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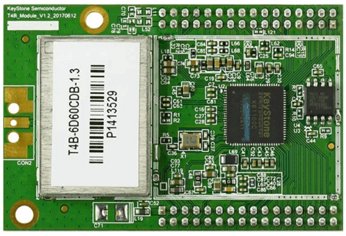

SIXTH LOGIC SLG002 DAB+ FM Development Board PRO2 User Guide

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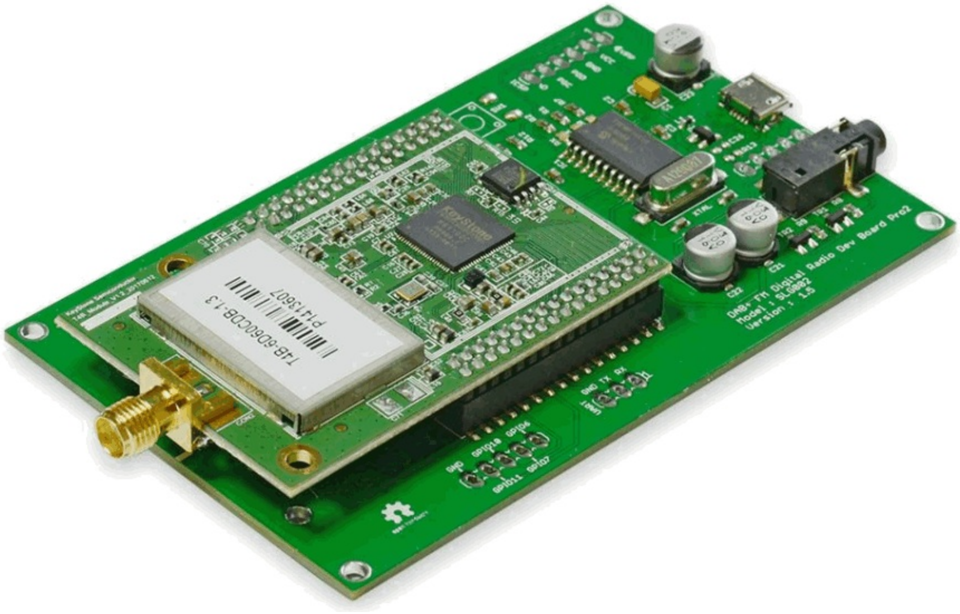

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DOCUMENT REVISION HISTORY

Revision A (April 2019)

- Initial Release of this Document.

Chapter 1. Introducing the DAB+ FM Development Board PRO2

INTRODUCTION

The following sections provide an overview of the DAB+ FM Development Board and demonstrate how to use it. The following topics are covered:

- Description of the DAB+ FM Development Board PRO2
- Using the DAB+ FM Development Board PRO2

DESCRIPTION OF THE DAB+ FM DEVELOPMENT BOARD PRO2

- The DAB+ FM Development Board PRO2 provides a platform for developing and evaluating DAB+ and FM receivers. The board contains a Keystone T4B-6D60CDB DAB/DAB+/FM/EPG/SlideShow the module on a PRO board with a Microchip PIC18F14K40 microcontroller.

The T4B-6D60CDB module is an ultra low power DAB/DAB+/FM receiver module with the following features:

- ETSI EN 300 401 compliant receiver
- DAB/DAB+ sensitivity to -99dBm (typical)
- Decodes multiple audio services up to 256kbps without external RAM
- FM with RDS (RDS reception is subject to certain conditions of power level and frequency deviation)
- Combined antenna input for FM / Band3
- Serial control interface
- RoHS compliant
- EPG
- SlideShow

The Microchip PIC18F14K50 provides a USB to Serial interface for the radio module to communicate with the host PC. Despite the sample code provided in this Development Board for communicating with the board being based on serial communication, users can analyze the serial communication and implement a driverless HID protocol by rewriting the firmware on the PIC18F14K50.

DEVELOPMENT BOARD OVERVIEW

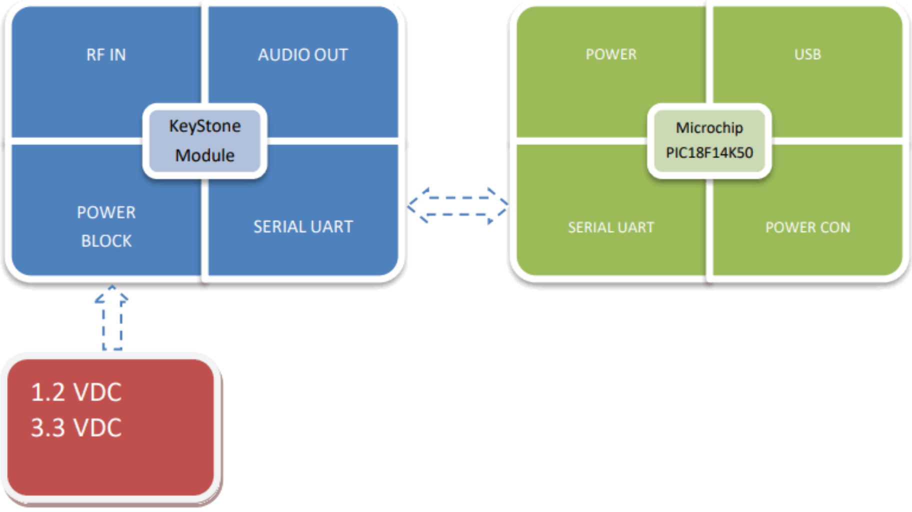


FIGURE 1.1: Development Board Block Diagram.

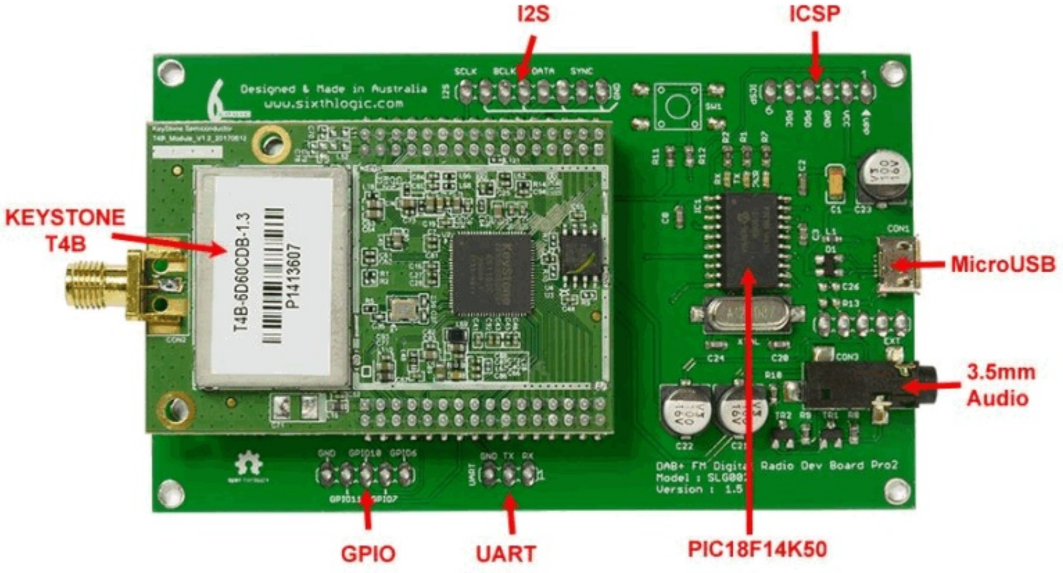


Figure1.2: Development Board Top View.

Chapter 2. Quick Start Guide

INTRODUCTION

This chapter explained the basic steps to get you started using the DAB+ FM Development Board.

HIGHLIGHTS

Items discussed in this chapter include:

- Setting up the hardware
- Installing the Microchip's CDC driver
- Running the sample program

SETTING UP THE HARDWARE

1. Download the DAB+ FM Development Board's software package from the product website and then unzip the software package to a known folder.
2. Connect the supplied antenna to the SMA connector on the board. The antenna has a magnetic base, sticking the antenna to a large metal surface, for example, a window frame, will produce a better reception. Users need to experiment to find a suitable location to place the antenna.
3. Connect a USB cable (Mini B) to the board and the other side of the cable to the Host PC.
4. Ensure the three LEDs on the board light up.
5. Connect speakers or headphones to the 3.5mm stereo jack, possible to perform this step after the board is ready.

Handling the Board

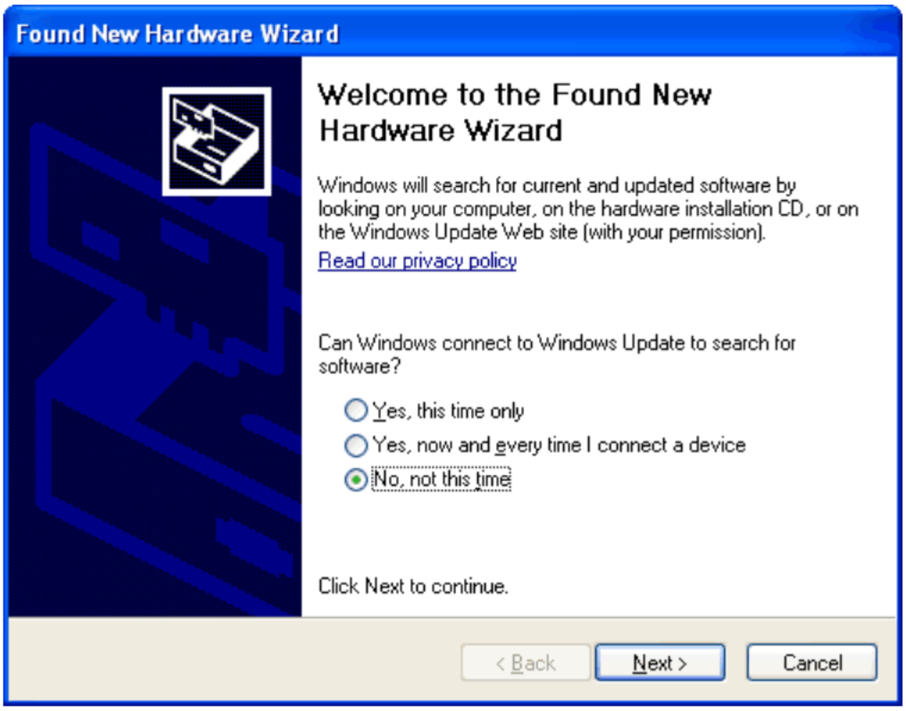
When handling the board, it is important to observe the following precaution:

⚠**Caution** Without proper anti-static handling, the board can be damaged. Therefore use antistatic handling precautions when touching the board.

⚠**Caution** In order to avoid damaging the board, only operate the board from a USB port's 5VDC supply.

INSTALLING MICROCHIP'S CDC DRIVER

After the board is being plugged into the host PC, Windows should recognize the board as "CDC RS-232 Emulation Demo". In the "Welcome to the Found New Hardware Wizard" window select "No, not this time" and then click "Next >" (Figure 2.1)



Welcome to the Found New Hardware Wizard

Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission).

Read our privacy policy

Can Windows connect to Windows Update to search for software?

○ Yes, this time only

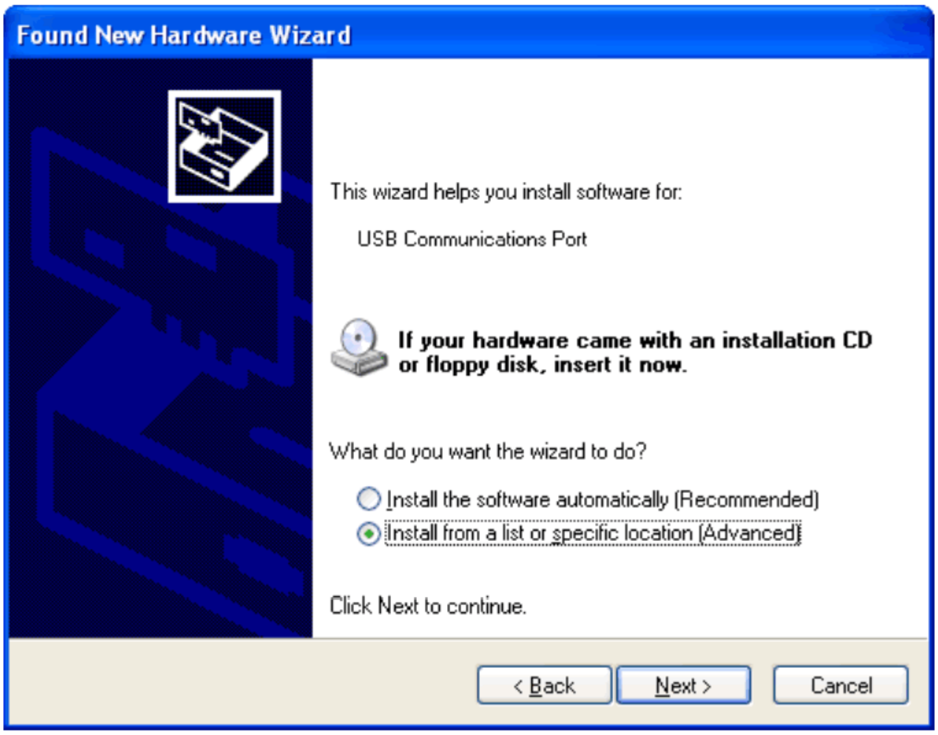
○ Yes, now and every time I connect a device

● No, not this time

Click Next to continue.

Figure 2.1: Found New Hardware Wizard Window.

The wizard will then prompt the user for a location from which to load the software for the communication port. Select “Install from a list or specific location (Advanced)” and click “Next >” (Figure 2.2)



This wizard helps you install software for:

USB Communications Port

If your hardware came with an installation CD or floppy disk, insert it now.

What do you want the wizard to do?

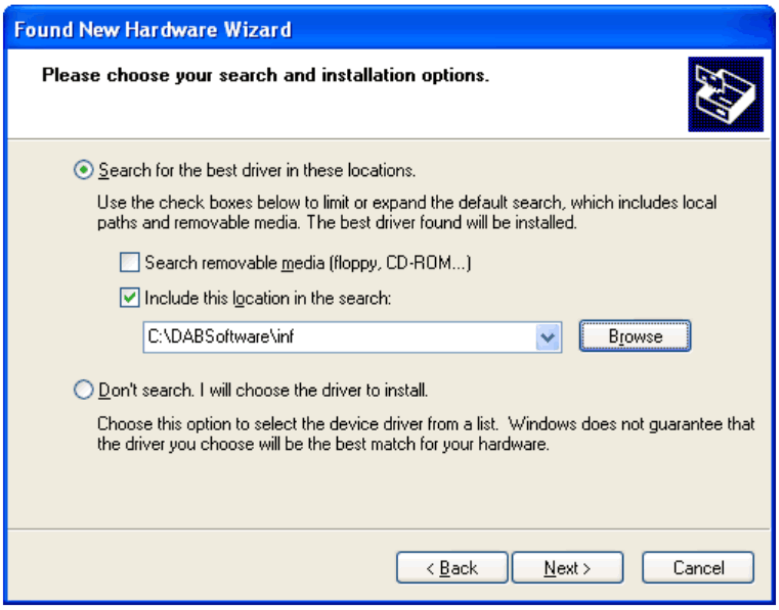
○ Install the software automatically (Recommended)

● Install from a list or specific location (Advanced)

Click Next to continue.

Figure 2.2: Select Software Location for Communication Port.

The wizard now prompts the user for the location of the .inf file that Windows will use to automatically configure the binary driver files (.sys files) to create the virtual COM port connection for the USB. Ensure that both “Search for the best driver in these locations” and “Include this location in the search” are both selected. Select “Browse” and navigate to the product software folder unzipped in step 2.3.1. If the user unzip the product software into the root of C driver, the driver files should be in the following folder:



Please choose your search and installation options.

● Search for the best driver in these locations.

Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.

□ Search removable media (floppy, CD-ROM...)

☑ Include this location in the search:

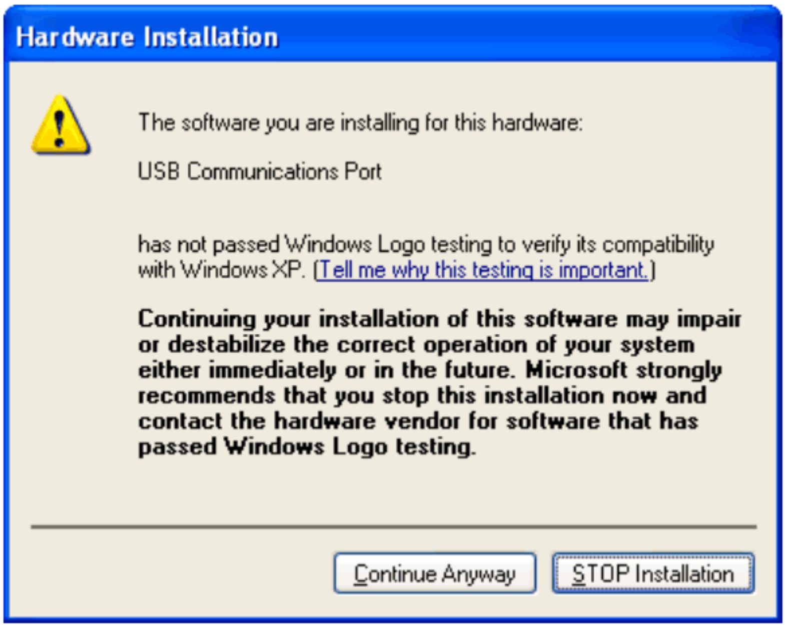
C:\DABSoftware\inf

○ Don't search. I will choose the driver to install.

Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.

Figure 2.3: Directing Windows to the .INF file for the CDC Serial Emulation Driver.

Click “Next >”. The window should now begin loading the driver. If any warnings are issued (Figure 2.4), select “Continue Anyway”.



The software you are installing for this hardware:

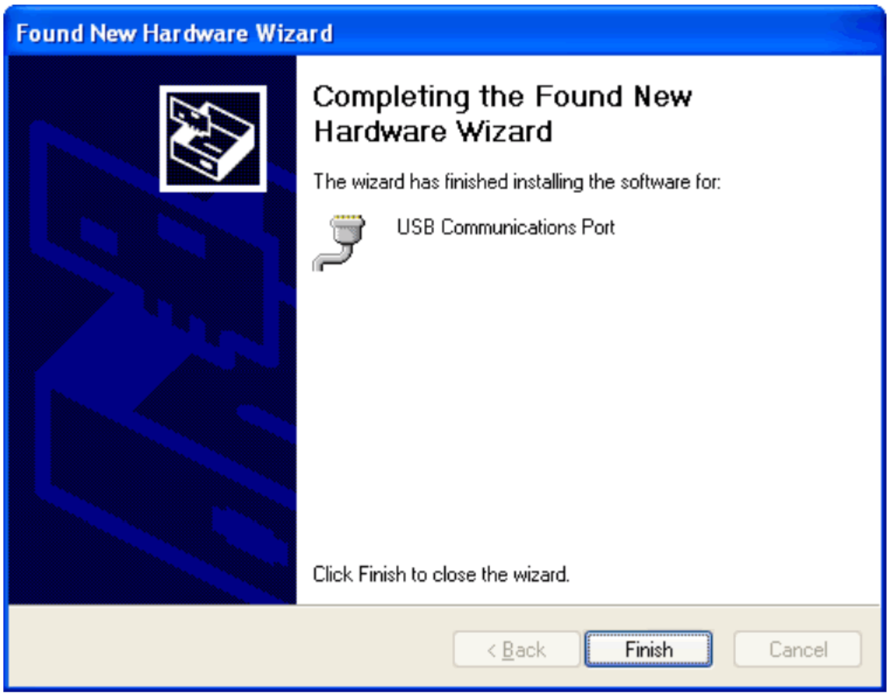
USB Communications Port

has not passed Windows Logo testing to verify its compatibility with Windows XP. (Tell me why this testing is important.)

Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.

Figure 2.4: Directing Windows to the .INF file for the CDC Serial Emulation Driver.

The wizard should indicate that the software for the Communications port was successfully installed. Select “Finish”. (Figure 2.5)



Completing the Found New Hardware Wizard

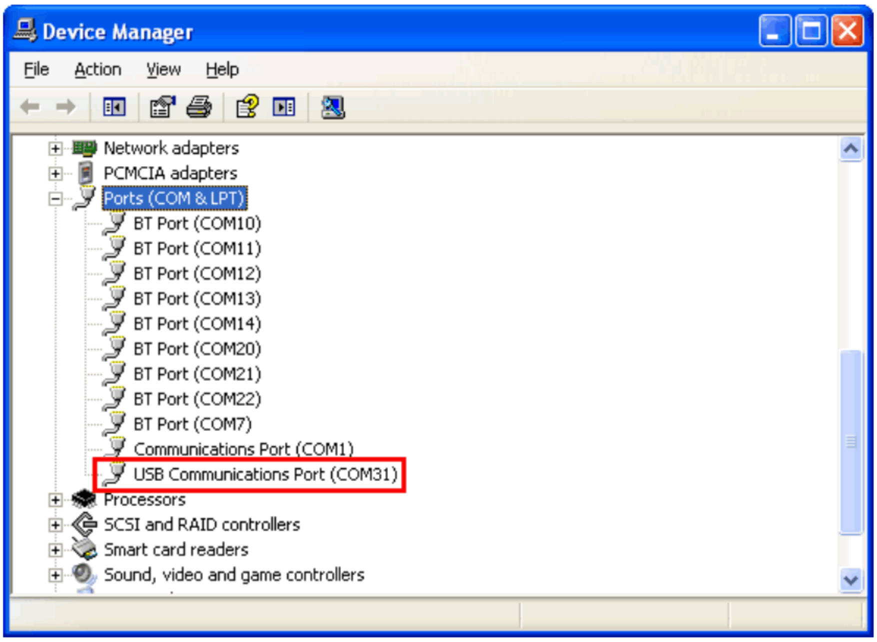
The wizard has finished installing the software for:

USB Communications Port

Click Finish to close the wizard.

Figure 2.5: Successful Driver Installation Window.

Next, the virtual COM port will be checked in the Device Manager to identify the COM port number. Click on Window's Start, Control Panel, System, Hardware, and finally Device Manager.
Expand the Ports (COM and LPT). The new virtual COM port created by the .inf file should be located in the Ports (COM and LPT) drop-down list in the Device Manager window. Figure 2.6 shows the created COM port. The user's COM port may differ.



```
Network adapters
PCMCIA adapters
Ports (COM & LPT)
    BT Port (COM10)
    BT Port (COM11)
    BT Port (COM12)
    BT Port (COM13)
    BT Port (COM14)
    BT Port (COM20)
    BT Port (COM21)
    BT Port (COM22)
    BT Port (COM7)
    Communications Port (COM1)
    USB Communications Port (COM31)
Processors
SCSI and RAID controllers
Smart card readers
Sound, video and game controllers
```

Figure 2.5: Device Manager showing COM port created.

Once the COM port driver has been successfully installed, the TX and RX LEDs will automatically turned off.

RUNNING THE SAMPLE PROGRAM

The sample program (VB.NET source code included) for the DAB+ FM Development Board requires Microsoft's .NET Framework 3.5 to work. The .NET Framework 3.5 can be found at:
http://www.microsoft.com/download/en/details.aspx?id=21
After installing the .NET Framework, navigate to the DAB software folder below:
C:\DABSoftware\TestKeyStoneRadio\bin\x86\Release

Execute TestKeyStoneRadio.exe

Figure 2.6 shows the default start-up screen of the sample program.

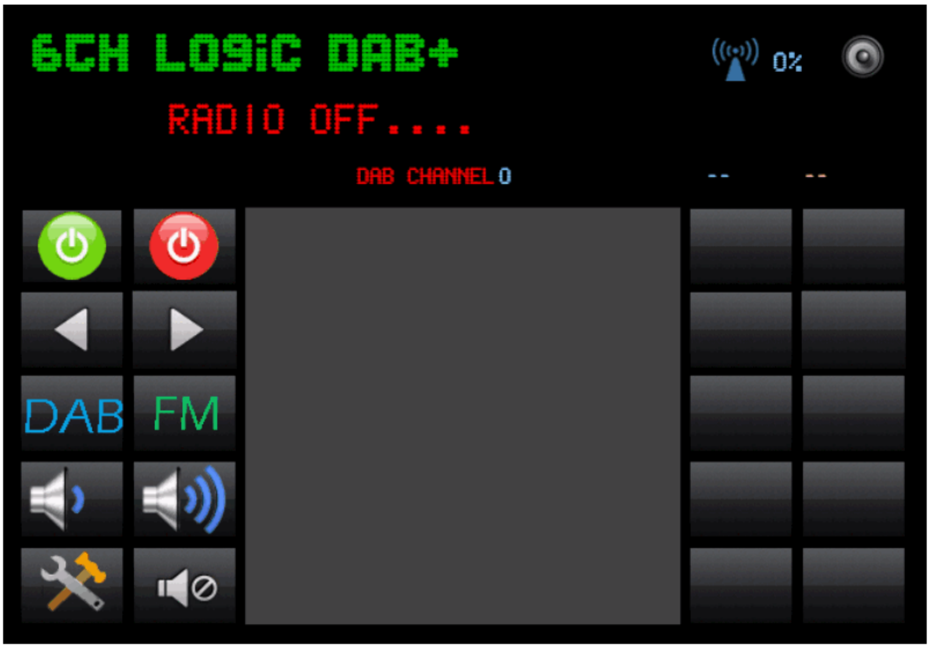


Figure 2.6: DAB Sample Program Start up Screen

Click the green Power On button and select a COM port number created by the Hardware Wizard in step 2.4. The DAB+ FM Development Board will start communicating with the sample software. If everything is working properly, the TX and RX LEDs will start to blink showing communication activities.

The DAB+ FM Development Board is designed and tested in Sydney, Australia. Therefore the stations around the Sydney location get stored in the default memory while the board was under manufacturing test. In order to tune to the user's DAB/DAB+ stations, double click on the "DAB CHANNEL" word, the sample software will send a full rescan command to the board.

Figure 2.7 shows the basic navigation of the sample software and the function of each button.

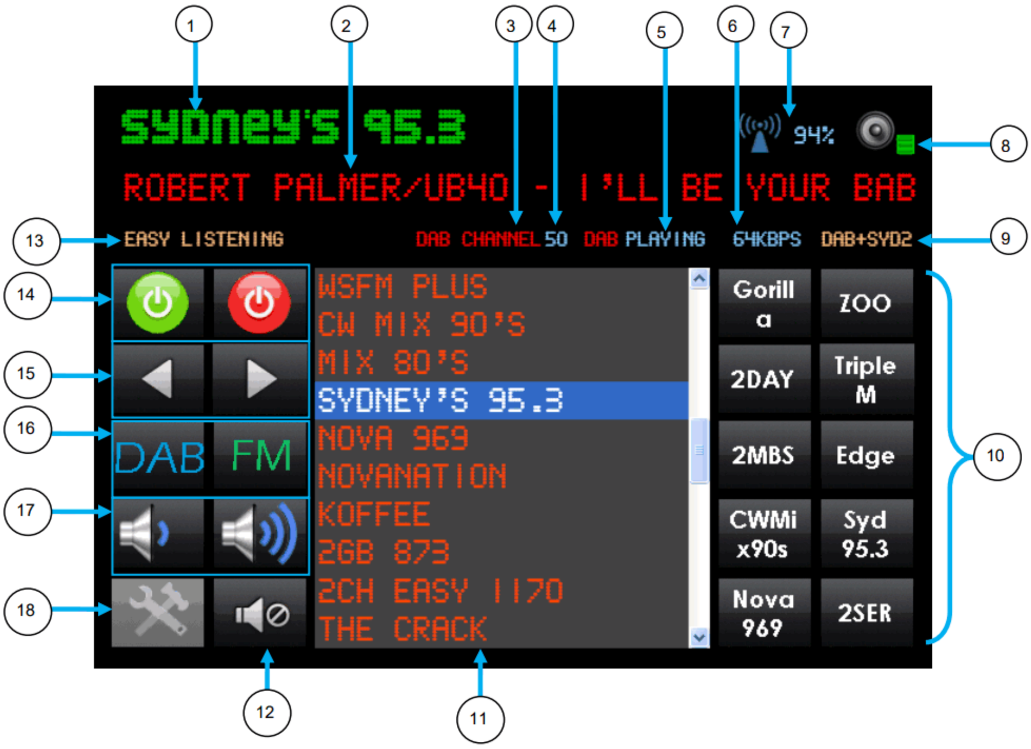


Figure 2.7: Basic Navigation and Function of each Button

1. Station Name. Drag the station name or frequency to Preset Button to save a channel.
2. RDS. Radio text.

3. DAB CHANNEL. Double click to force a full DAB channel to rescan.
4. Total channels of DAB stations stored on the board.
5. Radio status.
6. DAB data rate.
7. Radio reception strength. Click on the tower icon to switch between stereo and mono.
8. Audio volume scale.
9. Radio ensemble name.
10. Preset buttons.
11. DAB stations list. Click station name to play.
12. Mute.
13. Genre.
14. Power on and off buttons.
15. Previous or Next channel.
16. Radio modes select, DAB or FM.
17. Volume control.
18. COM port selection.

INITIAL AUTO SCANNING

When the board is shipped outside of Sydney, Australia, the stored DAB stations will no longer be effective. Users need to perform initial auto scanning in order to receive the local stations of the country. Double click the word "DAB CHANNELS" to perform an auto scan.

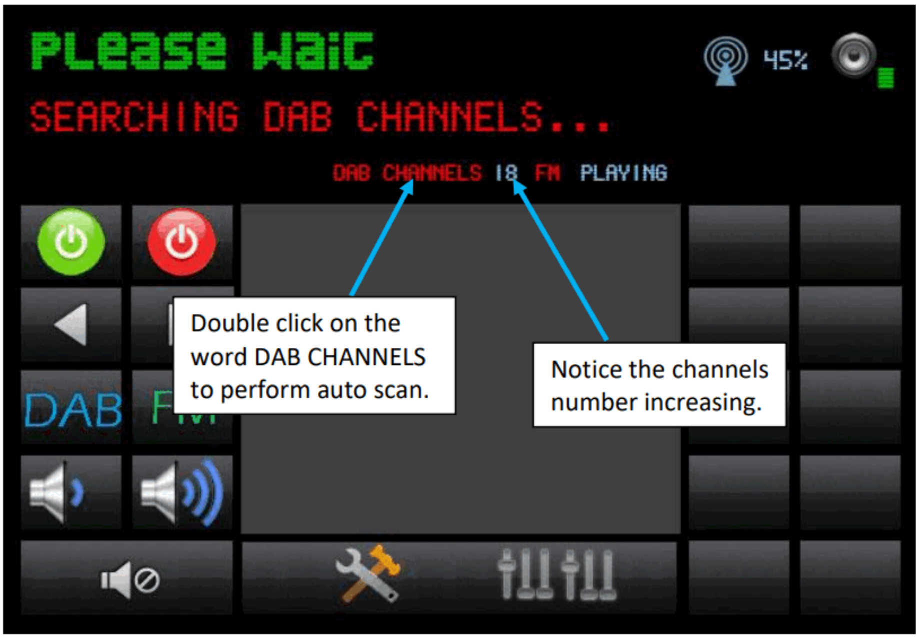

Please Wait
45%
SEARCHING DAB CHANNELS...
DAB CHANNELS 18 FM PLAYING
DAB
FM
Double click on the word DAB CHANNELS to perform auto scan.
Notice the channels number increasing.

Figure 2.8: Auto scanning

PRESET EQ

Users can also select preconfigured EQ like, Bass Boost, Jazz, Live, Vocal, and Acoustic.

ORIGINAL SOUND

If the pure original sound is what you need, then switching EQ off, and sitting headroom to 0 will get you the original sound.

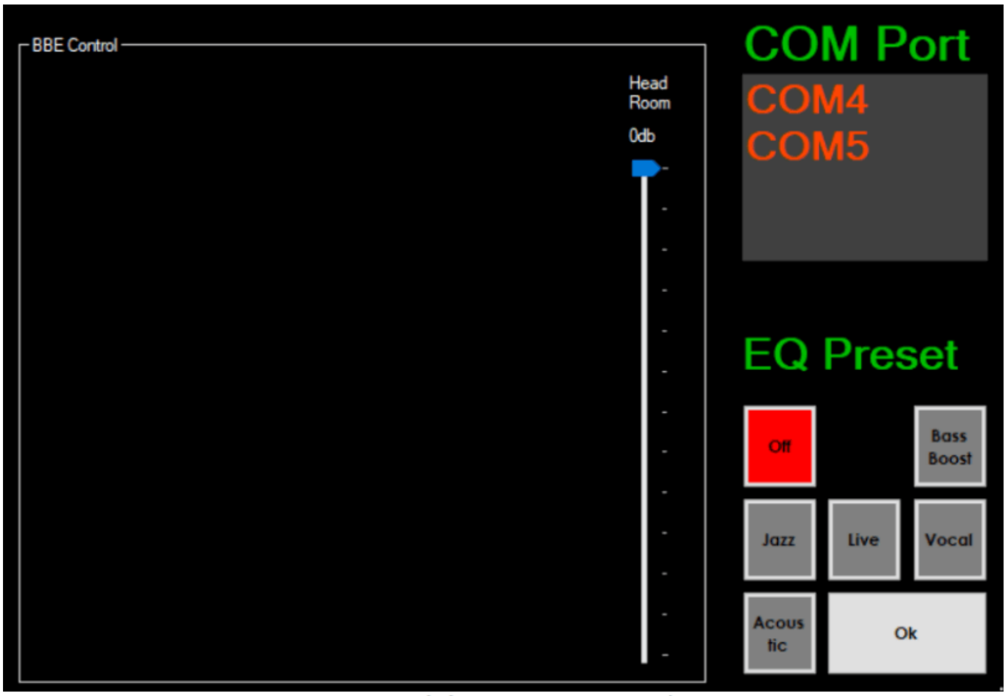
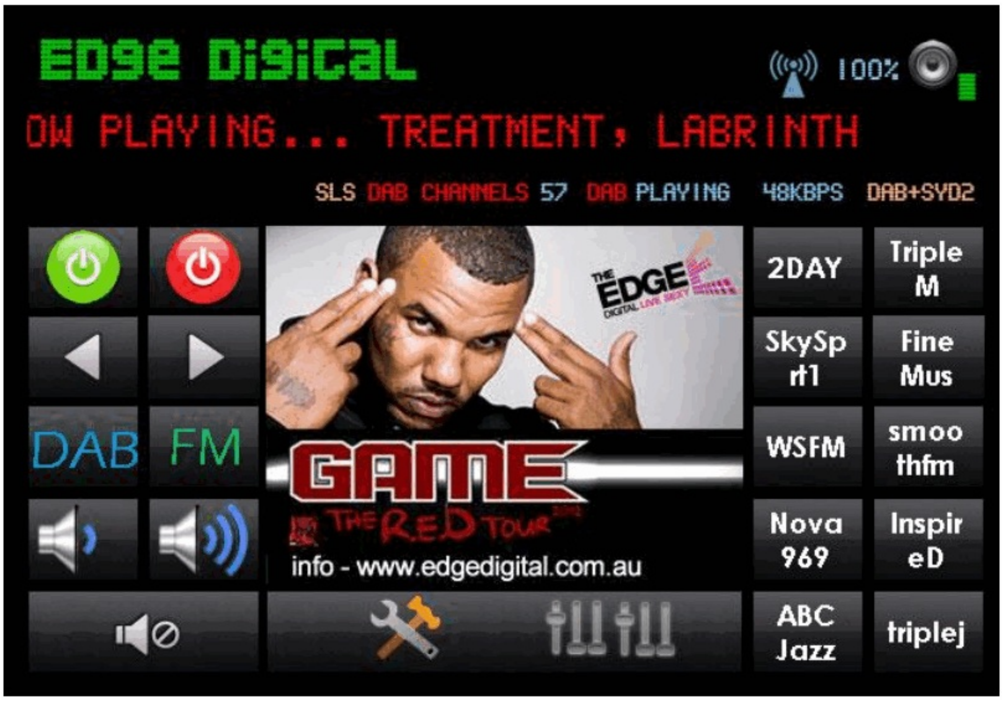


Figure 2.9: EQ Sound setting and configuration screen.

SLIDESHOW


EDge DiGiCaL
100%
OW PLAYING... TREATMENT, LABRINTH
SLS DAB CHANNELS 57 DAB PLAYING 48KBPS DAB+SYD2
DAB
FM
THE EDGE DIGITAL LIVE SEXY
GAME
THE RED TOUR
info - www.edgedigital.com.au
2DAY
Triple M
SkySp rt1
Fine Mus
WSFM
smoo thfm
Nova 969
Inspir eD
ABC Jazz
triplej

Slideshow adds visual content (slides) to radio broadcasts on DAB or DAB+. It enhanced the digital radio with visuals using images in JPEG or PNG format.

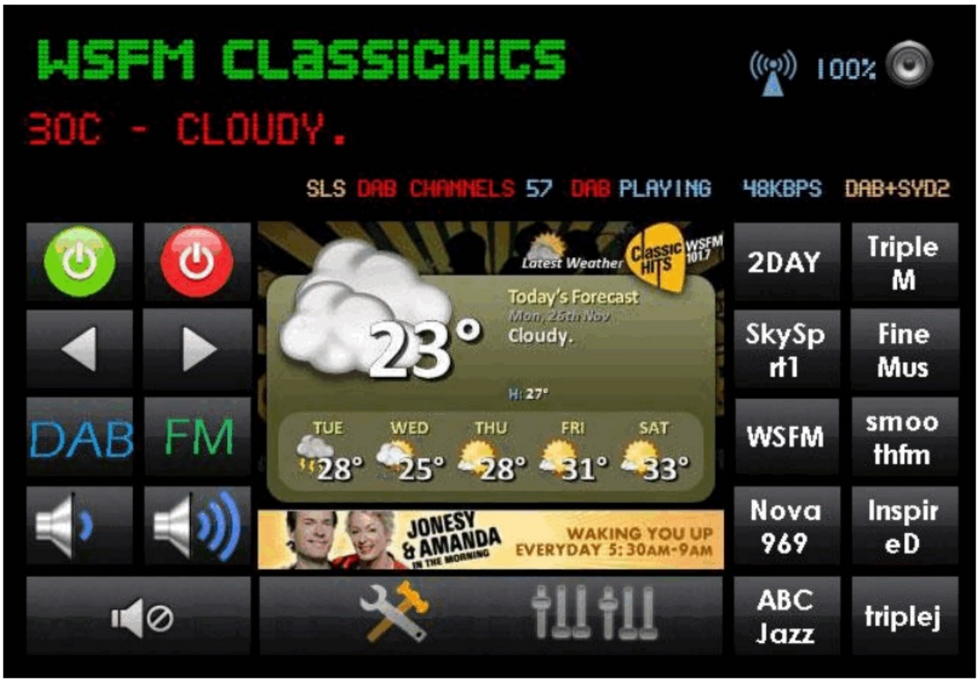


Figure 2.10: Slideshow in the middle of the demo software.

COMPILING THE SAMPLE PROGRAM

The provided source code was written in VB.Net using Microsoft Visual Studio 2008. There are 40 functions in the keystonecomm.dll library. Users could study the provided sample VB.NET source code and translate the sample program into C# or C/C++ as needed. The following VB.NET declarations are required to start a new project:

```
Function CommVersion Lib “keystonecomm.dll” () As Int32
Function OpenRadioPort Lib “keystonecomm.dll” (ByVal port As String, ByVal usehardmute As Boolean) As
Boolean
Function HardResetRadio Lib “keystonecomm.dll” () As Boolean
Function CloseRadioPort Lib “keystonecomm.dll” () As Boolean
Function PlayStream Lib “keystonecomm.dll” (ByVal mode As SByte, ByVal channel As Int32) As Boolean
Function StopStream Lib “keystonecomm.dll” () As Boolean
Function SetVolume Lib “keystonecomm.dll” (ByVal volume As SByte) As Boolean
Function IsSysReady Lib “keystonecomm.dll” () As Boolean
Function VolumePlus Lib “keystonecomm.dll” () As SByte
Function VolumeMinus Lib “keystonecomm.dll” () As SByte
Sub VolumeMute Lib “keystonecomm.dll” ()
Function GetVolume Lib “keystonecomm.dll” () As SByte
Function GetPlayMode Lib “keystonecomm.dll” () As SByte
Function GetPlayStatus Lib “keystonecomm.dll” () As SByte
Function GetTotalProgram Lib “keystonecomm.dll” () As Int32
Function NextStream Lib “keystonecomm.dll” () As Boolean
Function PrevStream Lib “keystonecomm.dll” () As Boolean
Function GetPlayIndex Lib “keystonecomm.dll” () As Int32
Function GetSignalStrength Lib “keystonecomm.dll” (ByRef biterror As Integer) As SByte
Function GetProgramType Lib “keystonecomm.dll” (ByVal mode As SByte, ByVal dabIndex As Int32) As SByte
Unicode Function GetProgramText Lib “keystonecomm.dll” (ByVal programText As String) As SByte
Unicode Function GetProgramName Lib “keystonecomm.dll” (ByVal mode As SByte, ByVal dabIndex As Int32,
ByVal
namemode As SByte, ByVal programName As String) As Boolean
Unicode Function GetPreset Lib “keystonecomm.dll” (ByVal mode As SByte, ByVal presetindex As SByte) As
Int32
Unicode Function SetPreset Lib “keystonecomm.dll” (ByVal mode As SByte, ByVal presetindex As SByte, ByVal
channel As Int32) As Boolean
Function DABAutoSearch Lib “keystonecomm.dll” (ByVal startindex As Byte, ByVal endindex As Byte) As Boolean
```

```
Unicode Function GetEnsembleName Lib “keystonecomm.dll” (ByVal dabIndex As Int32, ByVal namemode As SByte,
ByVal programName As String) As Boolean
Function GetDataRate Lib “keystonecomm.dll” () As Int16
Function SetStereoMode Lib “keystonecomm.dll” (ByVal mode As SByte) As Boolean
Function GetFrequency Lib “keystonecomm.dll” () As SByte
Function GetStereoMode Lib “keystonecomm.dll” () As SByte
Function GetStereo Lib “keystonecomm.dll” () As SByte
Function ClearDatabase Lib “keystonecomm.dll” () As Boolean
Function SetHeadroom Lib “keystonecomm.dll” (ByVal headroom As SByte) As Boolean
Function GetHeadroom Lib “keystonecomm.dll” () As SByte
Function MotQuery Lib “keystonecomm.dll” () As Boolean
Unicode Sub GetImage Lib “keystonecomm.dll” (ByVal ImageFileName As String)
Function GetApplicationType Lib “keystonecomm.dll” (ByVal index As Int32) As SByte
Sub MotReset Lib “keystonecomm.dll” (ByVal mode As SByte)
```

The sample program was provided to enable users to quickly learn the basic functionalities of the board, it has a lot of room for improvements, for example, in order to speed up the responsiveness of the user interface, and users could move some of the functions to worker threads and assign priority to each function. Please refer to http://www.monkeyboard.org/86-technical-documents/81-keystone-dab-fmmodule-programming-api for the latest API.

Chapter 3. Hardware Features and Descriptions

3.1 BOARD FEATURES

- KeyStone T4B-6D60CDB DAB/DAB+/FM/SLS/EPG radio module
- Microchip PIC18F14K50 USB Flash Microcontroller
- 12 Mhz crystal
- standard ICSP programming port for programming the PIC18F14K50
- EXT port logic signal for controlling external audio chip power and mute
- status LED, RX (orange), and TX (green)
- power LED (red)
- Bootloader push button
- 1.2VDC, 3.3VDC LDO
- 3.5mm stereo jack
- SMA antenna connector
- Dimensions : 100mm x 60mm

3.2 HARDWARE DESCRIPTIONS

Power Supply Circuit
The board is typically powered by 5VDC from USB. The PIC18F14K50 is drawing power directly from the USB. From the USB’s 5VDC, the power is further distributed into 1.2VDC and 3.3VDC LDO to the KeyStone module. The power of these LDO is always on.

Microchip PIC18F14K50
This microcontroller is used to provide a Virtual Serial Port to the KeyStone module. It is flashed with a customized CDC RS-232 Emulation Demo firmware. Other than performing the standard serial emulation, it also controls the reset and audio shunt of the KeyStone module.

Reset Circuit

Reset of the module is performed by pin emulated by DTR of the virtual serial port.

ICSP

The ICSP programming port is the standard Microchip's In-Circuit Serial Programming port and is compatible with Microchip's PICkit.

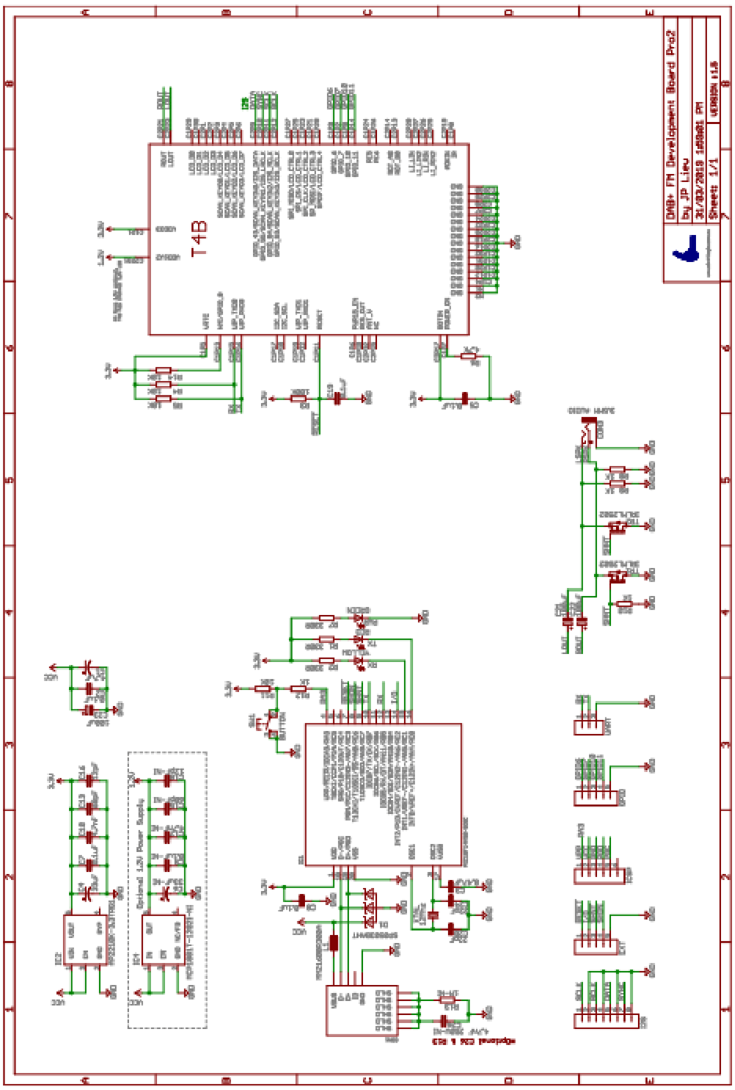
EXT

EXT port has two 5V logic signals, , and . They are used to control external audio circuitry's power and mute.

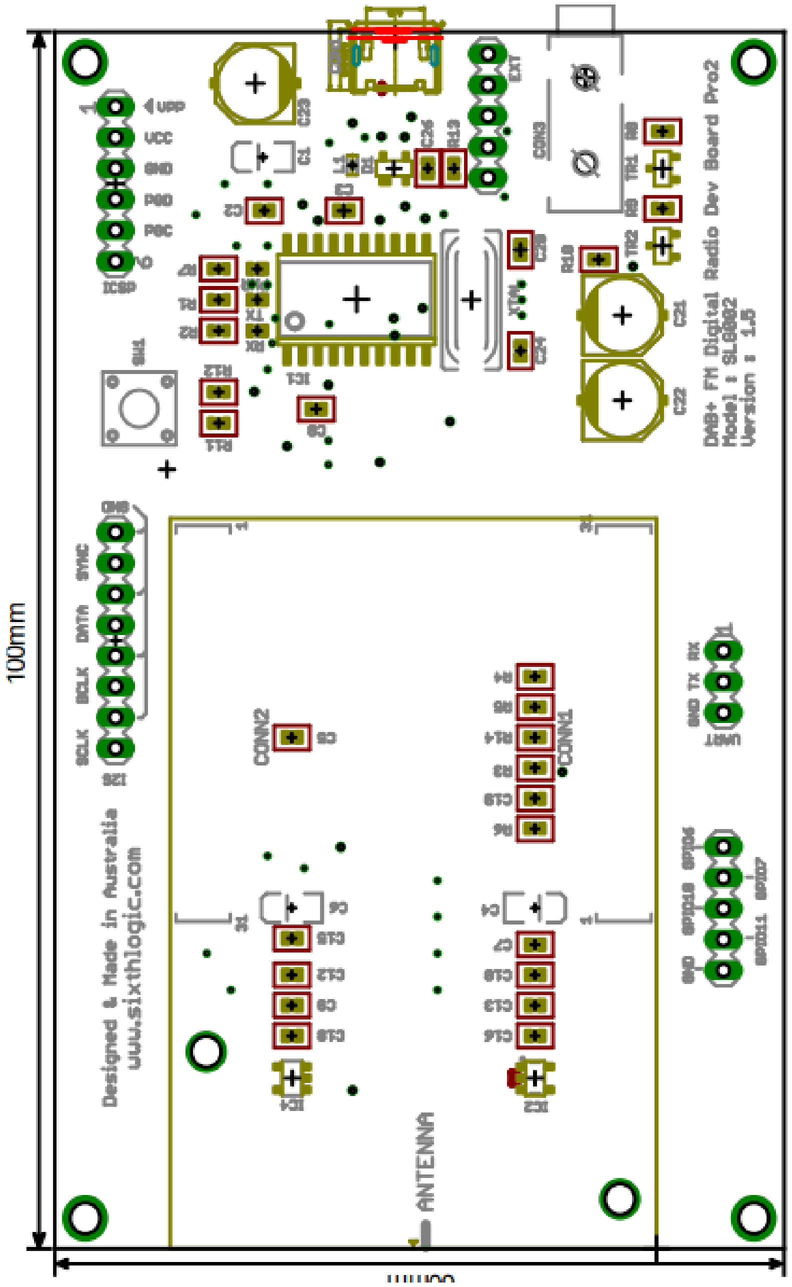
Push Button (SW1)

This button, when pressed during a power-up, will trigger the PIC18F14K50's USB HID bootloader in programming mode.

APPENDIX A – SCHEMATIC



APPENDIX B – MECHANICAL DRAWING



DEVELOPMENT BOARD/KIT IMPORTANT NOTICE

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This evaluation board/kit is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY and is not considered by SL to be a finished end-product fit for general consumer use. Persons handling the product(s) must have electronics training and observe good engineering practice standards. As such, the goods being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE, or UL, and therefore may not meet the technical requirements of these directives or other related directives.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund.

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EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

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This evaluation board/kit is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY and is not considered by SL to be a finished end-product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his/her own expense will be required to take whatever measures may be required to correct this interference.

Apr 2019 Sixth Logic DAB+ FM Development Board PRO2 User's Guide
www.sixthlogic.com

Documents / Resources

 LOGIC DAB+ FM Development Board PRO2 User's Guide	SIXTH LOGIC SLG002 DAB+ FM Development Board PRO2 [pdf] User Guide SLG002, DAB FM Development Board PRO2, SLG002 DAB FM Development Board PRO2, Development Board PRO2

Manuals+,