

Kinetis MKW41Z SMAC Software

Quick Start Guide

This document is a brief presentation of the Kinetis Simple Media Access Controller (SMAC) Software for the MKW41Z wireless microcontroller platforms, version 3.3.3. This software package is built using the Kinetis Software Development Kit (KSDK) version 2.2. This document covers installation of the software packages, hardware setup, build and usage of the provided demo applications.

Contents

1	Download.....	2
2	Building the Binaries	5
2.1	Building and Flashing the SMAC Software Demo Applications using MCUXpresso IDE...	7
2.2	Building and Flashing the SMAC Software Demo Applications using IAR.....	12
2.3	Flashing a Binary Image File Without Using an IDE.....	15
3	Hardware Setup	18
4	Example: Running the Connectivity Test Demo Application.....	20



1 Download

Navigate to <https://mcuxpresso.nxp.com/en/welcome>, and create a new configuration:

MCUXpresso Config Tools

MCUXpresso Config Tools provides a set of system configuration tools that help users of all levels with a Kinetis or LPC-based MCU solution. Let it be your guide from first evaluation to production development.

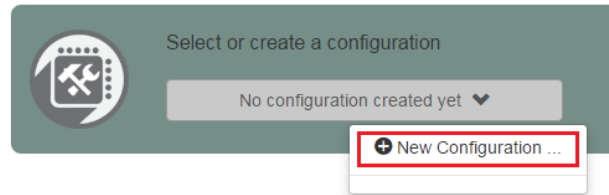


Figure 1: The MCUXpresso welcome screen

Type the desired platform or select from the list, then press “Specify Additional Configuration Settings”:

Search by Name

Select a Device, Board, or Kit

▼ Boards

- FRDM-KW41Z
- USB-KW41Z
- USB-KW41Z_K22F

▼ Processors

- MKW41Z256xxx4
- MKW41Z512xxx4

▼ Kits

Name your configuration

Select Configuration

Specify Additional Configuration Settings

Jump start your configuration

Figure 2: Available configurations

Select the desired toolchain(s) and middleware, then press the “Go to SDK Builder” button:

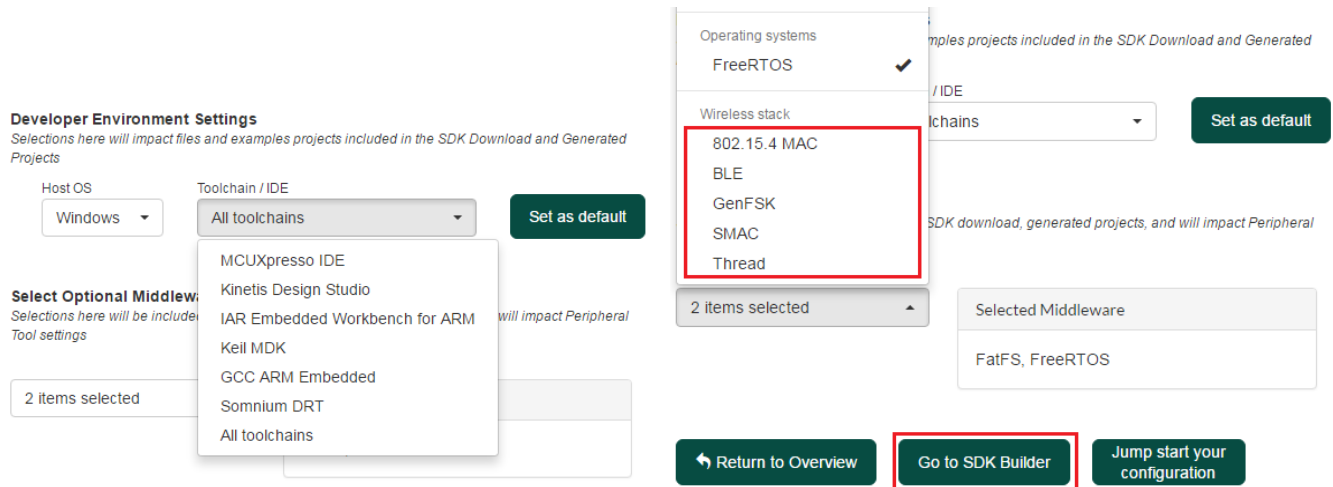


Figure 3: Select toolchain(s) and middleware

If the package is already built, the “Download” button will appear, else the “Request Build” button will appear:

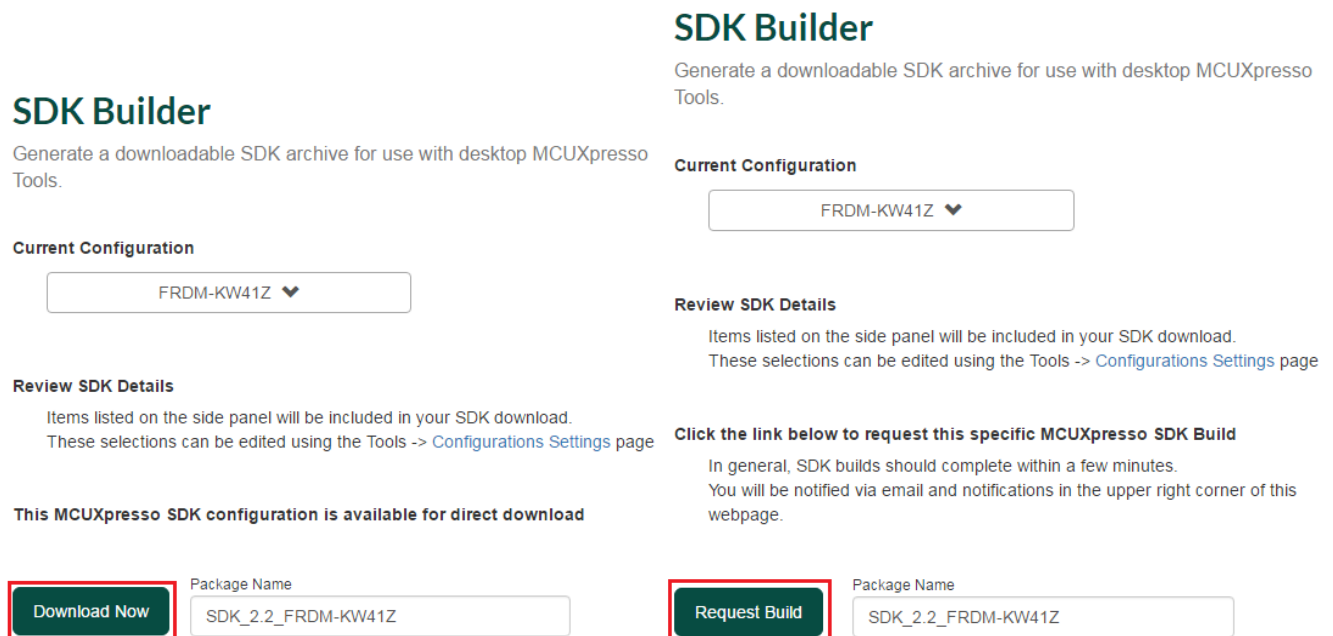


Figure 4: The SDK Builder

In one requests a new build, then a notification will be sent when process ends. To download the archive, access the SDK Archive manager:

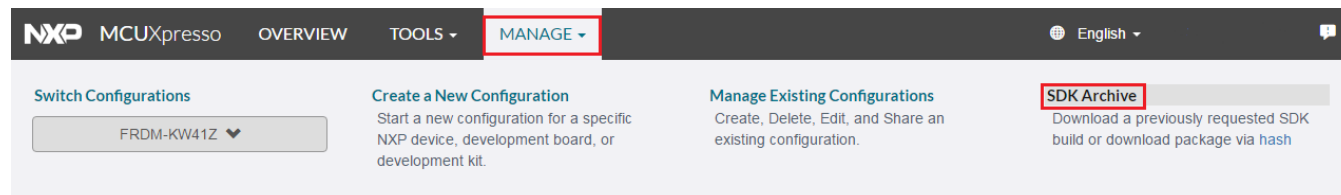


Figure 5: Access the Archive manager

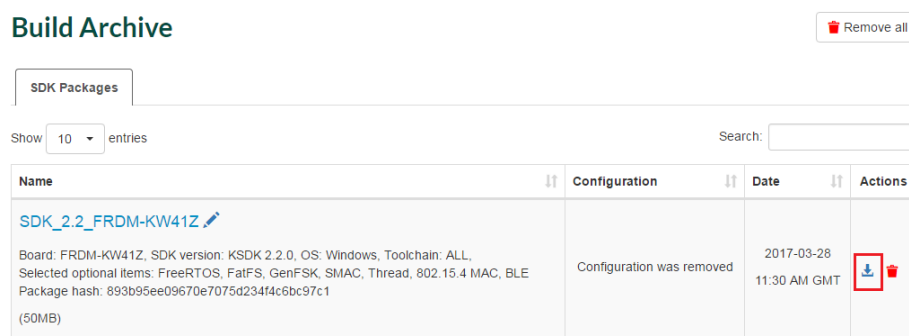


Figure 6: Download the archive

2 Building the Binaries

This section details the required steps for obtaining the binary files for usage with the boards.

NOTE

In order to be able to build any of these packages you need a copy of the IAR Embedded Workbench for ARM® version 7.80.4 or higher or MCUXpresso Integrated Development Environment version 10.0 or higher. This connectivity software package does not include support for any other toolchains.

The packages must be built with the debug configuration in order to enable debugging information.

This package includes various demo applications that can be used as a starting point.

The next section presents the steps required for building the Connectivity Test application. All applications can be found using the following placeholders for text:

- <connectivity_path>: represents the root path of the cloned application, or the root path for the SMAC software package.
- <board> : represents the target board for the demo app; can be either “frdmkw41z” or “usbkw41z_kw41z”
- <RTOS>: represents the scheduler or RTOS used by the app, can be “bm” or “freertos”
- <demo_app> : represents the demo app name
- <IDE> : represents the integrated development environment used to build projects and can be “iar” or in the case of MCUXpresso IDE it can be ignored.

The demo applications general folder structure is the following:

<connectivity_path>\boards\<board>\wireless_examples\smac\<demo_app>\<RTOS>\<IDE>\

Kinetis SMAC Software Demo Application Build Example

Selected app: connectivity_test

Board: frdmkw41z

RTOS: bare-metal scheduler

Resulting location in the connectivity software installation directory:


<connectivity_path>\boards\frdmkw41z\wireless_examples\smac\connectivity_test\
bare_metal\<IDE>

Resulting location for the cloned application using settings from *Figure 9*:

<C:\TEMP\connectivity_test\boards\frdmkw41z\wireless_examples\smac\connectivity_test\
bare_metal\<IDE>

NOTE

If your FRDM-KW41Z board is configured for the buck or boost modes of the DCDC converter inside the KW41Z microcontroller, please note that



the following defines need to be set: *gDCDC_Enabled_d* to 1 and *APP_DCDC_MODE* to *gDCDC_Mode_Buck_c* or *gDCDC_Mode_Boost_c* respectively, in the *app_preinclude.h* header file.

2.1 Building and Flashing the SMAC Software Demo Applications using MCUXpresso IDE

Step 1:

Drag and drop the archive into the MCUXpresso Installed SDKs window.

Step 2:

Import the SDK examples into Workspace.

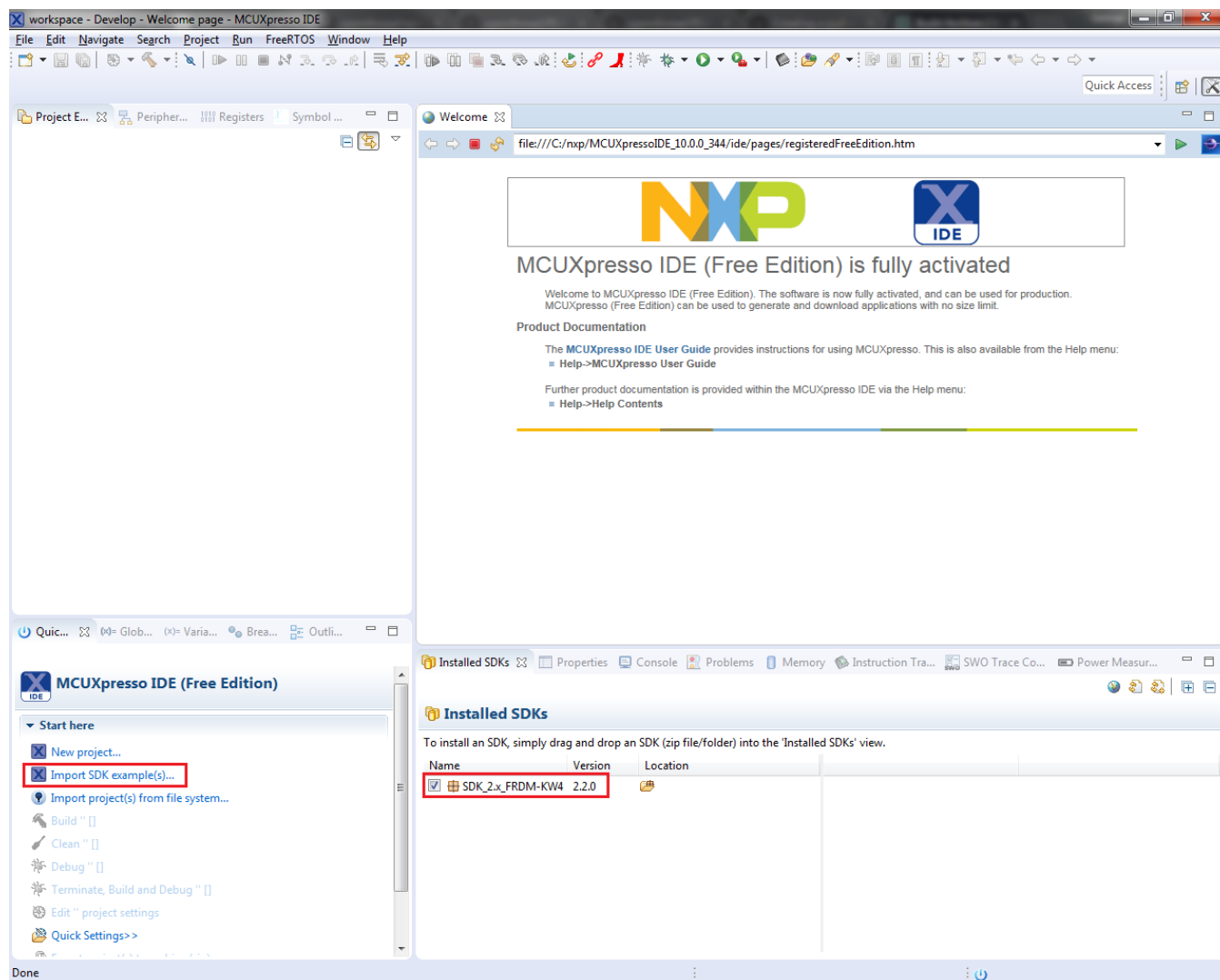


Figure 7: Installed SDKs

Step 3:

Select the board, then the desired example(s):

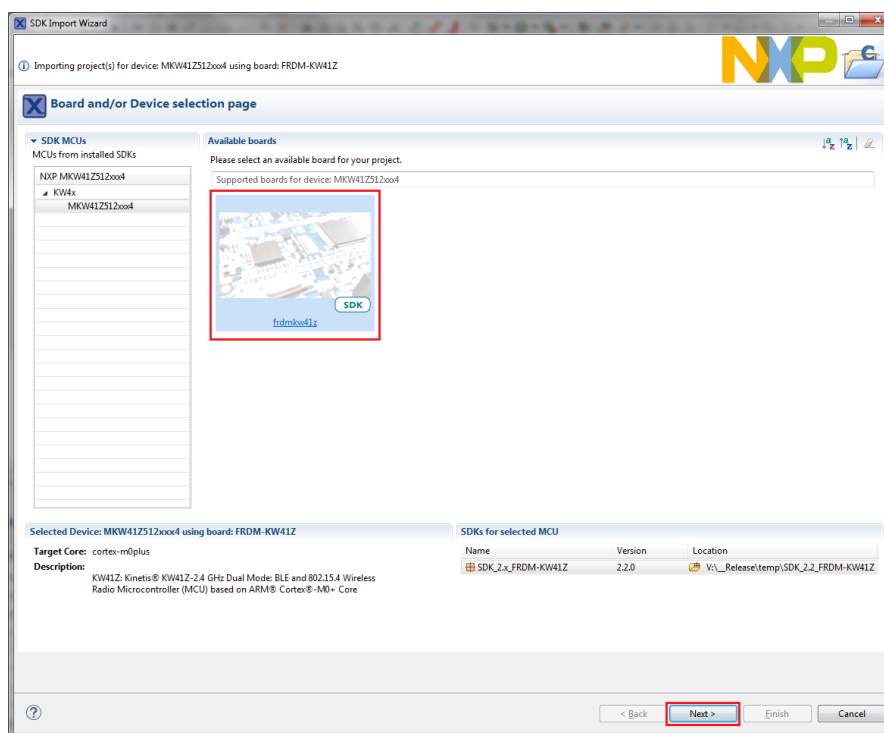


Figure 8: Select the board

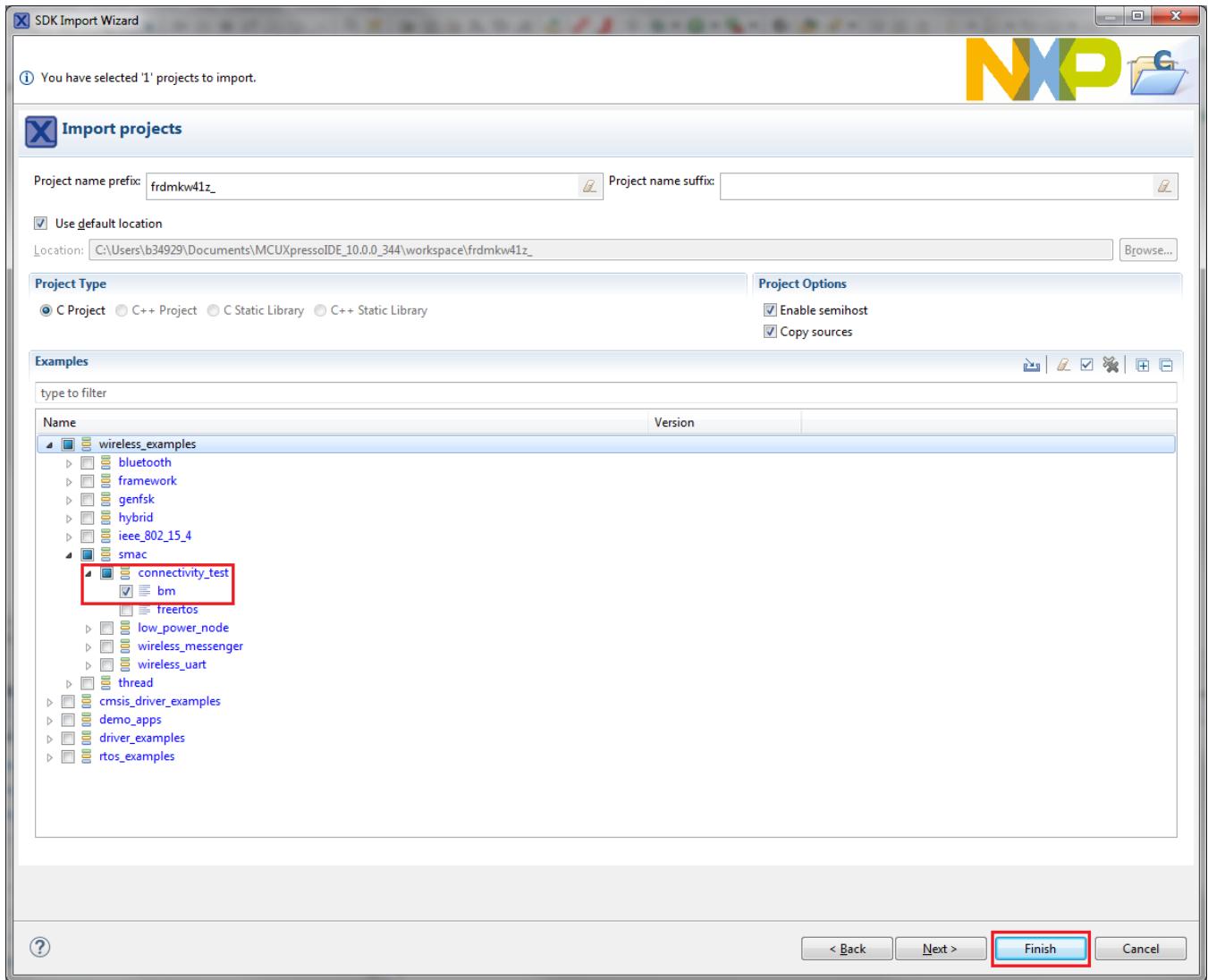


Figure 9: Select the example(s)

Step 4:

Build the SMAC connectivity_test project.

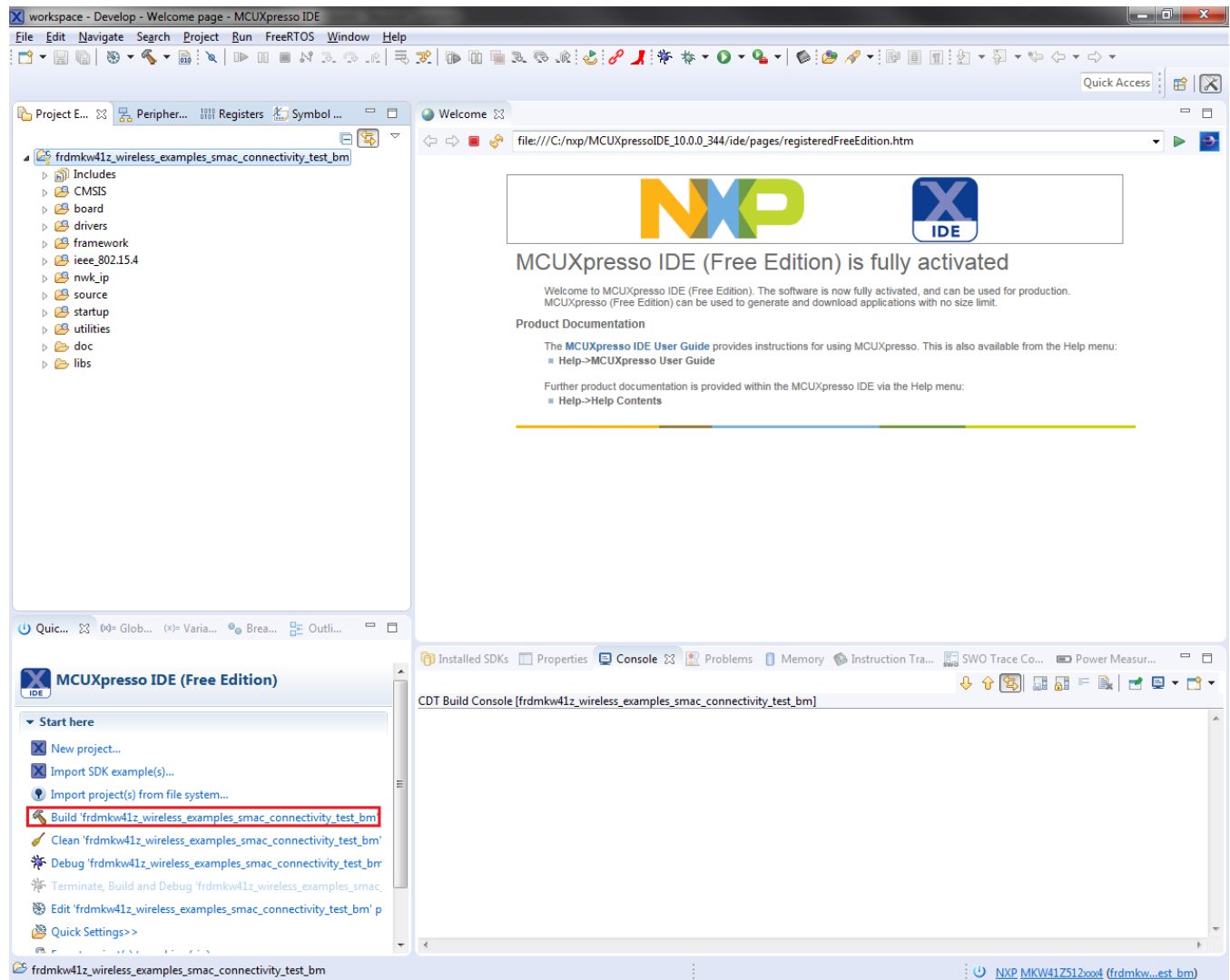


Figure 10: “connectivity_test” bare-metal build

Step 5:

Click the “Debug” button to flash the executable onto the board.

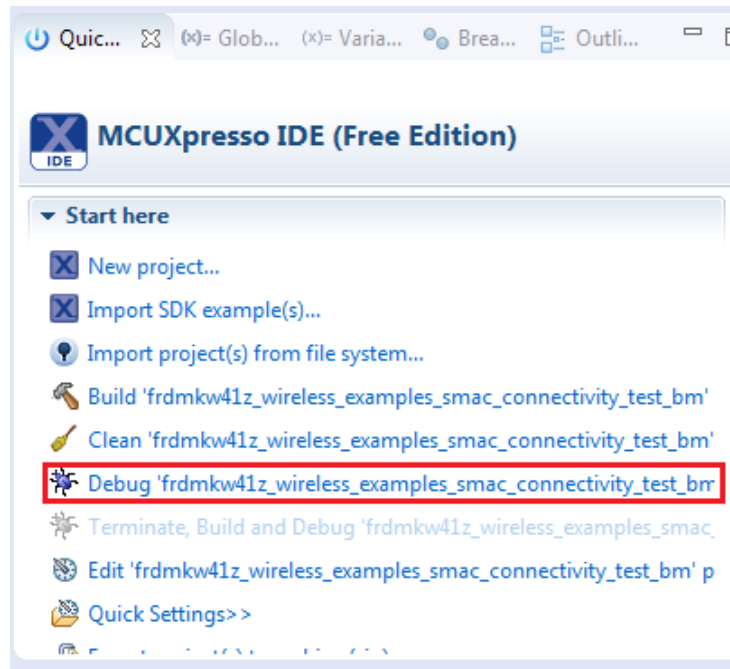


Figure 11: “connectivity_test” Debug

2.2 Building and Flashing the SMAC Software Demo Applications using IAR

Step 1:

Navigate to the resulting location in either the connectivity software installation directory or the cloned application root directory.

Step 2:

Open the highlighted IAR workspace file (*.eww file format):

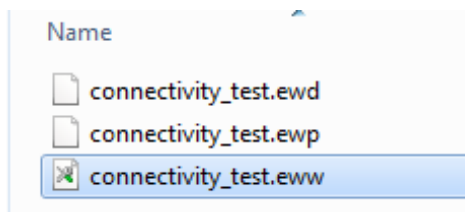


Figure 12: “connectivity_test” demo project location

Step 3:

Select the desired configuration for the Connectivity Test project.

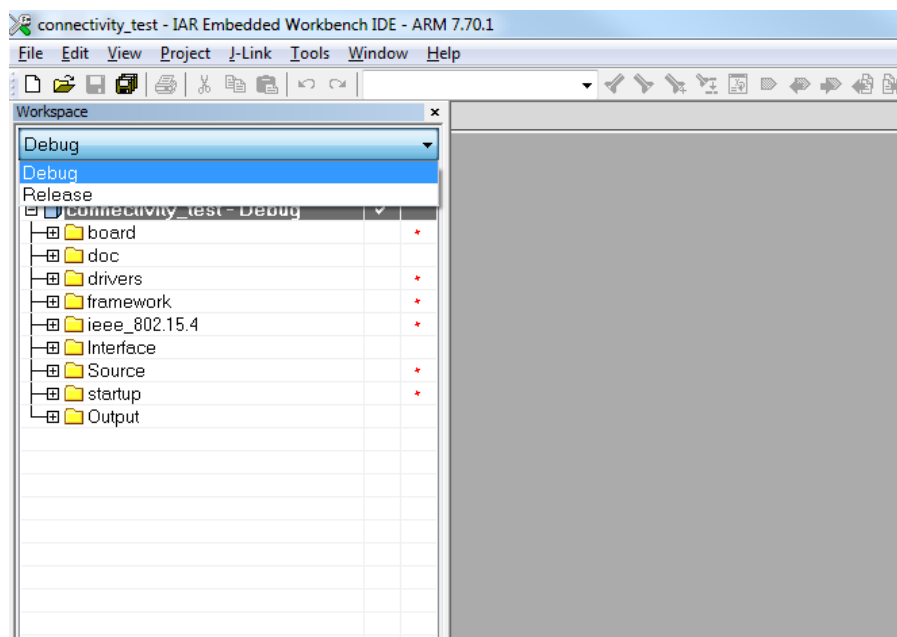


Figure 13: “connectivity_test” configuration selection

Step 4:

Build the project.

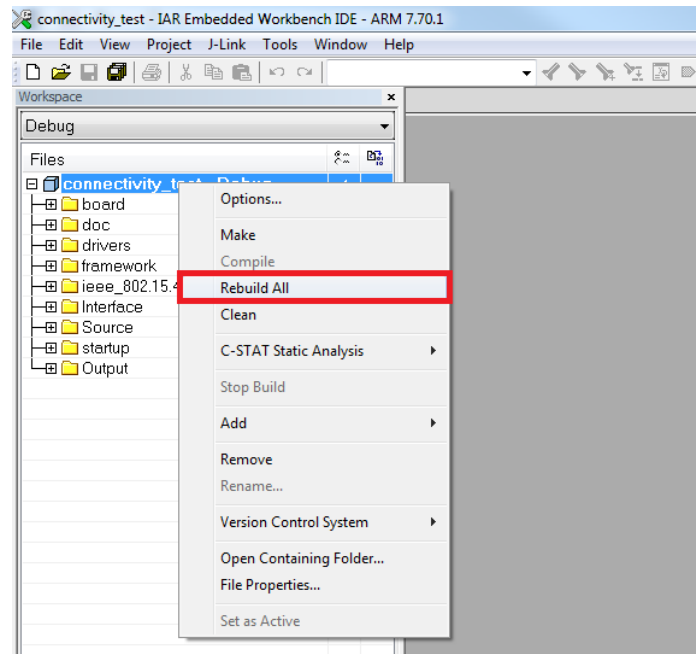


Figure 14: “connectivity_test” project build

Step 5

Make the appropriate debugger settings in the project options window:

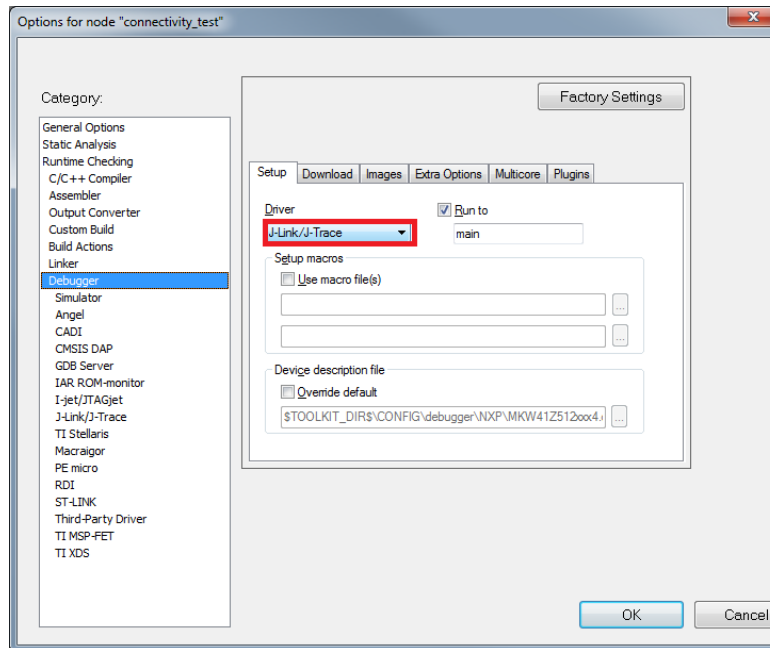


Figure 15: Debugger Settings

Step 6:

Click the “Download and Debug” button to flash the executable onto the board.

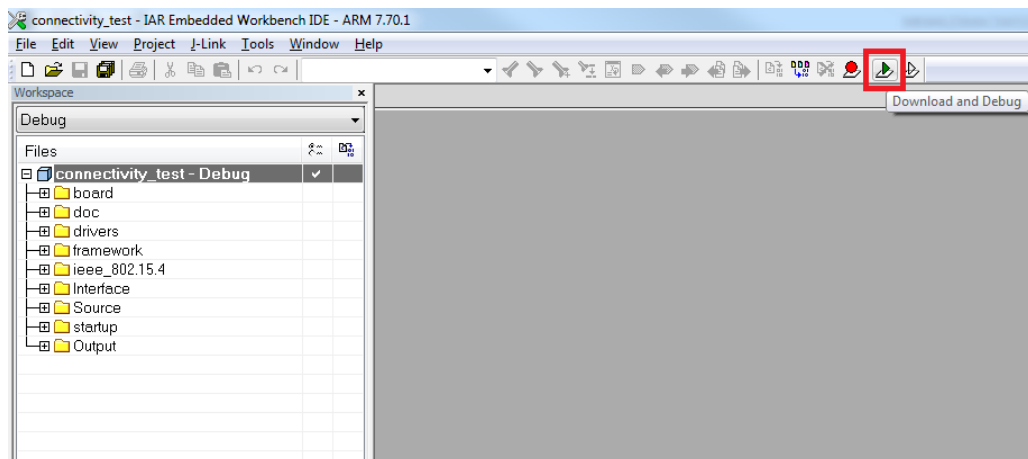


Figure 16: “connectivity_test” Download and Debug

NOTE

The projects are configured to use “J-LINK / J-Trace” as the default debugger. Please make sure that your board’s OpenSDA chip contains a J-Link firmware or that the debugger selection corresponds to the physical interface used. See the section below for more information.

2.3 Flashing a Binary Image File Without Using an IDE

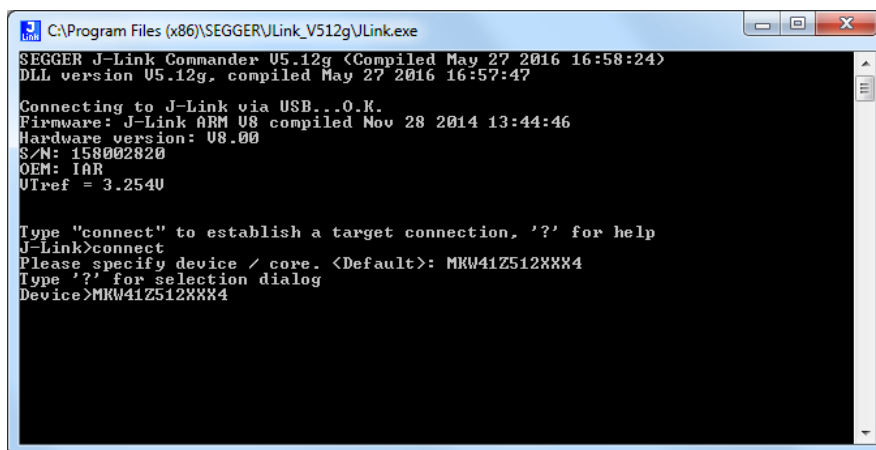
The MKW41Z connectivity software package contains in the `<connectivity_path>\tools\wireless\binaries` folder a series of pre-compiled binary applications that can be flashed onto a development board.

In order to flash the corresponding binaries to the FRDMKW41Z board, the best approach is to use the OpenSDA on-board interface J-Link Mass Storage Device functionality, by simply dragging and dropping the binary image in the mass storage drive exposed by this OpenSDA firmware.

In order to flash the firmware on the USBKW41Z, a J-Link probe is needed along with the latest J-Link software from www.segger.com.

Run the `jlink.exe` executable provided in the J-Link software installation follow the steps below for flashing the image on the microcontroller. Make sure that the binary file is in the same folder with the `jlink.exe` executable, or specify the absolute path to the file.

Step 1: Select MKW41Z512xxx4 device.



```
C:\Program Files (x86)\SEGGER\JLink_V512g\JLink.exe
SEGGER J-Link Commander V5.12g (Compiled May 27 2016 16:58:24)
DLL version V5.12g, compiled May 27 2016 16:57:47

Connecting to J-Link via USB...O.K.
Firmware: J-Link ARM V8 compiled Nov 28 2014 13:44:46
Hardware version: V8.00
S/N: 158002820
OEM: IAR
UTref = 3.254V

Type "connect" to establish a target connection, '?' for help
J-Link>connect
Please specify device / core. (Default): MKW41Z512XXX4
Type '?' for selection dialog
Device>MKW41Z512XXX4
```

Figure 17: MKW41Z512xxx4 device selection

Step 2: Select SWD target interface.

```

C:\Program Files (x86)\SEGGER\JLink_V512g\JLink.exe
SEGGER J-Link Commander V5.12g <Compiled May 27 2016 16:58:24>
DLL version V5.12g, compiled May 27 2016 16:57:47

Connecting to J-Link via USB...O.K.
Firmware: J-Link ARM V8 compiled Nov 28 2014 13:44:46
Hardware version: V8.00
S/N: 158002820
OEM: IAR
Vtref = 3.254V

Type "connect" to establish a target connection, '?' for help
J-Link>connect
Please specify device / core. <Default>: MKW41Z512XXX4
Type '?' for selection dialog
Device>MKW41Z512XXX4
Please specify target interface:
  J) JTAG <Default>
  S) SWD
TIF>S_

```

Figure 18: SWD interface selection

Step 3: Press “Enter” to select the default interface speed.

```

C:\Program Files (x86)\SEGGER\JLink_V512g\JLink.exe
SEGGER J-Link Commander V5.12g <Compiled May 27 2016 16:58:24>
DLL version V5.12g, compiled May 27 2016 16:57:47

Connecting to J-Link via USB...O.K.
Firmware: J-Link ARM V8 compiled Nov 28 2014 13:44:46
Hardware version: V8.00
S/N: 158002820
OEM: IAR
Vtref = 3.254V

Type "connect" to establish a target connection, '?' for help
J-Link>connect
Please specify device / core. <Default>: MKW41Z512XXX4
Type '?' for selection dialog
Device>MKW41Z512XXX4
Please specify target interface:
  J) JTAG <Default>
  S) SWD
TIF>S
Specify target interface speed [kHz]. <Default>: 4000 kHz
Speed>

```

Figure 19: SWD interface speed selection

```

C:\Program Files (x86)\SEGGER\JLink_V512g\JLink.exe
Device>MKW41Z512XXX4
Please specify target interface:
  J) JTAG <Default>
  S) SWD
TIF>S
Specify target interface speed [kHz]. <Default>: 4000 kHz
Speed>
Device "MKW41Z512XXX4" selected.

Found SWD-DP with ID 0x0BC11477
Found SWD-DP with ID 0x0BC11477
Found Cortex-M0 r0p1, Little endian.
FPUnit: 2 code (BP) slots and 0 literal slots
CoreSight components:
ROMTbl 0 @ F0002000
ROMTbl 0 [0]: FFFF0000, CID: B105900D, PID: 001BB932 MTB-M0+
ROMTbl 0 [1]: FFFF0000, CID: B105900D, PID: 0008E000 MTBDWT
ROMTbl 0 [2]: F00FD000, CID: B105100D, PID: 000BB4C0 ROM Table
ROMTbl 1 @ E00FF000
ROMTbl 1 [0]: FFF0F000, CID: B105E00D, PID: 000BB008 SCS
ROMTbl 1 [1]: FFF02000, CID: B105E00D, PID: 000BB00A DWT
ROMTbl 1 [2]: FFF03000, CID: B105E00D, PID: 000BB00B FPB
Cortex-M0 identified.
J-Link>

```

Figure 20: Cortex-M0 identified

Step 4: Type **loadbin app.bin 0** in order to flash the binary file (assuming application name is *app.bin*).


```
C:\Program Files (x86)\SEGGER\JLink_V512g\JLink.exe
Device>MKW41Z512XXX4
Please specify target interface:
J) JTAG (Default)
S) SWD
TIF>S
Specify target interface speed [kHz]. <Default>: 4000 kHz
Speed>
Device "MKW41Z512XXX4" selected.

Found SWD-DP with ID 0x0BC11477
Found SWD-DP with ID 0x0BC11477
Found Cortex-M0 r0p1, Little endian.
FPUnit: 2 code (BP) slots and 0 literal slots
CoreSight components:
ROMTbl 0 @ F0002000
ROMTbl 0 [0]: FFFFE000, CID: B105900D, PID: 001BB932 MTB-M0+
ROMTbl 0 [1]: FFFFF000, CID: B105900D, PID: 0008E000 MTBDWT
ROMTbl 0 [2]: F00FD000, CID: B105100D, PID: 000BB4C0 ROM Table
ROMTbl 1 @ E00FF000
ROMTbl 1 [0]: FFF0F000, CID: B105E00D, PID: 000BB008 SCS
ROMTbl 1 [1]: FFF02000, CID: B105E00D, PID: 000BB00A DWT
ROMTbl 1 [2]: FFF03000, CID: B105E00D, PID: 000BB00B FPB
Cortex-M0 identified.
J-Link>loadbin app.bin 0_
```

Figure 21: Load binary file

```
C:\Program Files (x86)\SEGGER\JLink_V512g\JLink.exe
Speed>
Device "MKW41Z512XXX4" selected.

Found SWD-DP with ID 0x0BC11477
Found SWD-DP with ID 0x0BC11477
Found Cortex-M0 r0p1, Little endian.
FPUnit: 2 code (BP) slots and 0 literal slots
CoreSight components:
ROMTbl 0 @ F0002000
ROMTbl 0 [0]: FFFFE000, CID: B105900D, PID: 001BB932 MTB-M0+
ROMTbl 0 [1]: FFFFF000, CID: B105900D, PID: 0008E000 MTBDWT
ROMTbl 0 [2]: F00FD000, CID: B105100D, PID: 000BB4C0 ROM Table
ROMTbl 1 @ E00FF000
ROMTbl 1 [0]: FFF0F000, CID: B105E00D, PID: 000BB008 SCS
ROMTbl 1 [1]: FFF02000, CID: B105E00D, PID: 000BB00A DWT
ROMTbl 1 [2]: FFF03000, CID: B105E00D, PID: 000BB00B FPB
Cortex-M0 identified.
J-Link>loadbin app.bin 0
Downloading file fapp.bin...
J-Link: Flash download: Flash programming performed for 1 range (34816 bytes)
J-Link: Flash download: Total time needed: 1.113s (Prepare: 0.060s, Compare: 0.036s, Erase: 0.186s, Program: 0.787s, Verify: 0.034s, Restore: 0.007s)
O.K.
J-Link>_
```

Figure 22: Download completed successfully

3 Hardware Setup

The hardware setup in this example uses either a FRDMKW41Z or USBKW41Z development platform, shown in the figure below:

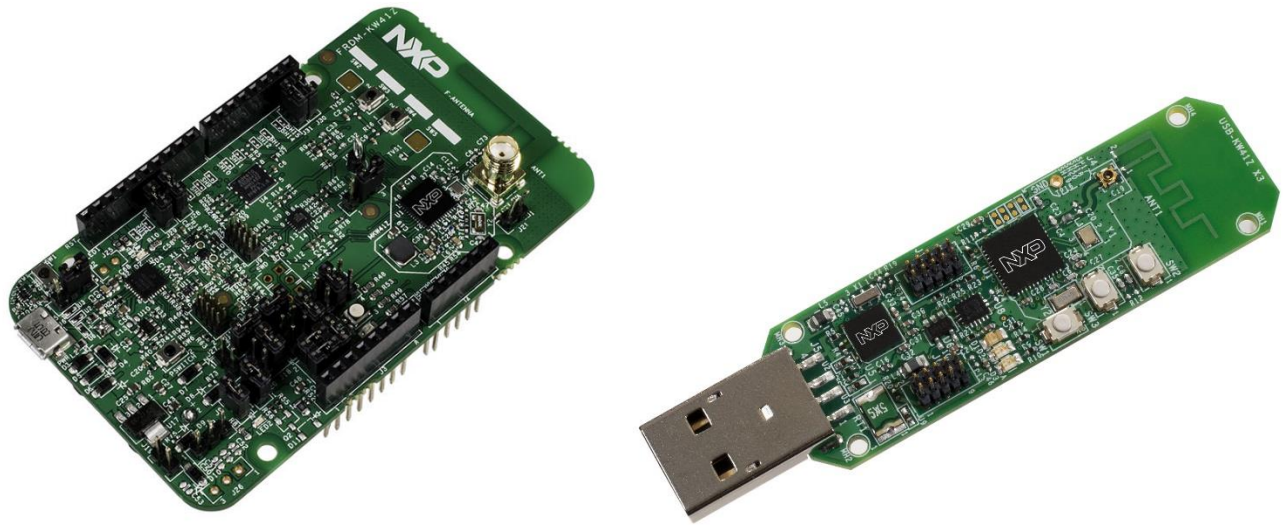


Figure 23: FRDMKW41Z and USBKW41Z

The FRDMKW41Z and USBKW41Z boards should have their OpenSDA USB ports connected to a Windows PC. The OpenSDA chip on the boards should have appropriate firmware flashed, with debugging and virtual serial COM port capabilities. For more information on OpenSDA please refer to the following webpage: www.nxp.com/opensda.

Variants of embedded firmware for the OpenSDA chip can be downloaded from:

<https://github.com/mbedmicro/CMSIS-DAP>
<https://www.segger.com/opensda.html>
<http://www.pemicro.com/opensda/>

J-LINK/J-TRACE is the default interface selected in the IAR Embedded Workbench for ARM® projects with FRDMKW41Z and USBKW41Z included in this release.

The FRDM-KW41Z board can be configured via jumpers to be in the two modes of the DCDC converter inside the KW41Z microcontroller or to bypass it entirely, as shown in the figure below:

Power Configuration

	PWR_CFG J18	PSW_CFG J16	DCDC_CFG J17	REG_CFG J22
Bypass Mode (auto start) VDCDC_IN (1.71 to 3.6V) Operation 1.8V - 3.6 V	1-2	1-2	3-4	1-3 2-4 5-6
Boost Mode (auto start) VDCDC_IN (0.9V to 1.8V) Single Battery Operation	2-4	3-4	1-2 5-6	5-6
Buck Mode (manual start) VDCDC_IN (1.8V to 4.2V) Coin Cell Battery Operation	2-4	5-6 press SW6 to start	3-4	5-6
Buck Mode (auto start) VDCDC_IN (1.8V to 4.2V) Coin Cell Battery Operation	2-4	3-4	3-4	5-6

Figure 24: FRDM-KW41Z Jumper Configuration for DCDC Mode

4 Example: Running the Connectivity Test Demo Application

The SMAC “connectivity_test” demo application requires a serial terminal program to connect to the boards. For this example, [Tera Term](#) was chosen.

Step 1:

Load the applications on the boards using IAR Embedded Workbench for ARM® by clicking “Download and Debug”.

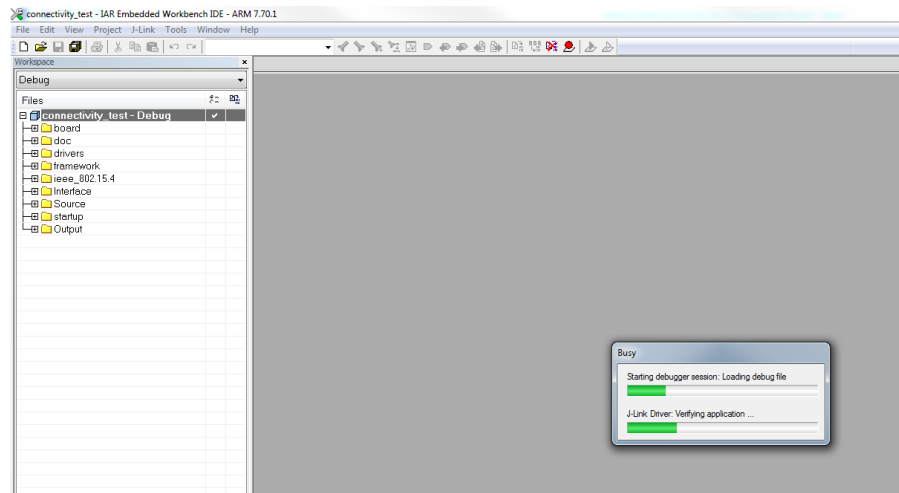


Figure 25: “connectivity_test” loading stage example

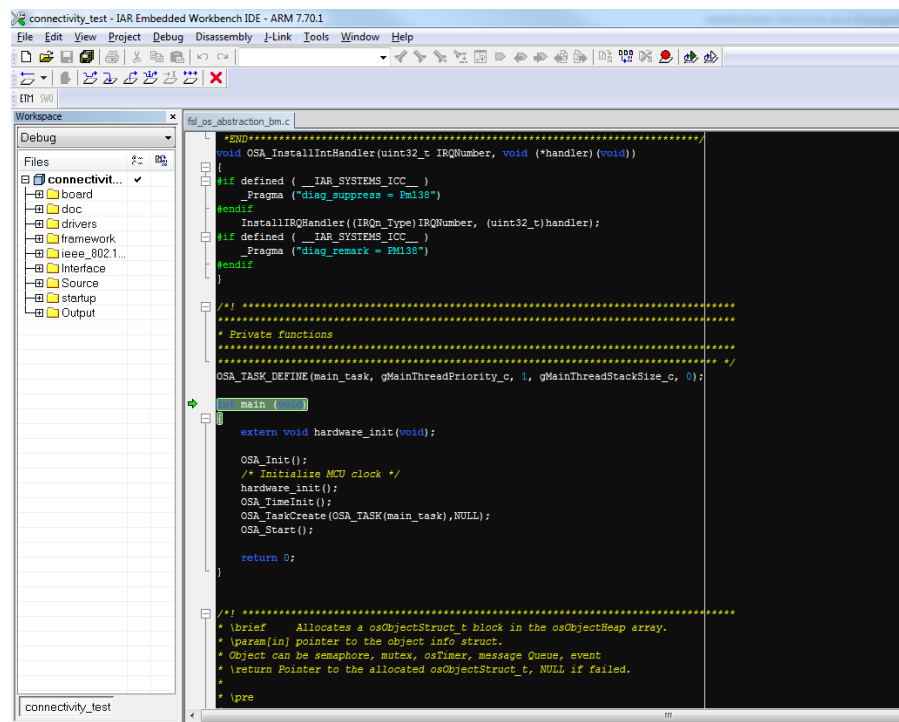


Figure 26: “connectivity_test” application loaded

Step 2:

After loading the application check “Device Manager” to get the serial ports numbers. These should appear with the prefix “JLink”.

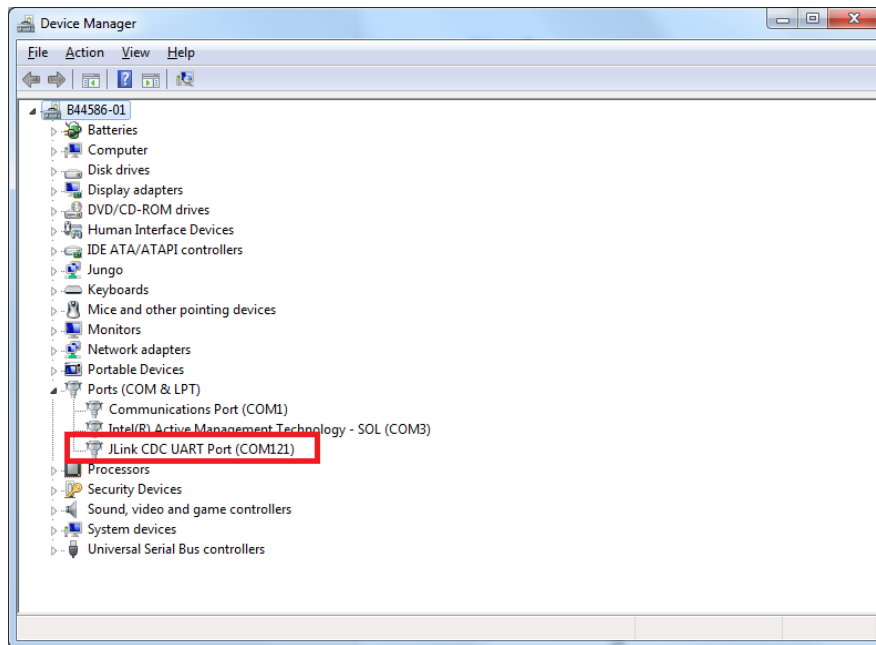


Figure 27: Device Manager serial port lookup

Step 3:

Using the port numbers specified in Device Manager, open a Tera Term instance and connect to the device using the 115200 baud rate. To change the baud rate of the terminal go to “Setup-> Serial Port” menu.

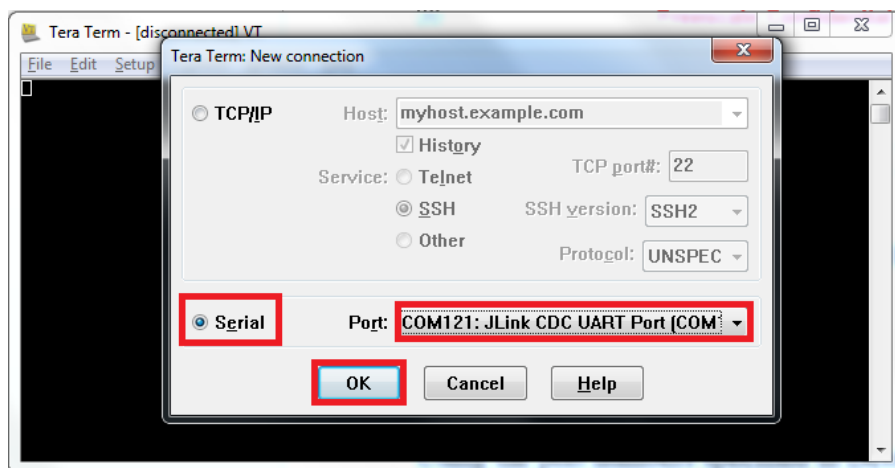


Figure 28: Select JLink serial connection COM port

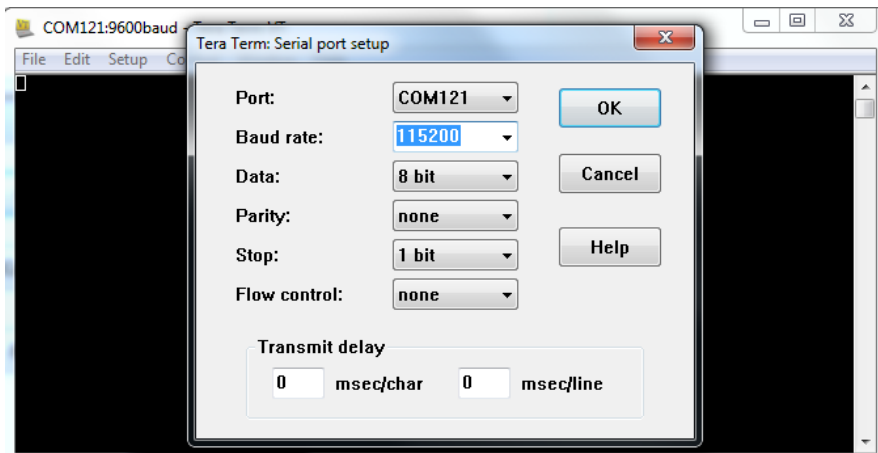


Figure 29: Setting the correct baud rate

Step 4:

Start the applications by pressing the ENTER key. Any other key will display the logo screen again.

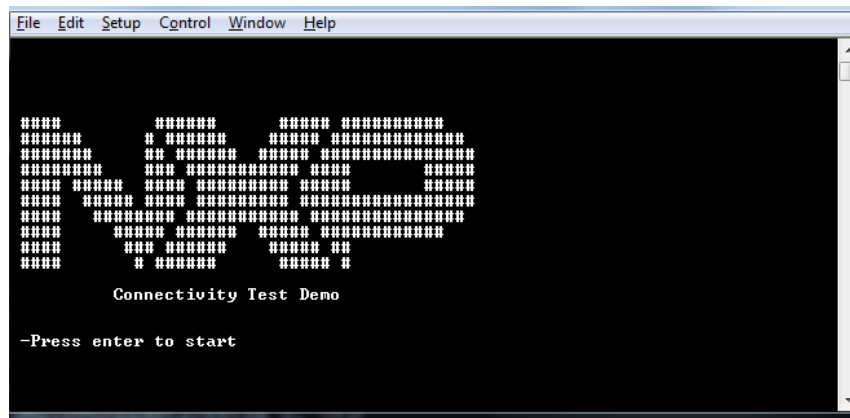


Figure 30: Application after a reset

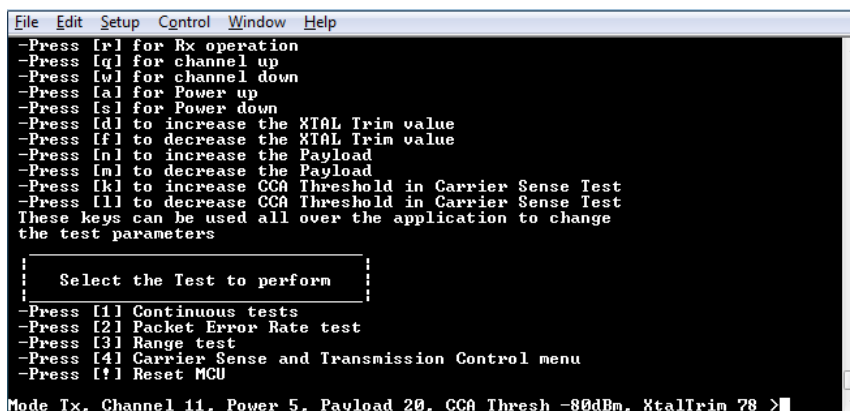


Figure 31: Connectivity Test main menu

Follow the on-screen instructions to run each test. If a test needs a second platform, follow the steps above to set it up.

The previous section demonstrates the basic steps to run a demo application. For detailed information about the demo applications, please refer the *KW41Z SMAC Demo Applications User's Guide* included in the installer (*KW41ZSMACDAUG.pdf*).

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