



USB Speakers Demo

Demo configuration, software and development tools

Rev. 2

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Revision History

Revision	Date	Changes
2	Sept 11, 2012	<ul style="list-style-type: none">• Initial Release
2.1	Sept 18, 2012	<ul style="list-style-type: none">• Added steps to change system audio output for different OS supported• Changed supported OS

1 Overview

The USB speaker enables high quality audio streaming thru USB implementing the USB Audio class and Tower system with enough flexibility to add audio post-processing such as equalizers, digital volume controls, audio enhancement algorithms.

To achieve the high quality audio, the demo implements 2 audio channels @ 96KHz with 24-bit samples and SW synchronization based on Isochronous Asynchronous transfers with a feedback endpoint, eliminating any need of extra HW for synch purposes.

The USB Speakers demo is a modification of the USB Speaker example application available on the USB stack with PHDC support:

www.freescale.com/usb

2 Features

- Stereo speakers with 24-bit samples @ 96 KHz
- USB Audio class v1.0 compliant
- Use resident USB driver from Windows , Mac and Linux dropping the need of specialized driver
- Isochronous Asynchronous transfers with a feedback endpoint implementation to eliminate the need of additional HW for audio synchronization
- Easily to build using Tower system
- DMA implementation with SAI module to free CPU load
- Compatible with Mac OS (Lion and Snow Leopard), Linux (Ubuntu 10.04 and above)

3 Hardware

3.1 Requirements

In order to set up the USB Speakers demo you would need:

- TWR-K60D100M
- TWR-SER
- TWR-AUDIO-SGTL (Rev B1)
- TWR-ELEV
- Active stereo speakers with 3.5mm plug and volume control
- One mini USB cable

3.2 Settings

The demo requires certain jumper configurations on the TWR-K60D100M and TWR-SER modules.

For the TWR-K60D100M:

- J10 to position 2-3 to get the 50 MHz clock from the TWR-SER

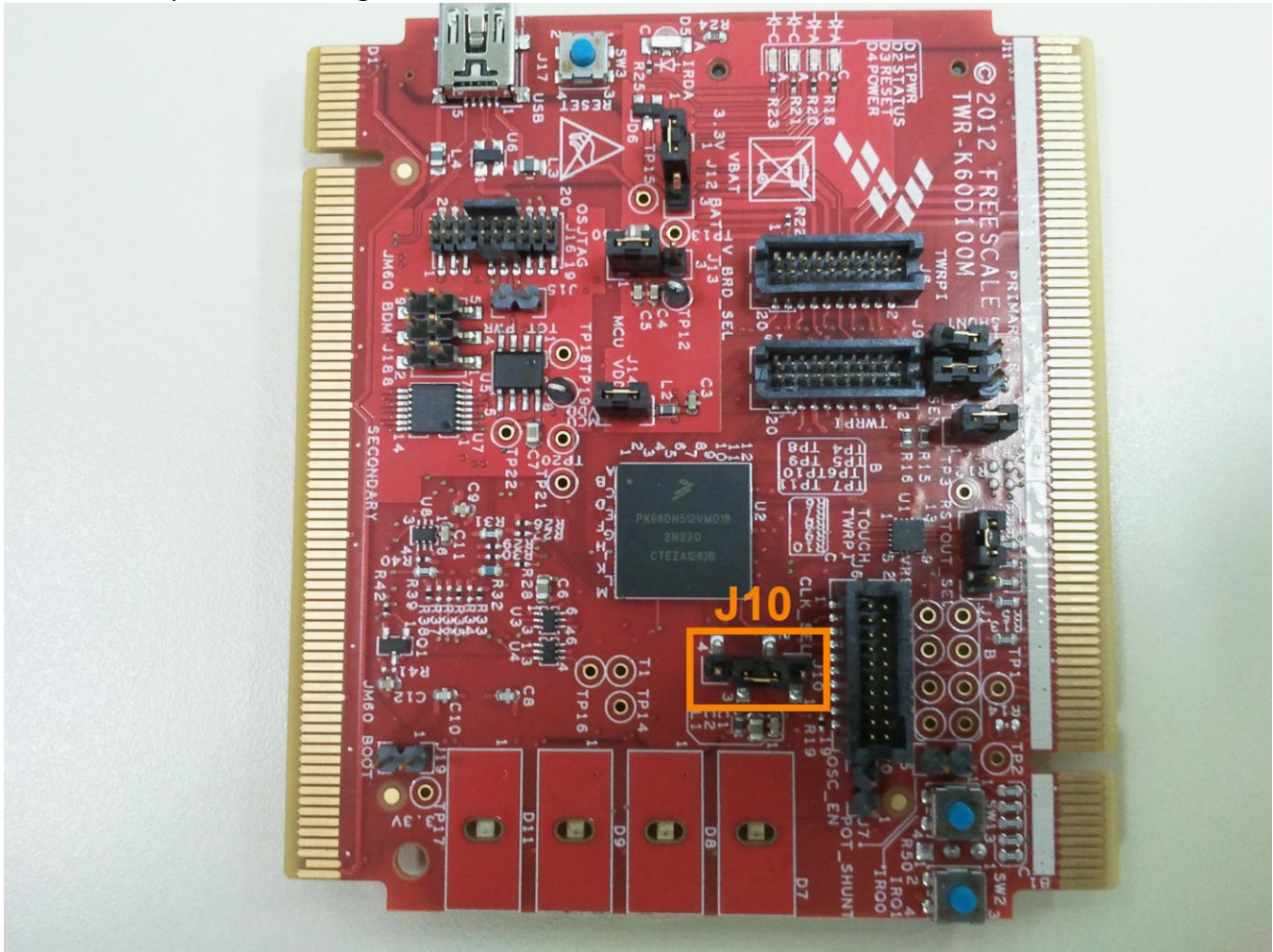


Figure 1. TWR-K60D100M Jumpers

For the TWR-SER:

- Set J3 in 2-3 position to provide 50MHz to the MCU (if TWR-K60N512 is used)
- J10 must be set to 2-3 to power the Tower thru USB
- J16 to position 3-4 to get 5v from the USB cable



Figure 2. TWR-SER Jumpers

Connect the active speakers to the J2 line out connector on the TWR-AUDIO-SGTL.

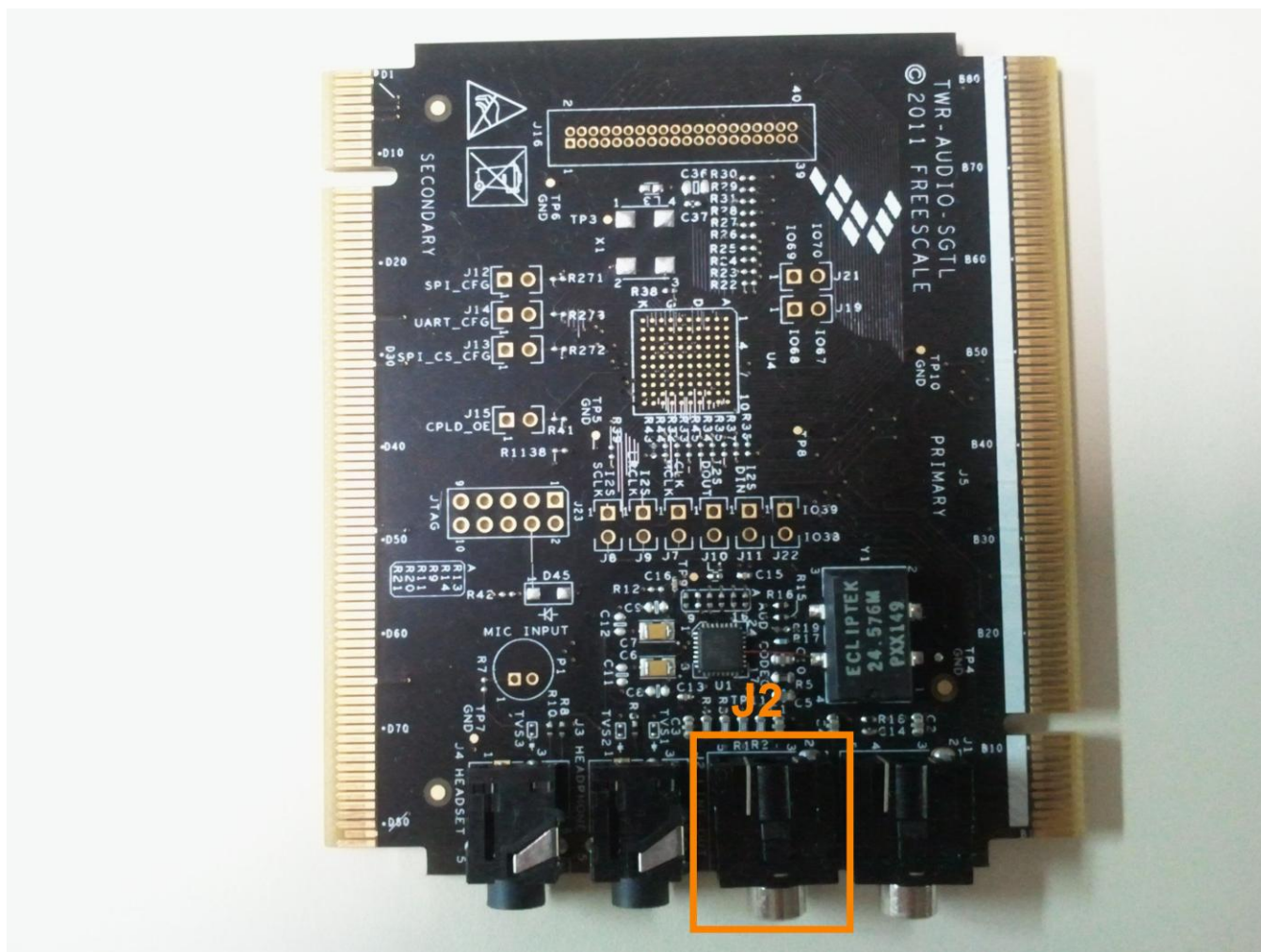


Figure 3. TWR-AUDIO-SGTL

4 Software

The SW is designed to minimize CPU load by implementing different HW modules:

- SAI driver (Master) for I2S mode
 - o DMA and FIFO enabled
- Audio buffer handler
 - o Ringbuffer approach managed by DMA
- IIC driver
- SGTL5000 Driver
 - o Lineout output enabled
 - o 96KHz sampling rate
 - o I2S Slave

- DAP disable
- Headphone output enabled
- USB Audio device class v1.0
 - Enumerates as speaker
 - Stereo
 - 1 sampling rate (96Khz)
 - 24-bit samples
 - Isochronous Asynchronous transfers
 - Feedback endpoint
 - Algorithm for feedback calculation
 - Ensures complete synched audio without adding or dropping samples or using external clock synthesizers

The SW follows the layered scheme shown in Figure 3:

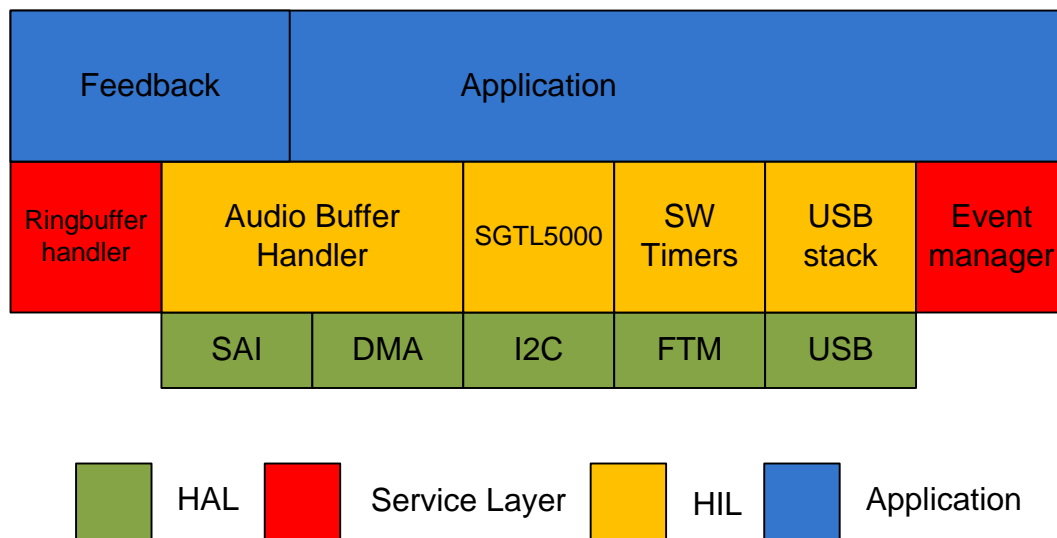


Figure 4. USB Speakers Demo SW

HAL: Hardware abstraction layer
 HIL: Hardware independent layer

5 Loading the Demo

- 1) Follow the directions in Section 6.1 to update OSJTAG firmware and 7 to install CodeWarrior 10.2 with updates
- 2) Open CW10.2. At the welcome screen, set the workspace default location.

- 3) If you already have CW10 open, you can change the workspace by going to File->Switch Workspace.
- 4) The first time you open CW10, you will be taken to the welcome screen. Click on Go To Workbench on the lower-left-hand side.
- 5) The workbench view will open. To ensure all the windows are properly set, go to Window->Reset Perspective.

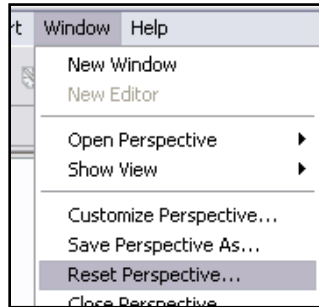


Figure 5. CodeWarrior reset perspective

- 6) Unzip the USB_Speaker_96Khz_24_bits_K60D100.zip file on any location of your computer
- 7) On CW click on File->Import in the menu bar. In the dialog box that appears, select Existing Projects into Workspace under the General folder. Click Next.

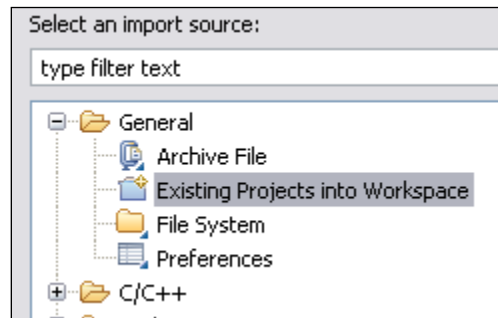


Figure 6. CodeWarrior import project


- 8) On the next screen, select the Select root directory: Option, and click Browse.
- 9) Navigate to the directory where the USB_Speaker_96Khz_24_bits_K60D100.zip was uncompressed and click OK.
- 10) Select the project. Then click Finish.
- 11) Clean the project by right-clicking on the project then selecting Clean...
- 12) Build the project by clicking the Hammer icon in the toolbar. 
- 13) Open the Flash File to Target tool by clicking on the black arrow of the lightning icon



Figure 7. Flash file to target

- 14) On the File Options section select Browse then Workspace.
- 15) A new window appears with the list of projects, expand the USB_Speaker_96Khz_24_bits_K60D100 project then the MK60DN512_INTERNAL_FLASH folder
- 16) Select the USB_Speaker_96Khz_24_bits_K60D100.afx file then click Ok

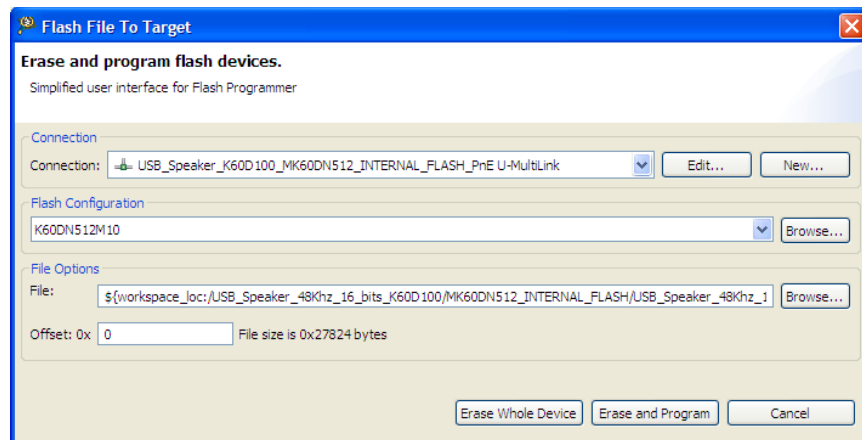


Figure 8. File selected

- 17) Connect the mini USB cable to USB connector on the TWR-K60D100M (J17)
- 18) Click on Erase and Program
- 19) Once CW finished programming the MCU unplug it from the PC
- 20) Assemble the Tower System
- 21) Connect the Tower System to the host PC by connecting the mini USB cable to the TWR-SER and the other end to the PC^{[1][2]}
- 22) The Tower System will power up and the LED on D11 will start toggling
- 23) Wait for the driver to be installed if needed
- 24) Open a multimedia player and start playing a music file

[1]Isochronous Asynchronous transfers are not supported on Windows XP and below releases

[2]This demo has been tested in:

- * Mac OS (Snow Leopard, Lion)
- * Linux (Ubuntu 10.04 and above)

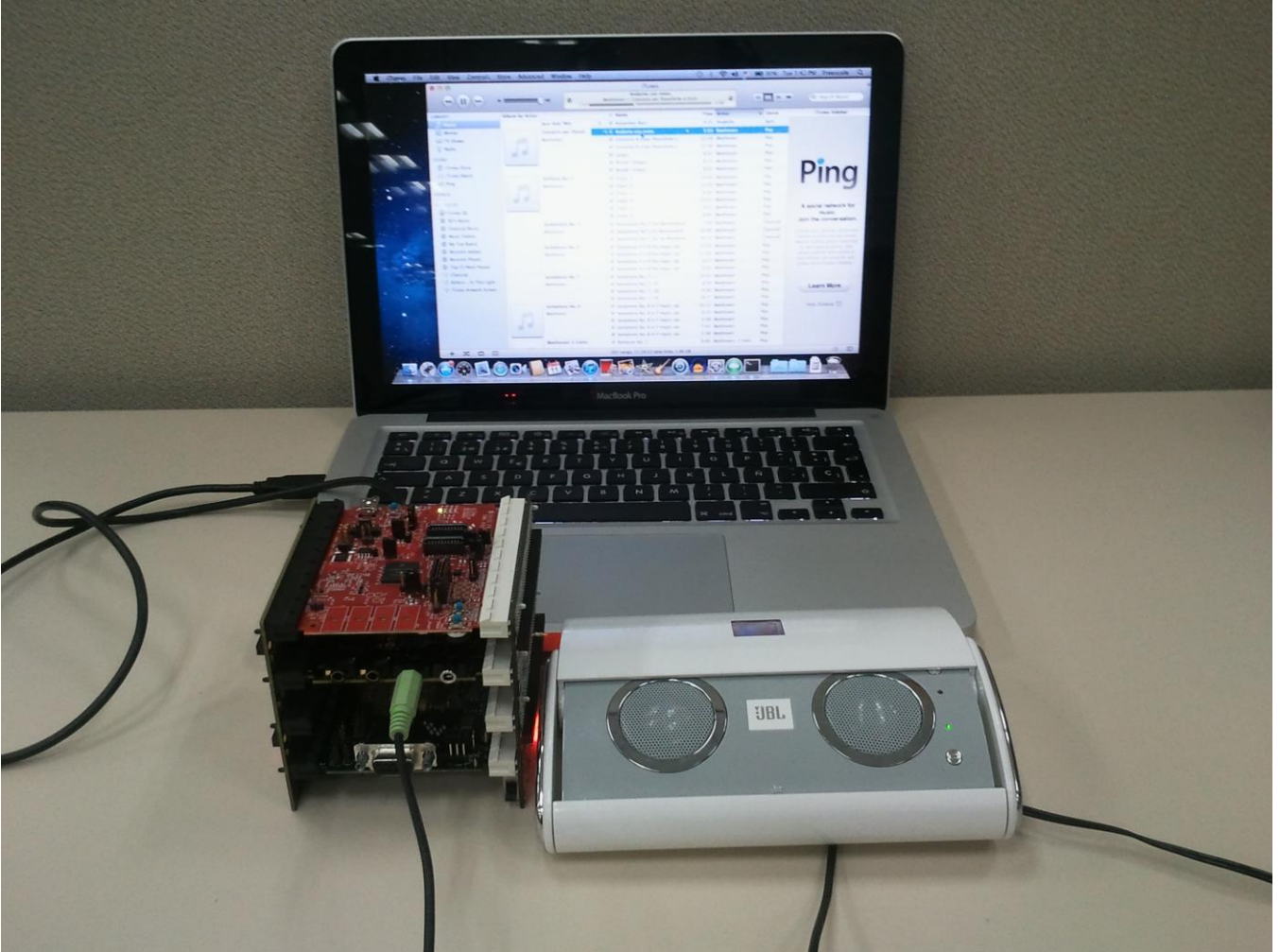


Figure 9. USB Speakers

5.1 Change System output

In order to select the system output to the Freescale USB Speakers follow the steps detailed below for the different OS supported.

5.1.1 Mac OS

1. Go to System Preferences

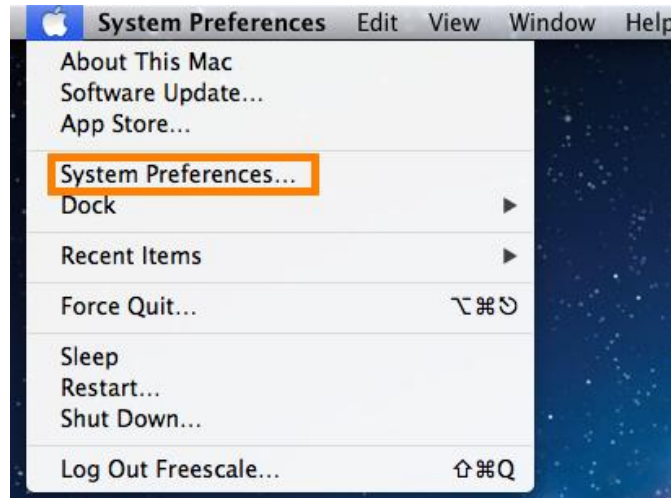


Figure 10. Mac System Preferences

2. Select Sound preferences



Figure 11. Sound Preferences

3. Select Output and then choose the Freescale USB Speakers

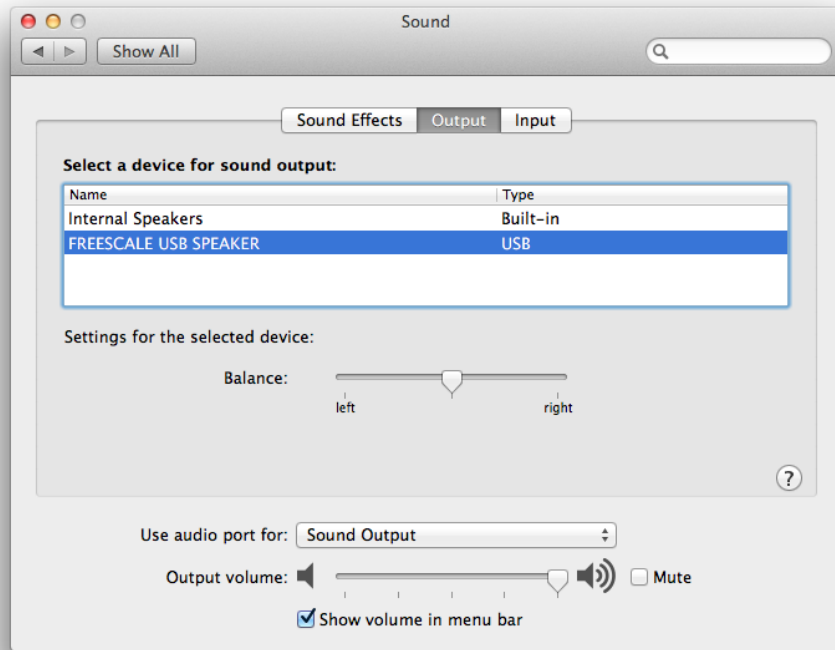


Figure 12. Sound Output

5.1.2 Ubuntu

1. Select System menu, then Preferences and Sound

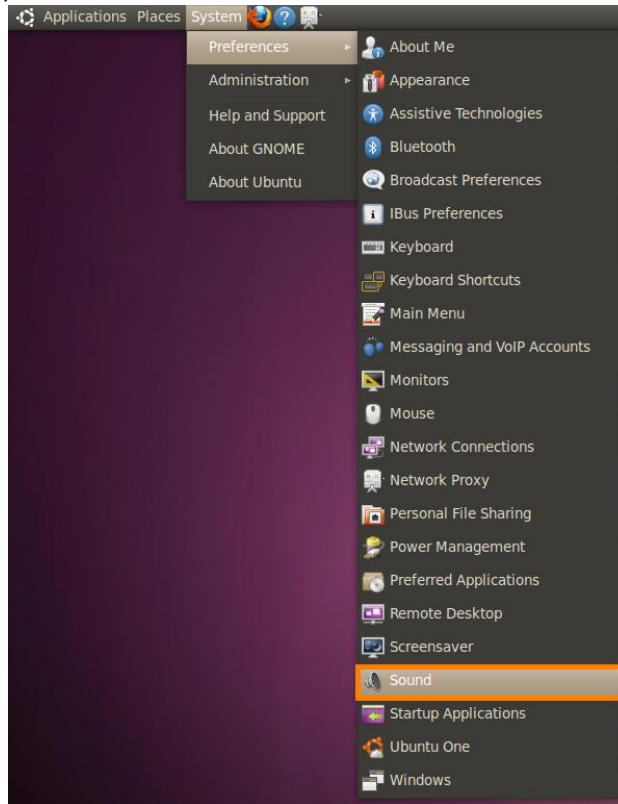


Figure 13. System Preferences Sound

2. Select Output from the Sound preferences window and choose Freescale USB Speakers as the default output

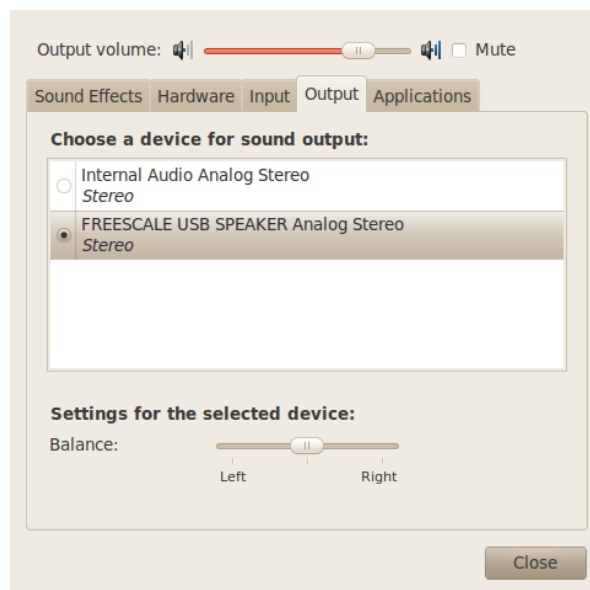


Figure 14. Linux Output

6 OSJTAG

The TWR-K60D100M includes the OSJTAG circuit. By default, all of the demo projects are set up to use OSJTAG to download and debug code.

6.1 Updating OSJTAG

Open Source JTAG, also known as OSBDM on ColdFire Tower processor modules, allows a user to program, debug, and get serial data from Kinetis devices via a USB cable. The firmware runs on a Freescale MCFS08JM60 on the underside of the Kinetis Tower processor module. To ensure compatibility between the drivers, firmware, and terminal window, the latest versions of each must be installed.

1. Download and install both of the latest P&E Firmware Updates and Recovery and OSBDM Virtual Serial Toolkit programs which can be found at <http://www.pemicro.com/osbdm>.
2. Make sure your Tower module is plugged in, and run the P&E Firmware Updater Utility to use the OSJTAG boot loader to upgrade to the latest OSJTAG version.
3. Under Select Hardware Type, ensure OSBDM/OSJTAG is selected. It should automatically detect your module settings and fill out the rest of the fields automatically.

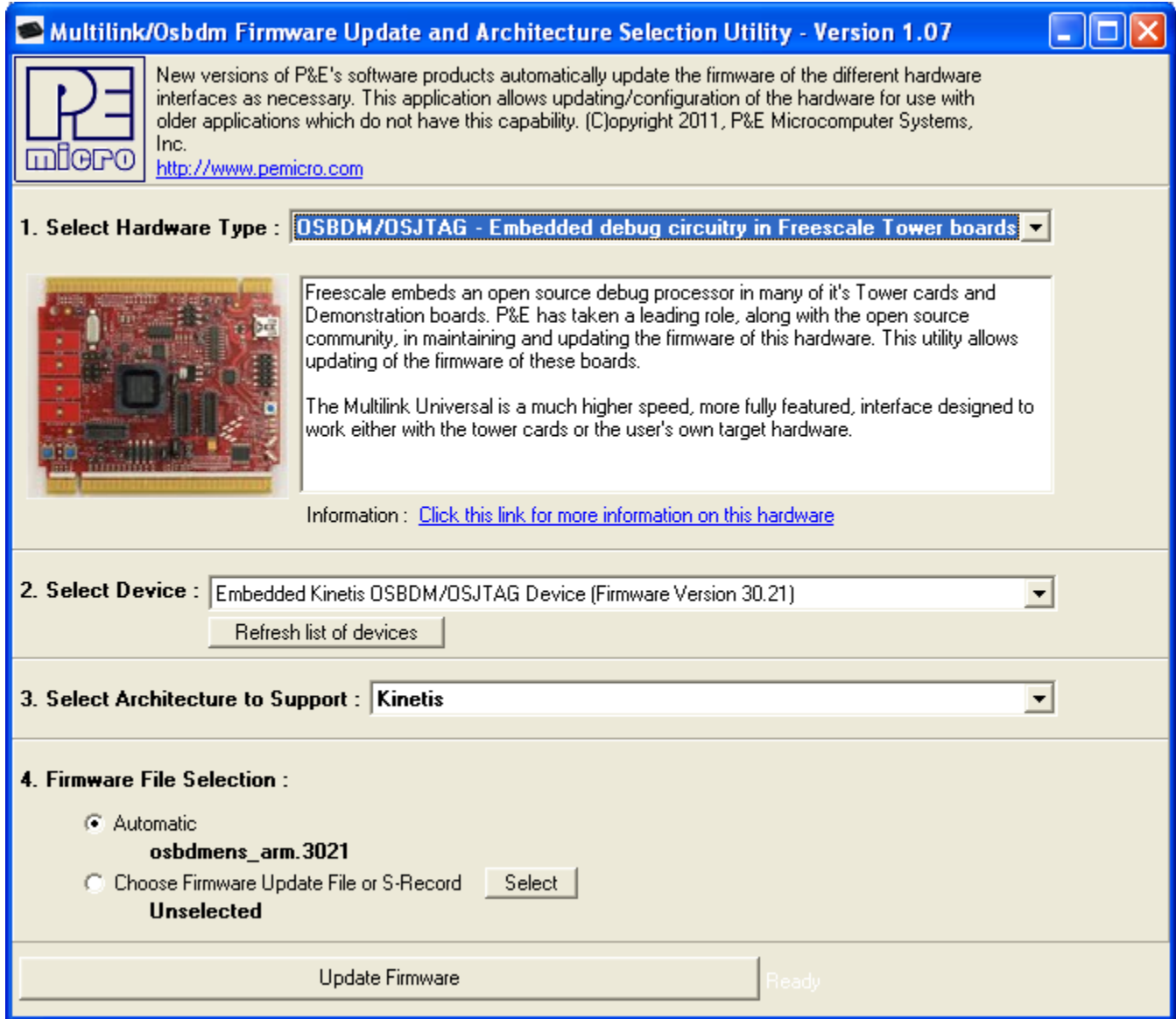


Figure 15. Firmware update

4. Click on Update Firmware to update the firmware. It will prompt you to disconnect the USB cord from your computer, and then short the JM60 boot loader jumper header. It is J19. Then reconnect the module to your computer.

The firmware will then be updated on your module. When it is finished, it will prompt you again to disconnect the USB cable, remove the jumper, and then reconnect the module. OSJTAG is now updated.

6.2 Troubleshooting OSJTAG

When the Tower module is plugged in, it should enumerate as a composite device, with one driver for debugging, and the other as a serial port. If you go to the Device Manager you should see the following:

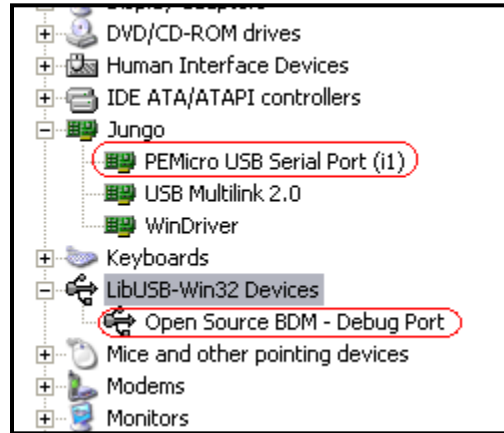


Figure 16. Device Manager

If you only see it enumerate as the Open Source BDM Debug Port, then your computer may be automatically picking up an outdated driver. To fix this, right-click on the OSBDM driver and select Uninstall. Then unplug and re-plug in the Tower processor module, and it should enumerate correctly.

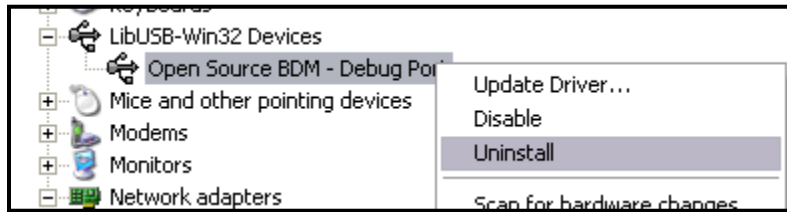


Figure 17. OSJTAG uninstall

If there are still problems with enumerating correctly, you can also manually select the drivers.

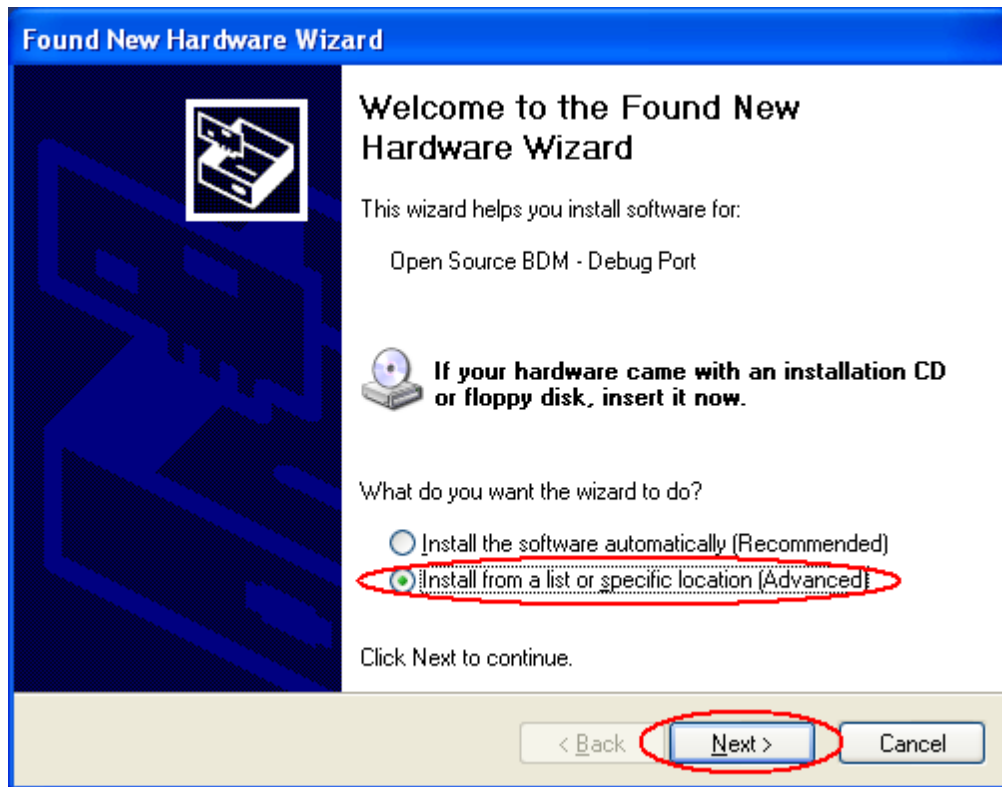


Figure 18. OSJTAG install

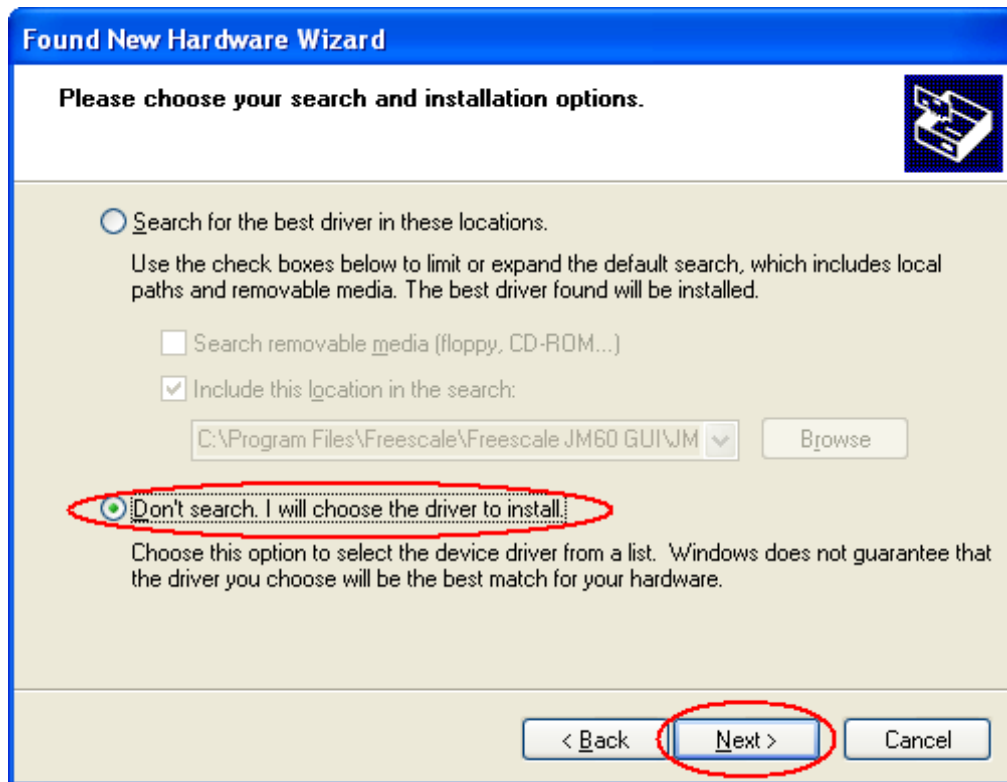


Figure 19. OSJTAG install option

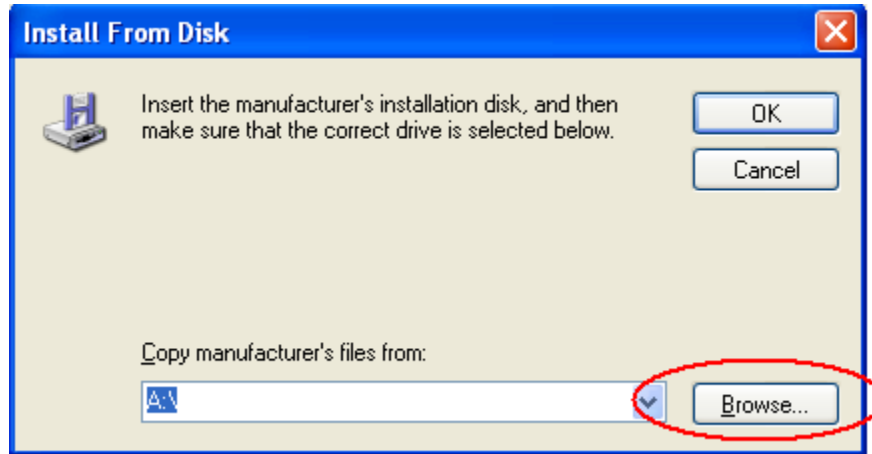


Figure 20. OSJTAG driver browse

- For the Open Source BDM – Debug Port, use the driver at:
C:\pemicro\kinetis_tower_toolkit\Drivers\osbdm\OSJTAG_Debug_Interface_libusb.inf
- For the PEMicro USB Serial Port (i1), use the driver at:
C:\pemicro\kinetis_tower_toolkit\Drivers\osbdm\OSJTAG_Serial_Interface_windriver_version.inf

7 Development Software

7.1 Download CW

Download CodeWarrior for MCU 10.2 from the following link and install it:

<http://www.freescale.com/codewarrior>

7.2 Update CW

The USB Speakers demo must be used with the latest Service Packs (SP) and the update version 1.0.0 for CodeWarrior for MCU's v10.2. To download the available SP:

1. Go to Help->Install new Software...
2. On the "Work with" drop down menu, select the FSL MCU Eclipse Update Site

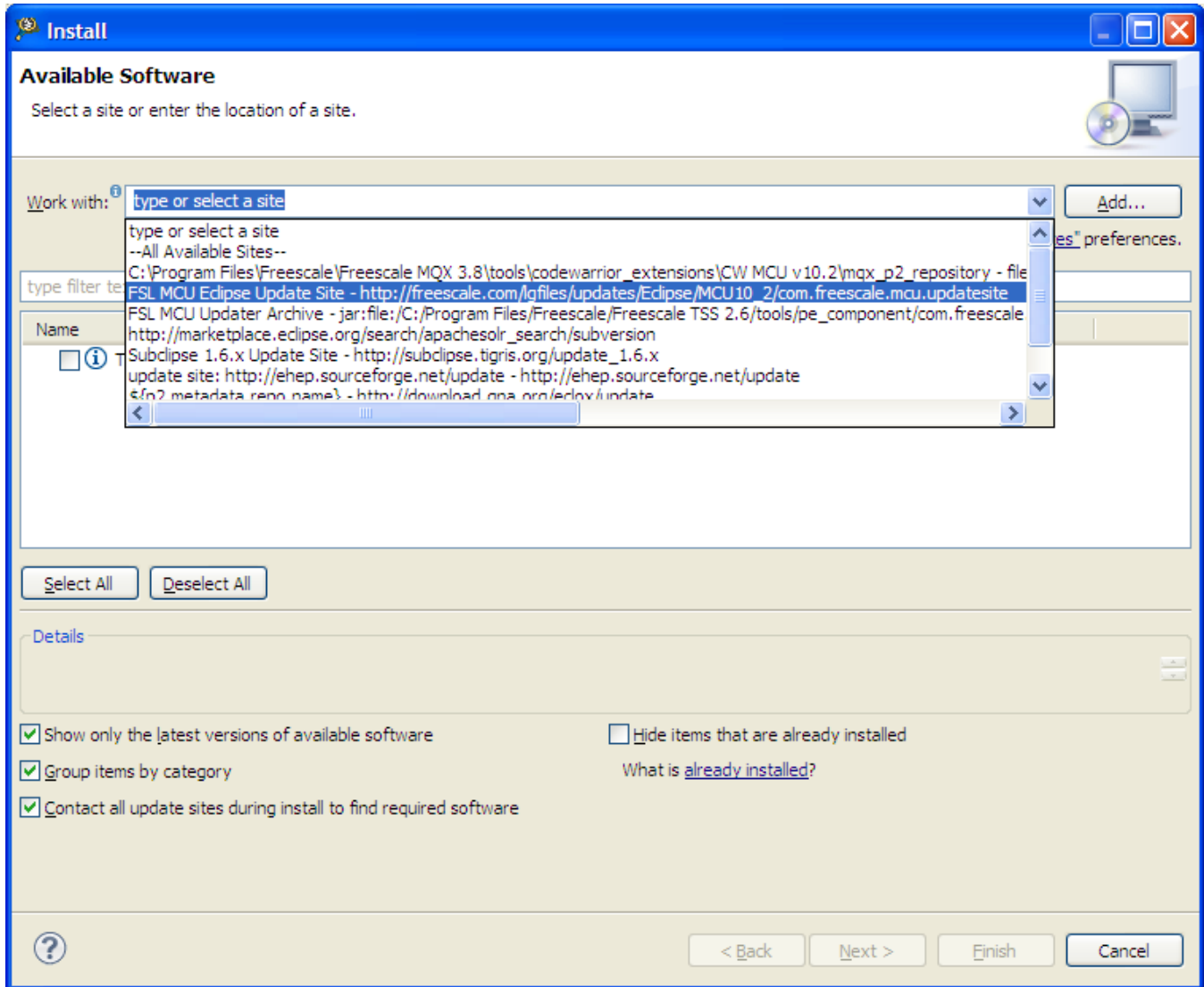


Figure 21. CodeWarrior update site

3. Select all of the available updates, clear the box “Contact all update sites during install to find required software”. Click Next.

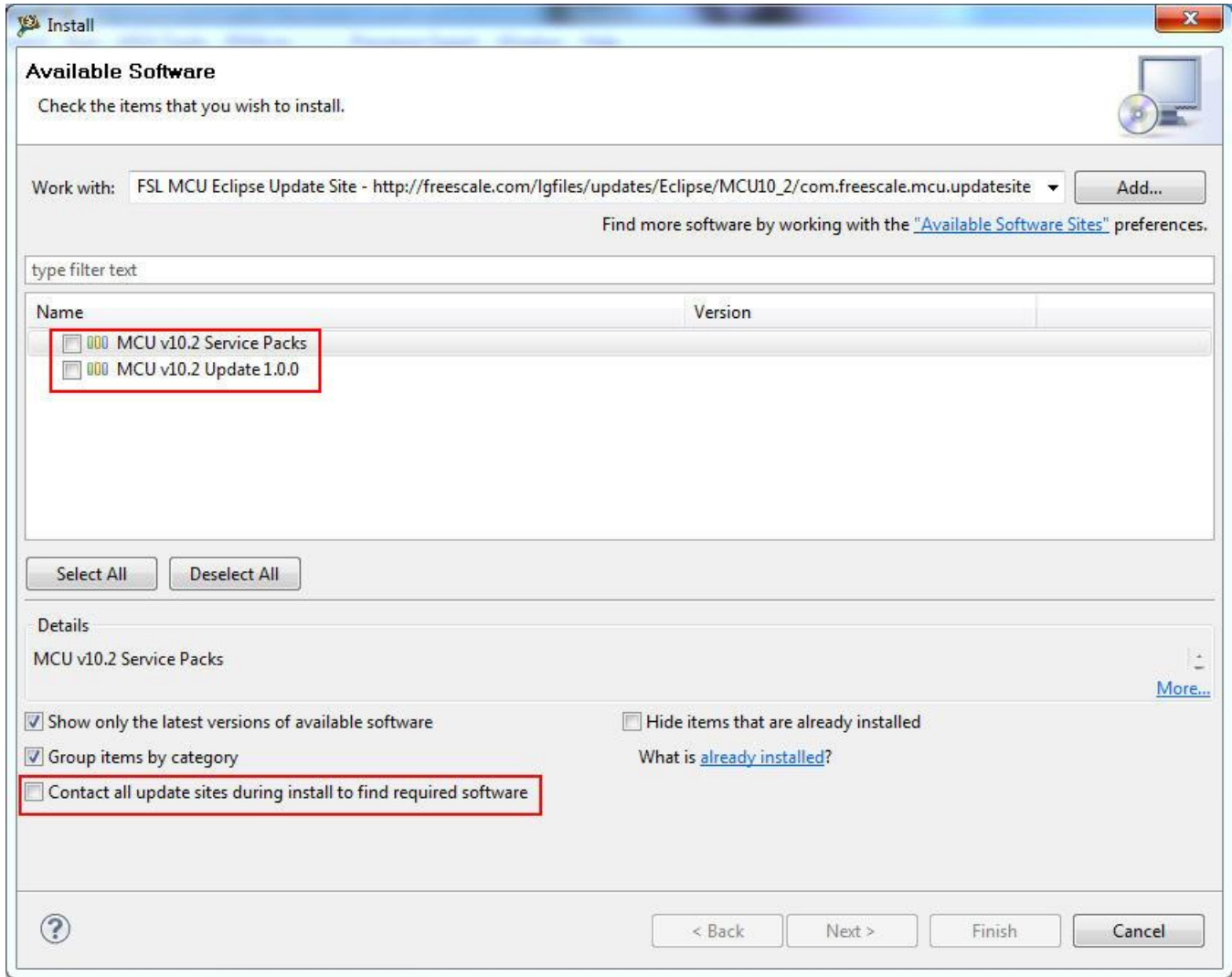


Figure 22. CodeWarrior update packages

4. A list of all the packages that will be installed is shown, select all of the packages and click Next.

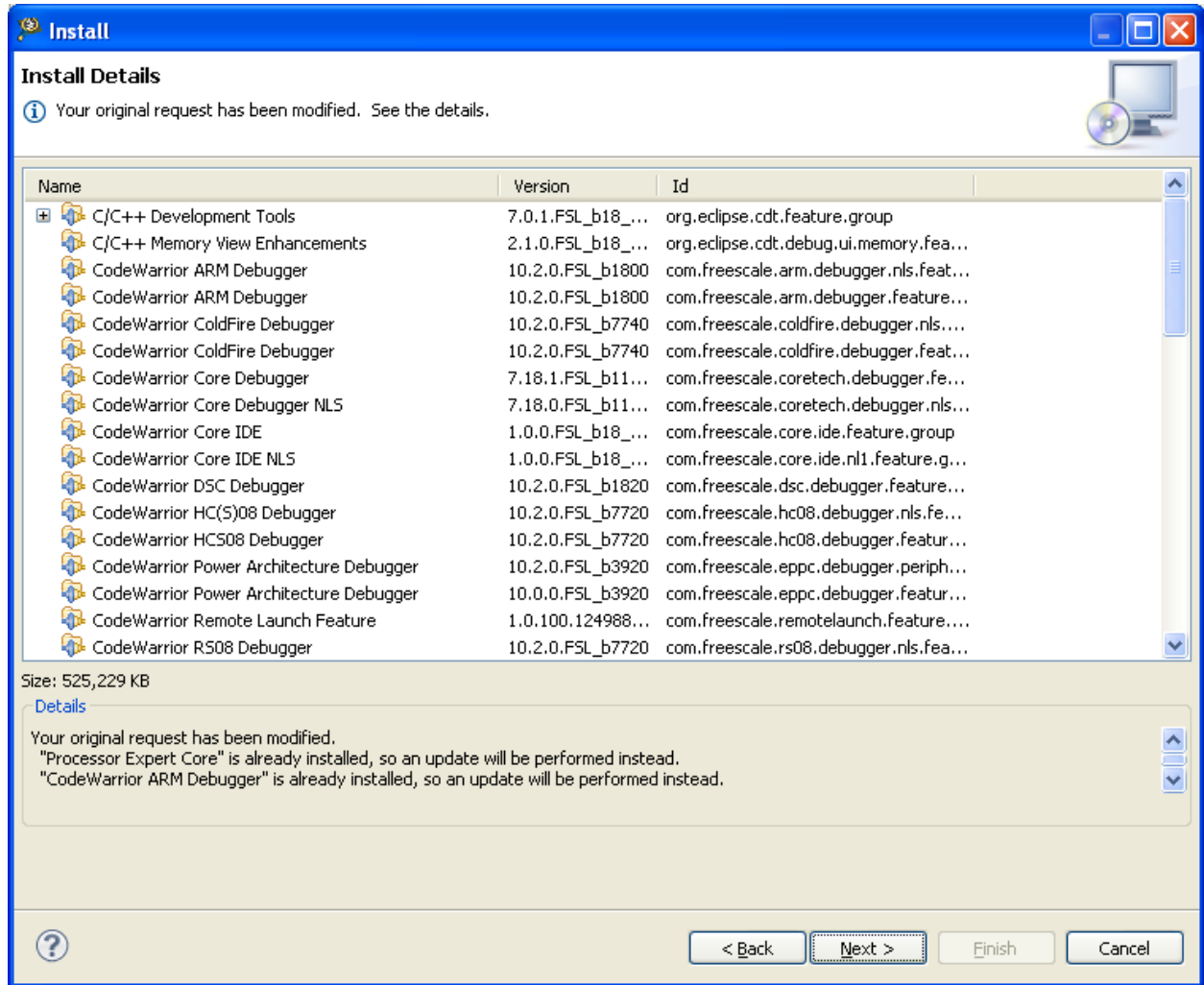


Figure 23. CodeWarrior install packages

5. Now the licensing window appears, accept all terms and licensing and click Finish.

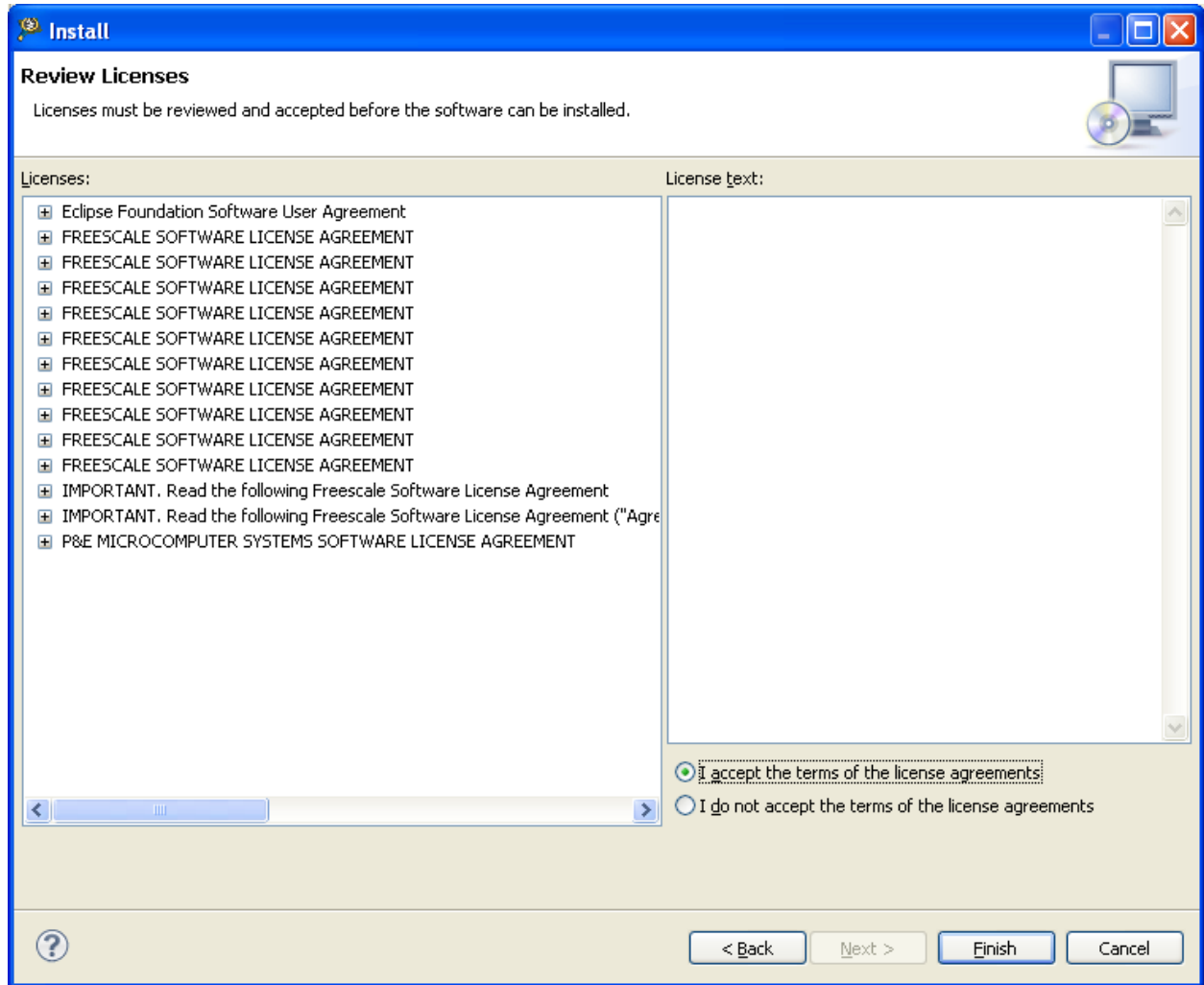


Figure 24. CodeWarrior terms and licensing

6. After all of the packages are installed, restart CodeWarrior.

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