF PROJECT CONFIGURATION>" from the Project Menu.

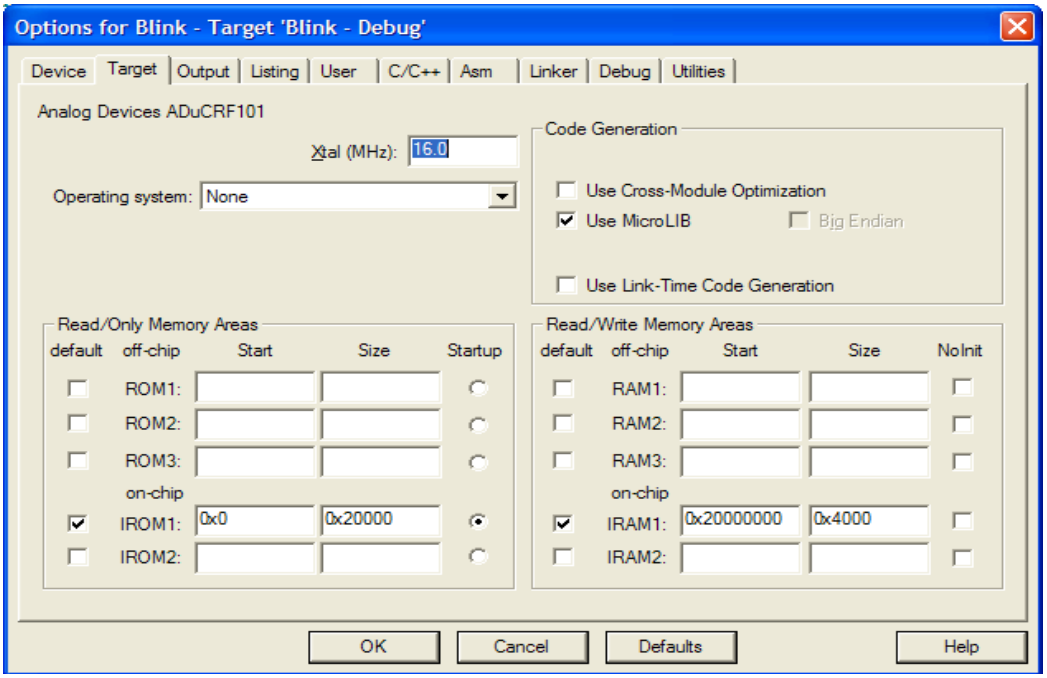
- In the "Device" category, "Target" panel, the device selected should be "AnalogDevices ADuCRF101" as shown in the screenshot below.



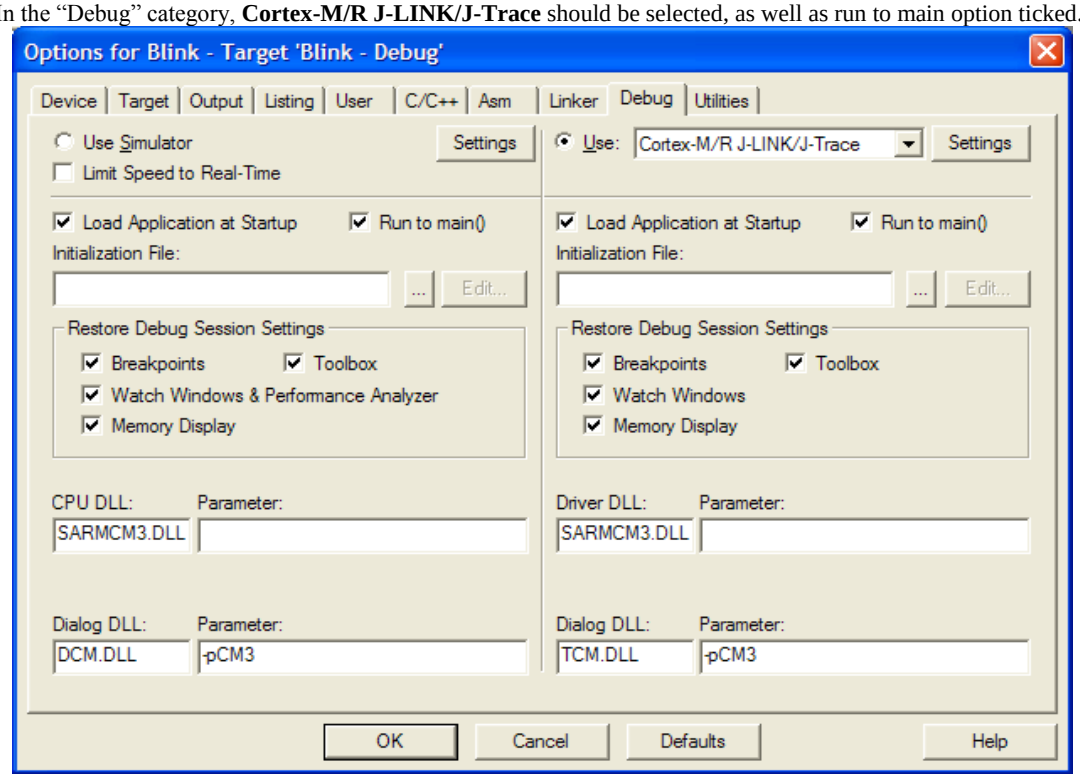
- In the "C/C++" category, the configuration should be specified as shown below.



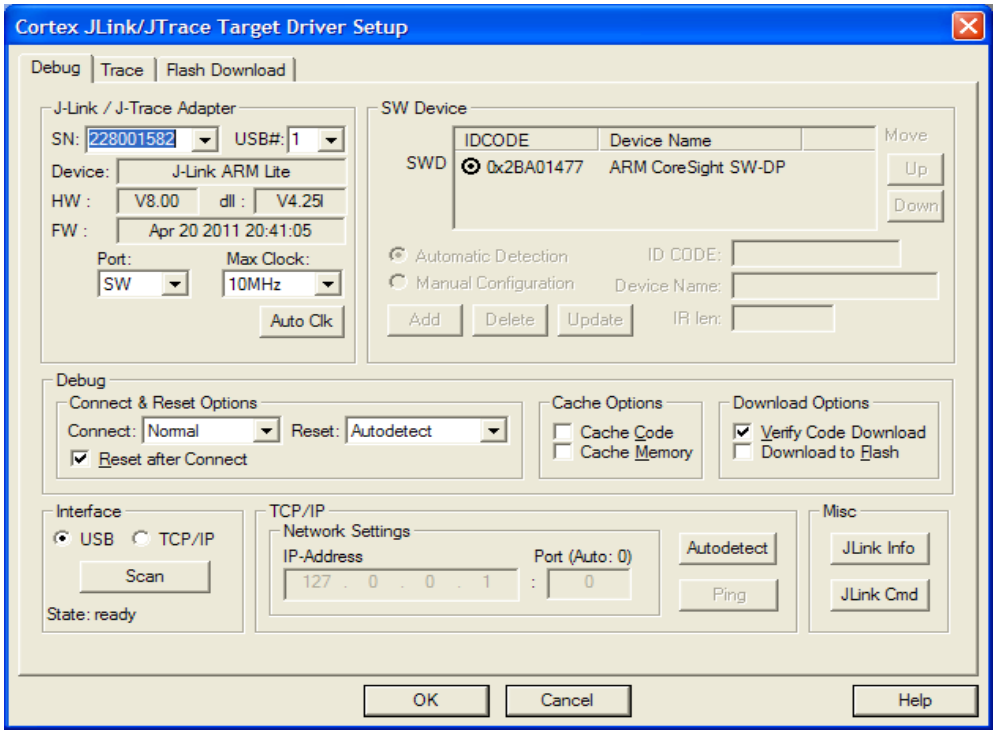
- In the “Target” category, the configuration should be as shown be as shown below.



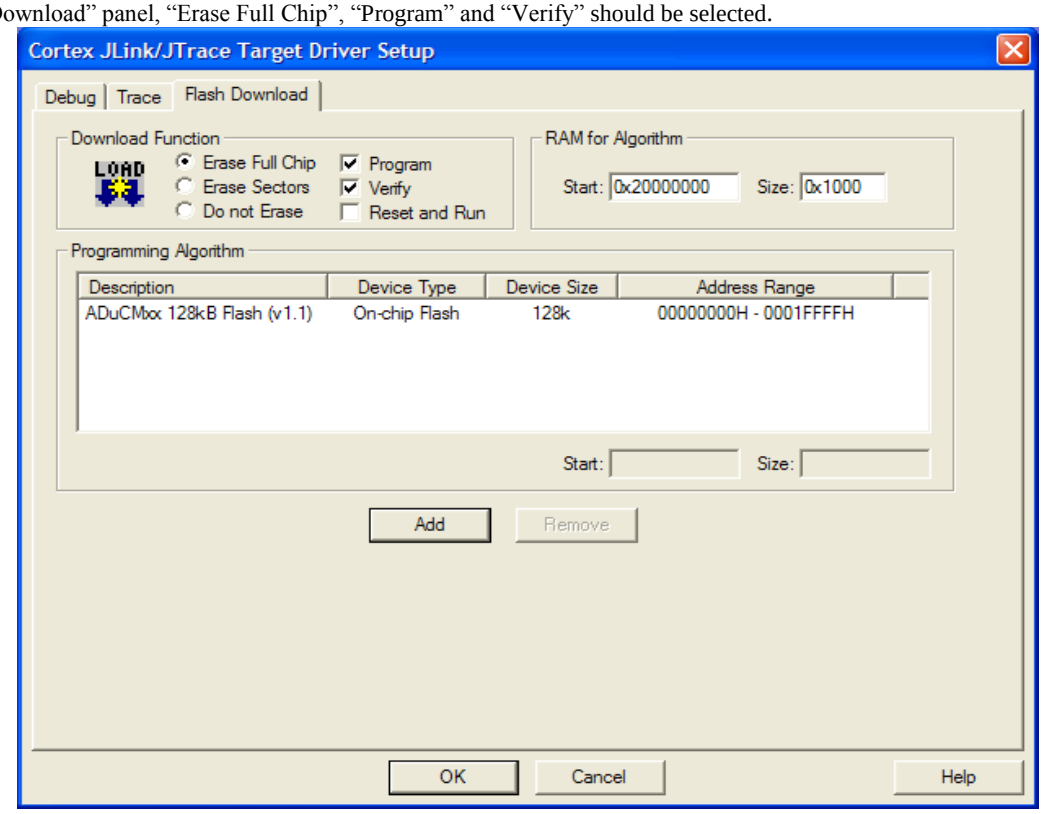
- In the “Debug” category, **Cortex-M/R J-LINK/J-Trace** should be selected, as well as run to main option ticked.



In the **Cortex-M/R J-LINK/J-Trace** settings,the following settings should be selected. The SN and USB# will be different depending on the hardware.



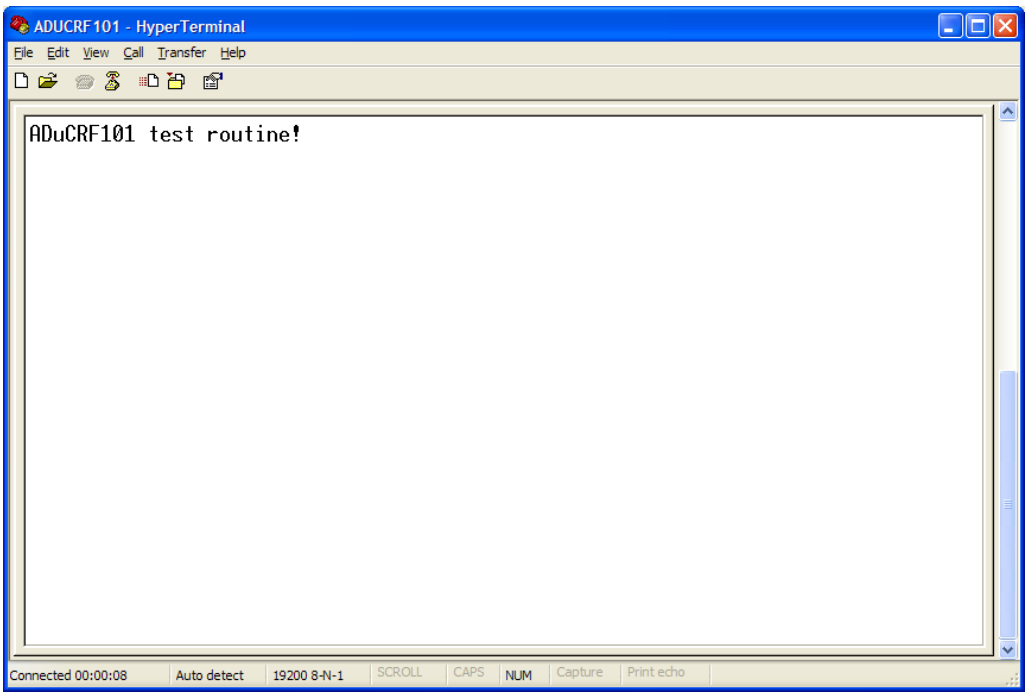
- In the “Flash Download” panel, “Erase Full Chip”, “Program” and “Verify” should be selected.



Downloading and debugging the project:

Download/debug by pressing the debug button  . Debugging of the code execution will start at the start of the main function. The following debug features can be used: single step, step over, breakpoint etc.

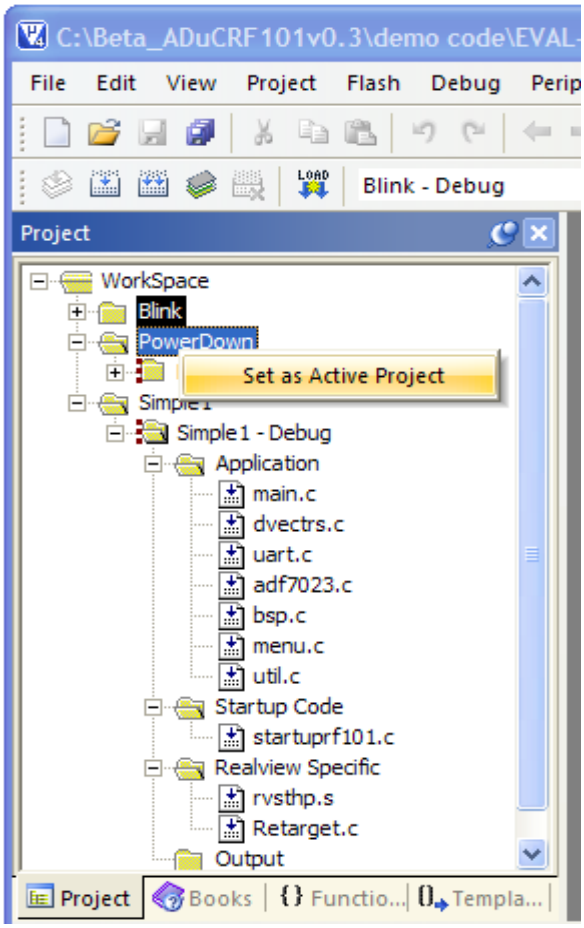
Press the go button  and in the HyperTerminal window, see the message displayed.



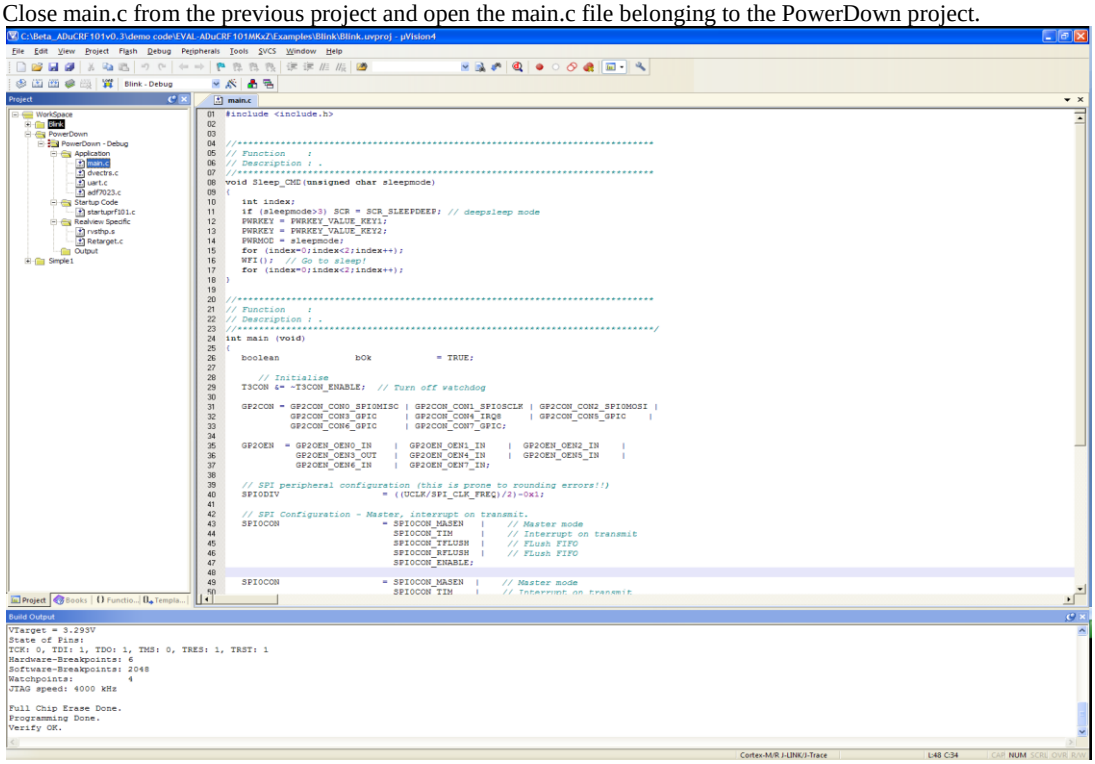
Modifying the project:
Change the message to display on the HyperTerminal.

The make button  allows recompiling the project. Press the debug button and press Go. Our new message should display on HyperTerminal.

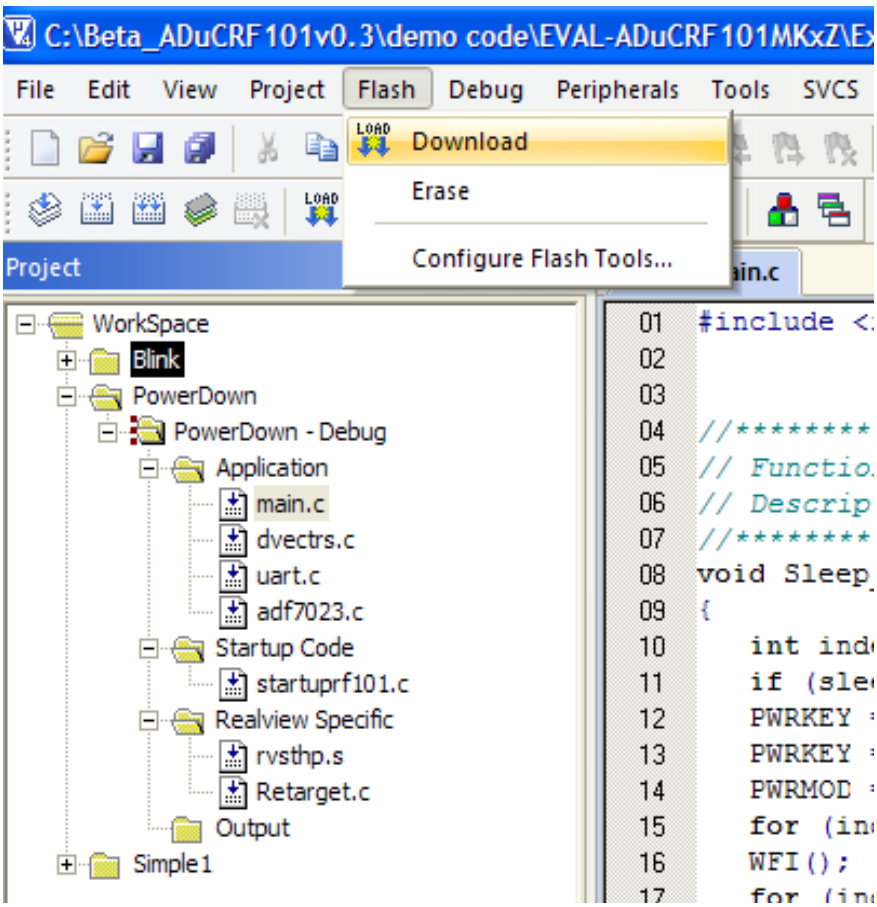
Changing project:
Right click on the PowerDown project in the workspace and click “Set as Active Project”.



Close main.c from the previous project and open the main.c file belonging to the PowerDown project.



Download this project, by selecting “Download” from the Flash menu

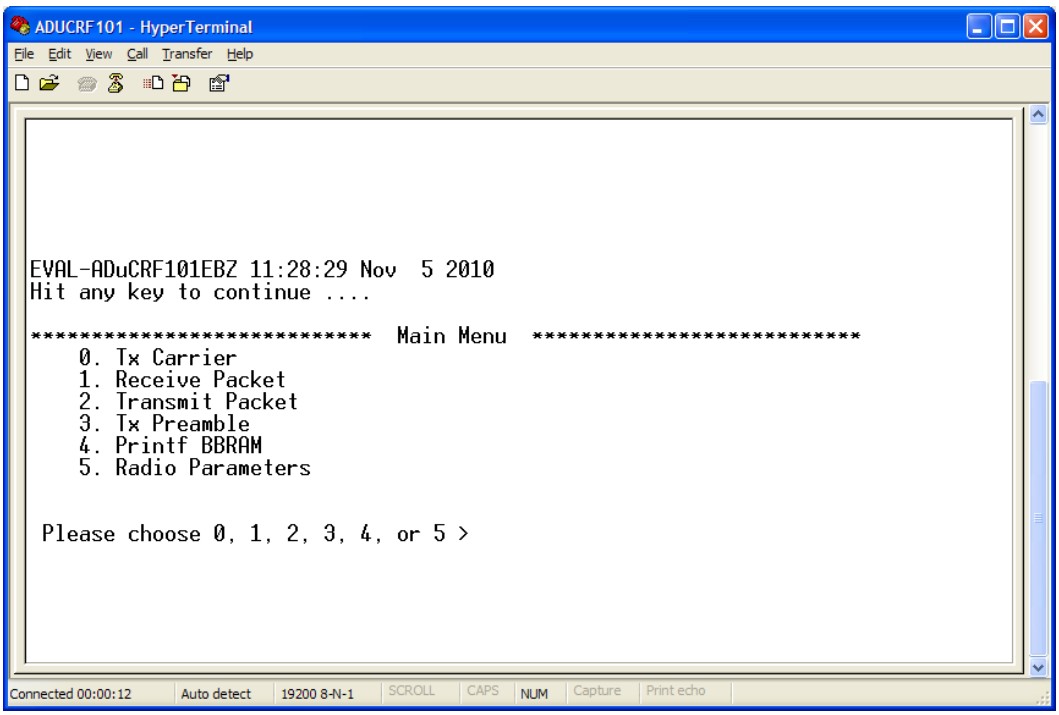


This project demonstrates how to achieve low power consumption on the ADuCRF101. An amp meter and power supply are required.

Disconnect the ADuCRF101 mini-board from the interface board. Remove LK1 And LK2. Connect J1-3 (IOVDD) to a 3V supply, and J1-4 (GND) to the amp meter. Connect the amp meter to the GND of the power supply. Consumption should be around 8mA.
Once the device is in low power mode, serial wire debug is not available. Therefore a delay must be included in user code to allow connecting via serial wire before entering low power mode. In this example, the delay is replaced by waiting on P0.7 to be pulled low. Pull P0.7 low and observe the current consumption dropping.

Changing project:
Right click on the **"Simple1"** project in the workspace and click "Set as Active Project"

Download this project, by selecting "Download" from the Flash menu as described previously.



This project demonstrates some simple operations involving the radio via a Hyperterminal based menu system.

This includes the following

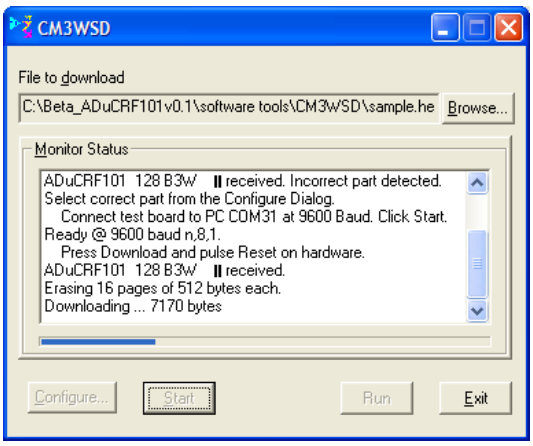
- Transmitting a packet.
- Reception of a packet.
- Transmission of a carrier signal.

(4) WINDOWS SERIAL DOWNLOADER

The Windows Serial Downloader for Cortex-M3 based part (CM3WSD) is a windows software program that allows a user to serially download Intel Extended Hex files as created by assembler/compilers to the ADuCRF101 via the serial port. The Intel Extended Hex file is downloaded into the on-chip Flash/EE program memory via a selected PC serial port (COM1 to COM31).

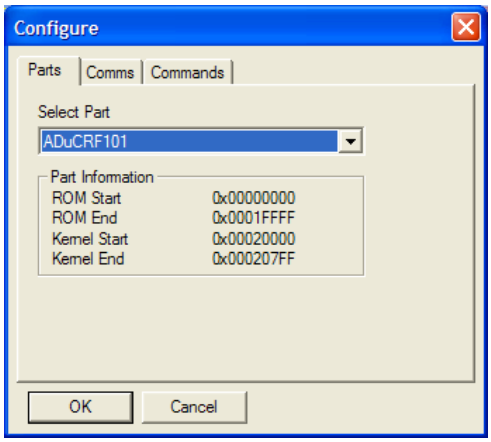
Preparing for Download

1. Connect the ADuCRF101 mini-board to the interface board.
2. Connect the interface board to the PC using a USB cable.
3. Ensure all the links are inserted on both boards.
4. The user should place the ADuCRF101 into serial download mode using the following sequence:
   - Pull P0.6 low
   - Pull the RESET pin low and then high (float)
   - P0.6 can be let float once RESET is high



Downloading using CM3WSD

5. Launch CM3WSD.exe under the software tools\CM3WSD folder.
6. Select the file at C:\Beta_ADuCRF101v0.3\software tools\CM3WSD\sample.hex.
7. Press the Configure button and in the Parts panel select ADuCRF101. Press OK.
8. Select the correct COM port and a baud rate of 115200.
9. Press the Start button. The CM3WSD sends a reset command to the ADuCRF101. If the ADuCRF101 is in serial download mode and the COM port between the PC and the mini-board are setup correctly then the CM3WSD should start downloading the hex file and display a progress bar while the file is downloading. Once the file has been successfully downloaded monitor status box will be updated with "Flashing Complete Click Reset to run program".



Running the downloaded file

Running using the ARMWSD

10. Click the Reset button with P0.6 floating or pulled high. The monitor status box will be updated with the message "Running".

Manual Run option

11. Pull RESET low, then high (or float) on the mini-board to reset the ADuCRF101, with P0.6 floating or pulled high. The program starts running automatically after reset as can be seen by the flashing LED.

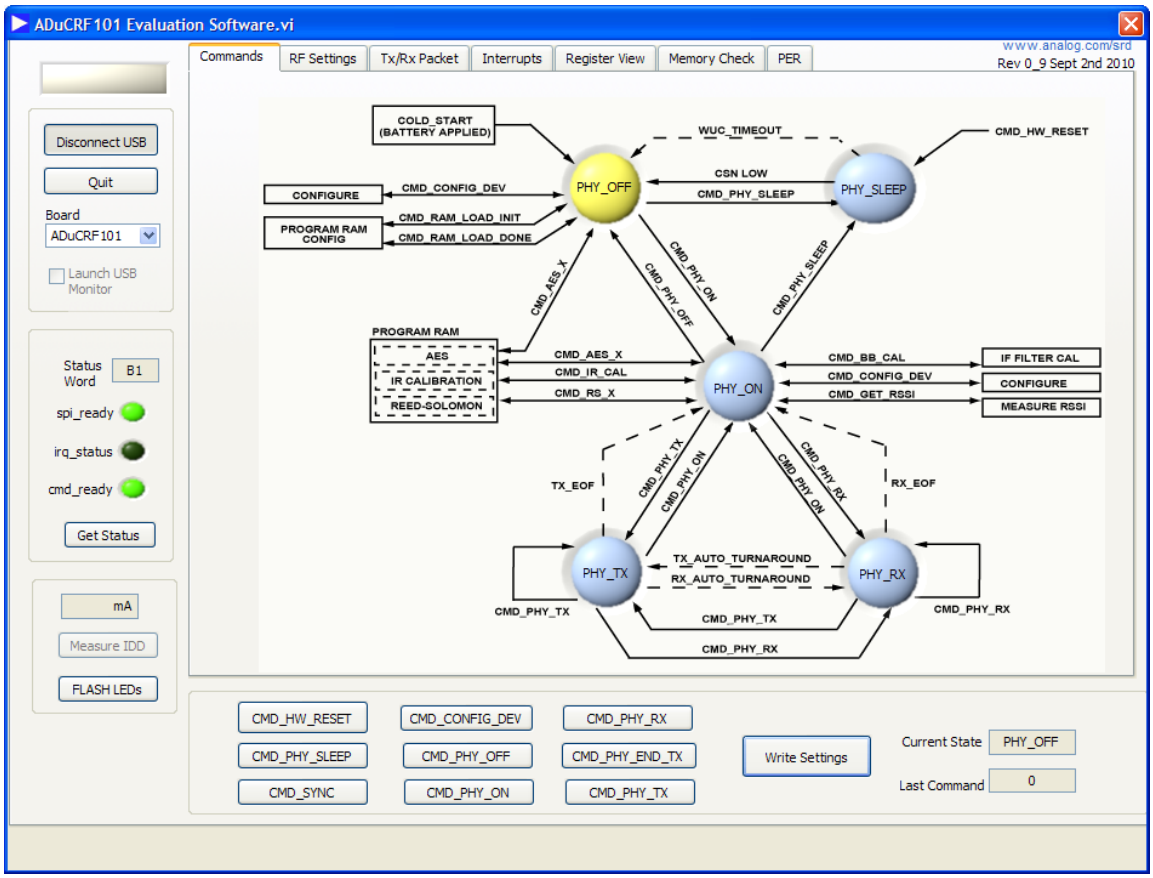
(5) RADIO EVALUATION TOOL

The Radio Evaluation Tool is a Labview based windows software program that allows a user to interact with the radio via a graphical user interface.

This tool requires the download of an Intel hex file to the ADuCRF101 to allow it to interact with the radio.

1. Install the Windows program by double-clicking on C:\Beta_ADuCRF101v0.3\software tools\RadioEval\setup.exe. By default, the tool is installed to C:\Program Files\Analog Devices\ADuCRF101. A re-boot after installation may be necessary.
2. Download the Intel Hex file - C:\Beta_ADuCRF101v0.3\software tools\RadioEval\RadioEval_ADuCRF101.hex – using the technique described in Section (4) Windows Serial Downloader. Reset the part afterward to allow the downloaded code to execute.
3. Launch C:\Program Files\Analog Devices\ADuCRF101\ADuCRF101.exe and click the "Connect USB" button.

Refer to the ADuCRF101 User Manual for a detailed description of the states and options. The tool allows the configuration of the radio and the transition between states without having to write any code and can be used to build up an understanding of the operation of the part.



(6) DOCUMENTATION DIRECTORY

The following documentation is available on the CD.

```
Beta_ADuCRF101v0.3\Documentation\ApplicationNotes\
           AN-CortexM3downloadProtocol.pdf          Describes the UART download protocol implemented on the
                                                    ADuCRF101

Beta_ADuCRF101v0.3\Documentation\DataSheet\
           ADuCRF101_AnomalyList_PrB.pdf            ADuCRF101 anomaly list for Rev B silicon
           ADuCRF101_PrD.pdf                        ADuCRF101 Preliminary datasheet
           ADuCRF101UserGuide PrA_1057.pdf          ADuCRF101 User Manual Rev.PrA

Beta_ADuCRF101v0.3\Documentation\Evaluation board\
           EVAL-USB-SWDUART Rev0 SCH.pdf            Cortex-M3 based ADuCxxx Interface Board Rev 0 schematics
           EVAL-USB-SWDUART Rev0 PCB.pdf            Cortex-M3 based ADuCxxx Interface Board Rev 0 PCB layers
           EVAL-ADUCRF101 RevB.pdf                   ADuCRF101 Mini-Board Rev A schematics
```

Any user of the ADuCRF101 Mini-Kit should consult all these documents before proceeding to ‘explore’ the ADuCRF101.