

# **ADI Voice Platform User Manual V2.0**

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## Change History

Version	Date (dd/mm/yyyy)	Author	Description
2.0	10/12/2018	C.BARDOU	Release version

# 1 Introduction

## 1.1 About eSoftThings

**eSoftThings** is an engineering and a professional services company focusing on next generation connected wireless devices. At **eSoftThings**, we strongly believe successful next generation connected wireless objects will require ultra-low power operation, natural voice recognition and control solutions, privacy and security, and robust interoperability and compatibility.

We know how important your customers are to you, and our **eSoftThingsLab** enables unique and high value services to help you release your products to market on time and on budget. The lab is fully equipped for low power systems, RF systems (WLAN, Bluetooth, GPS, 2G/3G/LTE, etc.) and audio systems.

## 1.2 Purpose of This Manual

This document describes how to setup and evaluate the Analog Devices far-field voice interface demonstration system. The voice interface application executes on the ADADN8080 voice processor and integrates Voice Trigger wake function, 4-channel microphone processing and beamforming, direction-of-arrival estimation, noise suppression, and acoustic echo cancellation. A Dragonboard 410c board and linear or circular microphone array board are used to demonstrate a complete system and to provide connectivity to the Amazon Alexa Voice Service (AVS) for functional evaluation. For timing, electrical, and package specifications of the ADADN8080 processor, refer to the ADADN8080 Processor Data Sheet.

## 1.3 Intended Audience

The primary audience for this manual is a systems engineers developing and evaluating voice-controlled devices. The manual assumes the audience has a working knowledge of Dragonboard 410c, embedded Linux operating system and the Amazon Alexa Voice Service.

## 1.4 References

Amazon AVS:  
<https://developer.amazon.com/avs>

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## 2 EVALUATION PLATFORM

### 2.1 Features

- 4 MEMS microphone inputs
- Stereo audio playback with Stereo Acoustic Echo Cancellation
- Far-field voice capture over multiple digital PDM microphones
- Low-power always on Voice detection with DSP core wake-up
- Low-Latency audio path for high-performance applications
- Integrated support for beamforming
- LED Voice Trigger indicator to identify direction of origin for voice stream and Voice Trigger capture
- Example “Alexa” AVS client application

### 2.2 Evaluation kit contents

- Dragonboard 410c
- ADADN8080 Mezzanine audio board
- Circular Mic Array board
- Linear Mic Array board
- USB cable Type-C to Type-C to link microphone array board to Dragon board.
- USB cable 10cm to link Mezzanine board to Dragon board

### 2.3 Additional equipment needed

- AC/DC Adapter 12V 2A min
- Two Loudspeakers

### 2.4 Hardware Versions

- VoicePlatform Mezzanine board
  - o Hardware version => V02
  - o BOM version => 1.06
- Circular and Linear Mic Array board
  - o Hardware version => V01
  - o BOM version => 1.01

### 2.5 Software Versions

- Kernel version => 4.14.15
- Linaro Debian dragonboard-410c-359
- Alexa SDK => 1.10

Two versions of the software can be installed: sensory and no sensory.

The only difference between the 2 versions is the ADADN firmware:

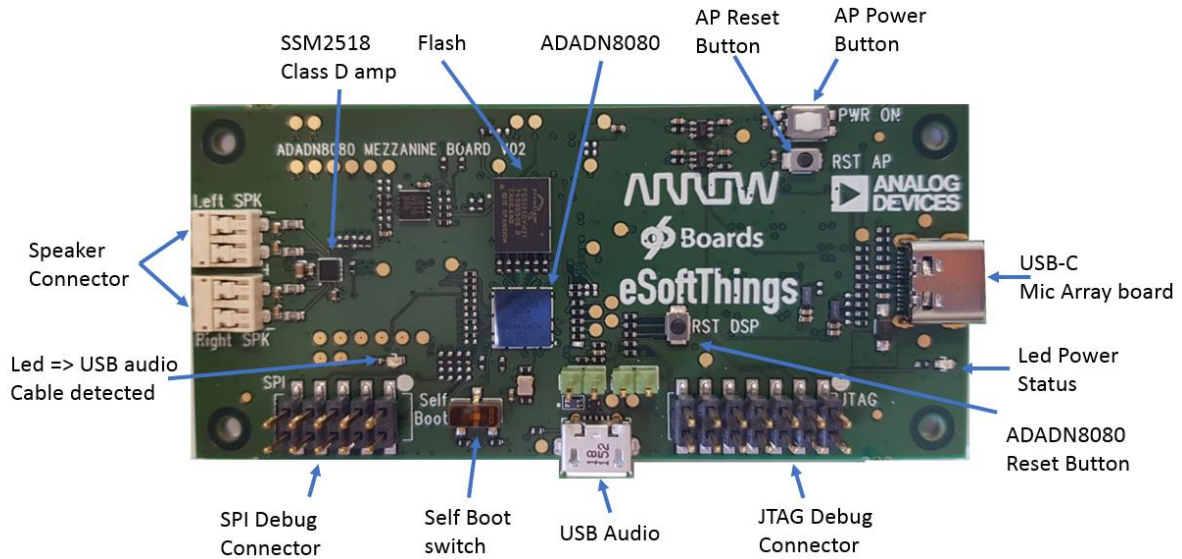
- The sensory version implements sensory voice recognition algorithm in the ADADN.
- The no\_sensory version implements the reTuneDSP voice recognition algorithm in the ADADN.



## 2.6 Hardware

### 2.6.1 ADADN8080 Mezzanine Audio Evaluation board:

The board includes the ADADN8080 DSP processor, self-boot Flash memory, power regulator, USB to I2S adapter and signal connectors. The block Diagram is present in the appendices at the end of this document.



**Figure 1: ADADN8080 Mezzanine audio board**

### 2.6.2 Microphone array board:

These 2 boards have 4 MEMS microphones.

- 3 microphones on a 25mm diameter circle and 1 centered microphone), an indicator green LED, a pushbutton and 8 blue LEDs for the Circular Microphone Array board.



**Figure 2: Circular microphone arrays board**

- 4 microphones spaced of 20mm for the Linear Microphone Array board.

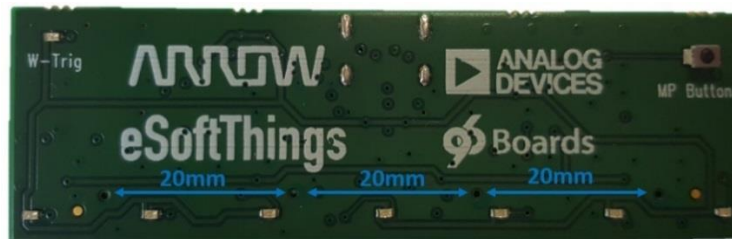


Figure 3: Linear microphone arrays board

### 2.6.3 Dragonboard 410c

Dragonboard 410c board runs a sample Amazon AVS client, connected to the ADADN8080 via USB link and SPI.



Figure 4: Dragonboard 410c board

## 2.7 Circular microphone array board LED Indicators

The evaluation kit has 9 software-controlled LED indicators: 1 LED (W-Trig) for voice trigger indication and 8 LEDs on the topside of the Circular microphone array board showing voice-trigger/direction-of-arrival indication.

### 2.7.1 Circular Array Top view

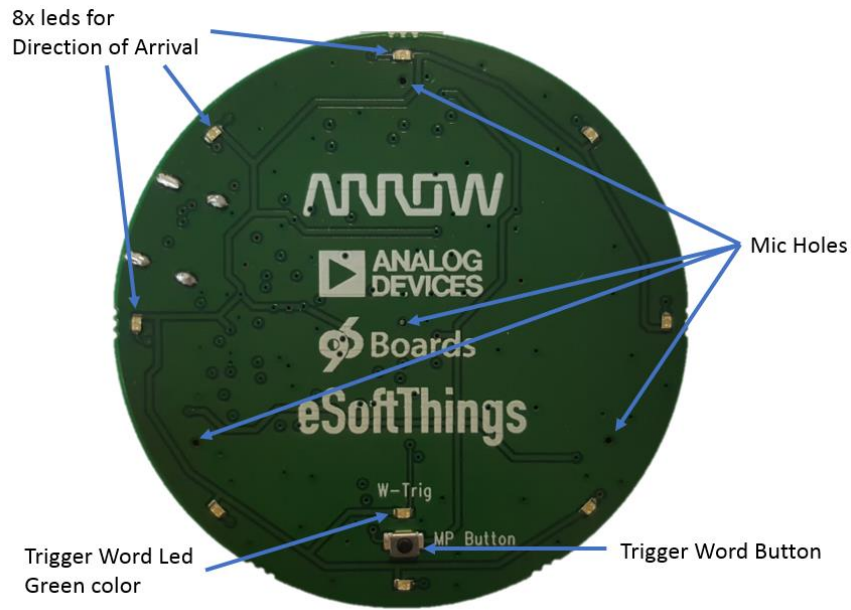


Figure 5: Circular Mic Array Top View

### 2.7.2 Circular Array Bottom view

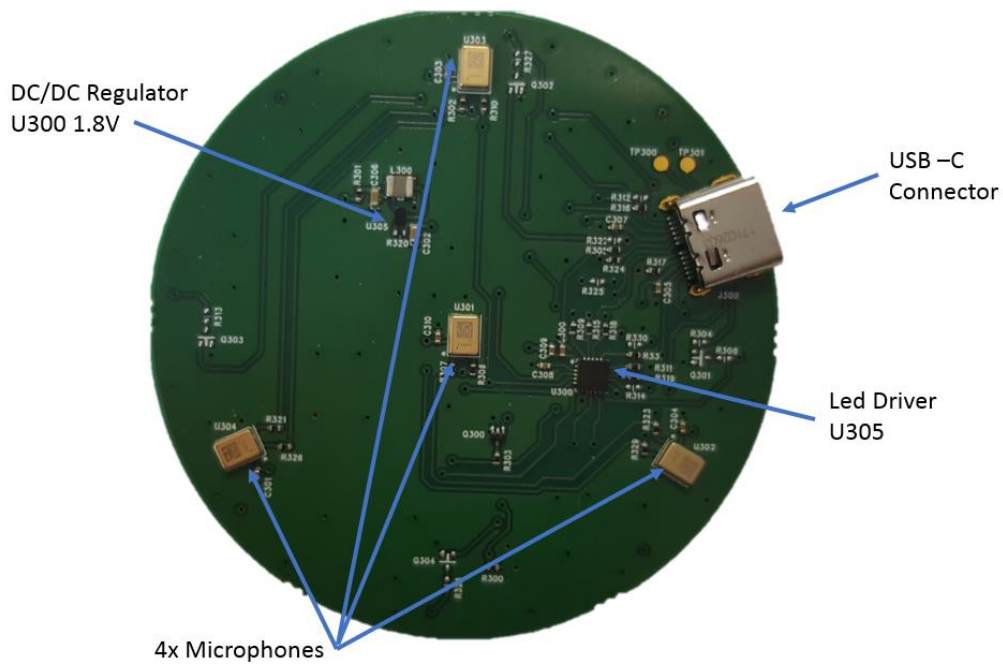


Figure 6: Circular Mic Array Bottom View

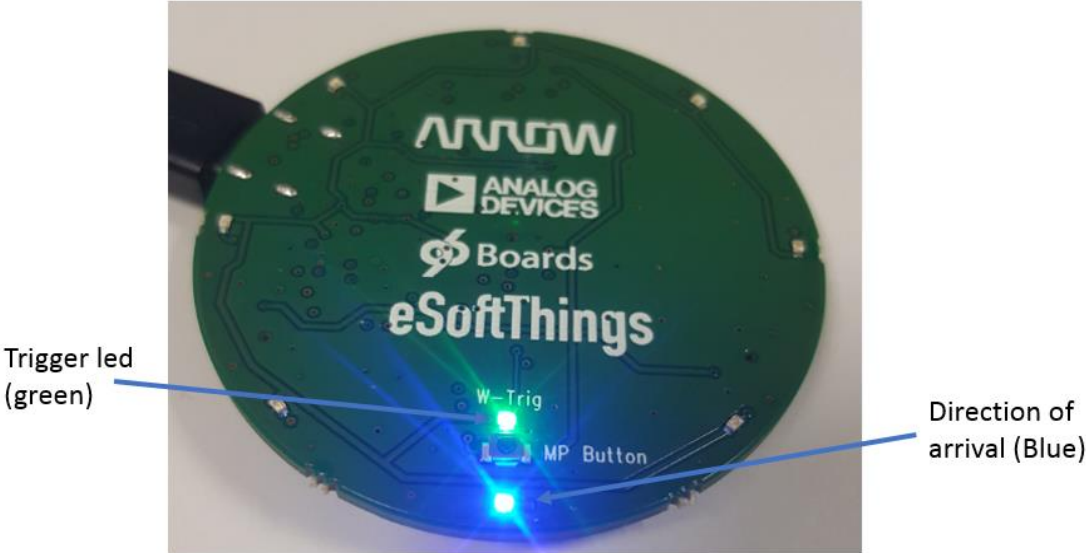
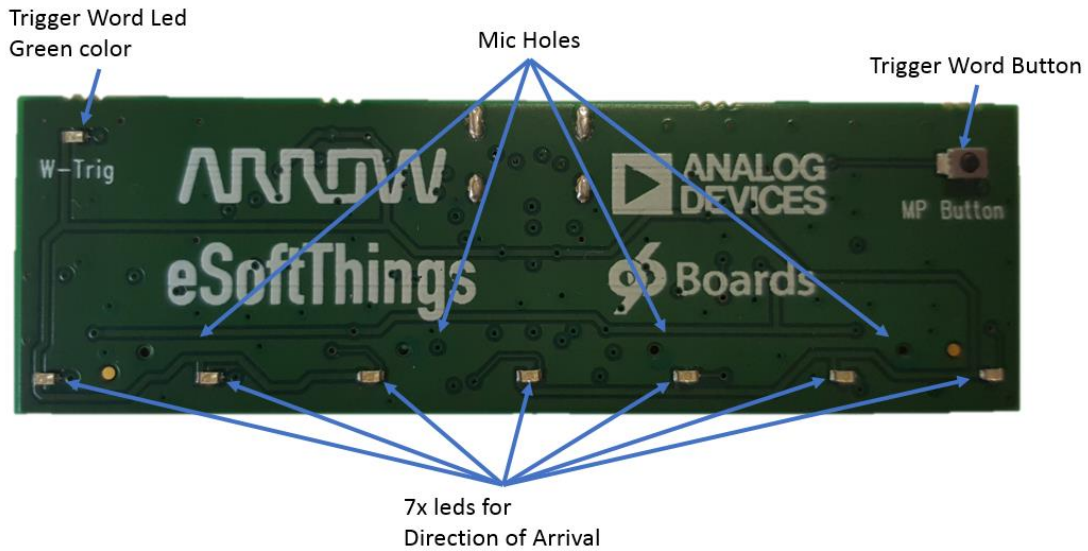


Figure 7 : Trigger word detection and indication of signal arrival

## 2.8 Linear microphone array board LED Indicators

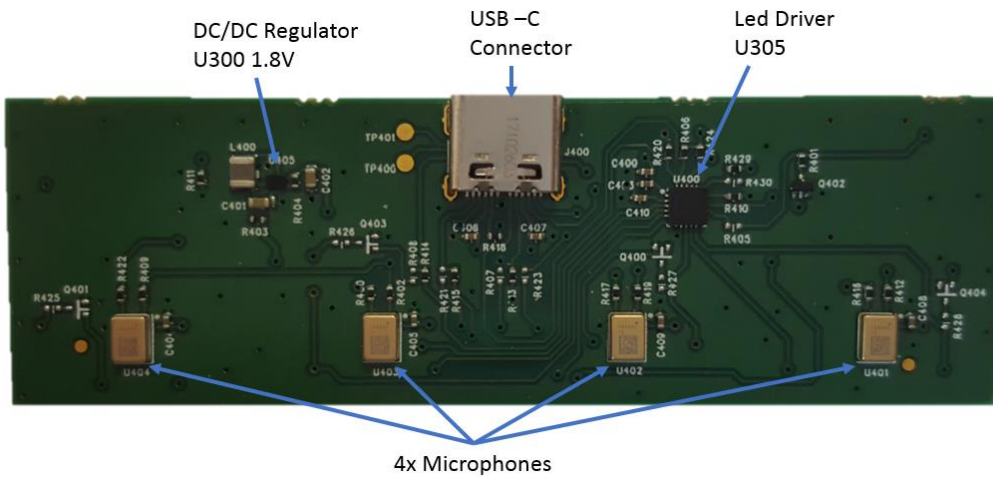
The evaluation kit has 8 software-controlled LED indicators: 1 LED (W-Trig) for voice trigger indication and 7 LEDs on the topside of the Linear microphone array board showing voice-trigger/direction-of-arrival indication.

### 2.8.1 Linear Array Top view



**Figure 8: Linear Mic Array Top View**

### 2.8.2 Linear Array Bottom view



**Figure 9: Linear Mic Array Bottom View**

## 2.9 Microphone array board Trigger Button

Press the button (MP Button) on the microphone array board to manually trigger a voice command.

In this case, the trigger led will switch on.

## 2.10 USB-C

USB-C receptacle is intended to provide connectivity with Microphones Arrays boards only, meaning replace usual Flex connection. It is therefore not intended to support USB-C specifications as typical USB-C connection.

When a Linear or a Circular Microphone Array board is plugged and detected, all its electrical signals (audio, LED Driver commands, Button) are made available over USB Type-C cable.

The detection logic in place on VoicePlatform Board and Microphone Arrays Boards will initiate a I2C communication to distinguish the Linear Array Board from the Circular Array Board.

When the Microphone Array board is identified, the ADADN8080 is loaded with the corresponding FW image and associated parameter settings, then the Mic Array Boards is lightening the LEDs.

All connection with a Microphone Array board not allowed necessarily a communication. One possibility of 2 on the USB-C plug authorize a good connection. A led indication on the Microphone Array board confirm the good connection. By the way, a led animation is also present after few seconds of connection.

## 2.11 Microphone Placement

If the microphones are located too close to the speaker, acoustic clipping may occur at high playback levels which can significantly degrade voice performance.

### 3 Cable and board connection

#### 3.1 Analog speaker

##### 3.1.1 Class D amplifier

Analogue Speaker output signals, left and right, are available on connectors, both on top surface. The link between the class D amplifier and the DSP ADADN8080 is done by a unidirectional I2S link.

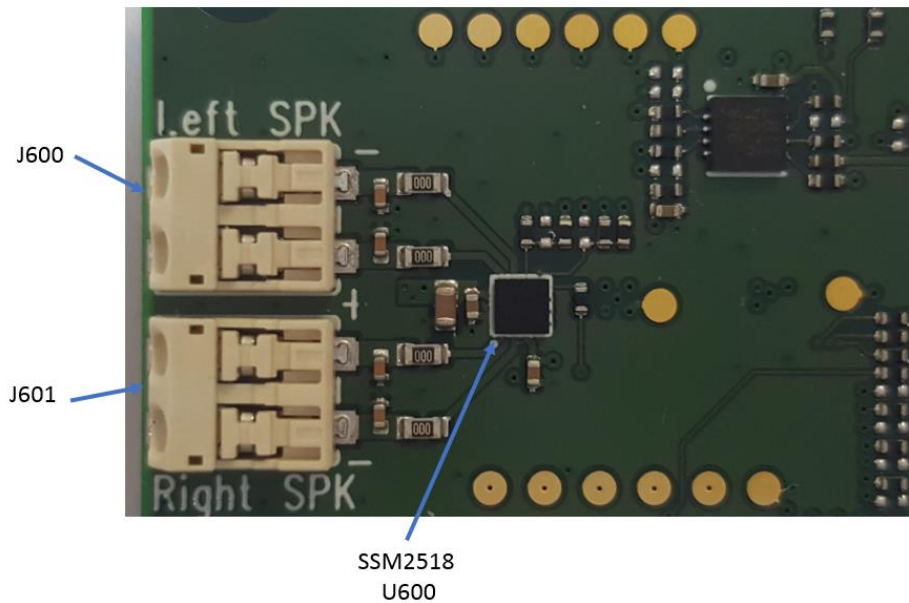


Figure 10: Speaker interfaces

##### 3.1.2 Speaker connection

The speaker connector allows up to 22AWG size of cable. To insert wire in the connector, press like it is indicated in the picture below.

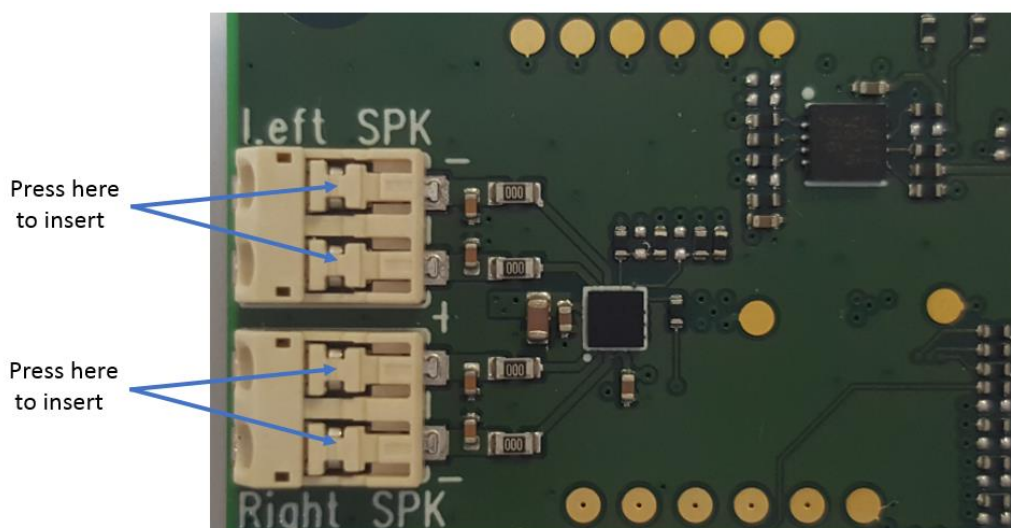


Figure 11: Zone to press to insert cable in the Speaker connector

### 3.2 Low Speed Connector signals description

The low speed connector is one of the two links with the Dragonboard. The SPI, I2C and Gpios signal spent by this connector.

#### 3.2.1 Low Speed Connector signals on DragonBoard-410c

Other Signals	SSM2518		ADADN8080		APQ8016		Low Speed Connector		Low Speed Connector		APQ8016		ADADN8080		SSM2518		Other Signals
	Pin Name	Function	Pin Name	Function	GPIO	Label	Pin Name	Pin Name	GPIO	Label	Function	Pin Name	Function	Pin Name	Function	Pin Name	
GND	GND	GND	GND	GND	GND	GND	GND	Pin 1	Pin 2	GND	GND	GND	GND	GND	GND	GND	GND
					2	UART0_CTS_N	UART0_CTS	Pin 3	Pin 4	PWR_BTN_N	PHONE_ON_N						
					0	UART0_TX	UART0_TxD	Pin 5	Pin 6	RST_BTN_N	PM_RESIN_N						
					1	UART0_RX	UART0_RxD	Pin 7	Pin 8	SPIO_SCLK	SPIO_CLK	SPI clk	CTRL_SCK				
					3	UART0_RTS_N	UART0_RTS	Pin 9	Pin 10	SPIO_DIN	SPIO_MISO	SPI MISO	CTRL_DQ1				
					4	UART1_TX	UART1_TxD	Pin 11	Pin 12	SPIO_CS	SPIO_CS_N	SPI CS	CTRL_SS				
					5	UART1_RX	UART1_RxD	Pin 13	Pin 14	SPIO_DOUT	SPIO_MOSI	SPI MOSI	CTRL_DQ0				
LED SCL Option1					7	I2C0_SCL	I2C0_SCL	Pin 15	Pin 16	PCM_FS	LS_EXP_MI2S_WS	I2S FS	LRCLK5				
LED SDA Option1					6	I2C0_SDA	I2C0_SDA	Pin 17	Pin 18	PCM_CLK	LS_EXP_MI2S_SCK	I2S BCLK	BCLK5				
LED SCL Option2	SCL	I2C SCL	SCL	I2C SCL	22	I2C1_SCL	I2C1_SCL	Pin 19	Pin 20	PCM_DO	LS_EXP_MI2S_DATA0	I2S data In	SIO5_1				
LED SDA Option2	SDA	I2C SDA	SDA	I2C SDA	23	I2C1_SDA	I2C1_SDA	Pin 21	Pin 22	PCM_DI	NC						
LED SDA Option2			EVENT	ADADN_IRQ	36	LS_EXP_GPIO_A	GPIO-A	Pin 23	Pin 24	GPIO-B	LS_EXP_GPIO_B	Host Reset	ResetB				
					13	LS_EXP_GPIO_C	GPIO-C	Pin 25	Pin 26	GPIO-D	LS_EXP_GPIO_D						
			SIO5_0	I2S data out	115	LS_EXP_GPIO_E	GPIO-E	Pin 27	Pin 28	GPIO-F	LS_EXP_GPIO_F						
			GPIO6		24	LS_EXP_GPIO_G	GPIO-G	Pin 29	Pin 30	GPIO-H	LS_EXP_GPIO_H						
Data Transit Validated					35	LS_EXP_GPIO_J	GPIO-J	Pin 31	Pin 32	GPIO-K	LS_EXP_GPIO_J						
Board Detection					28	LS_EXP_GPIO_K	GPIO-K	Pin 33	Pin 34	GPIO-L	LS_EXP_GPIO_L						
							+1V8	Pin 35	Pin 36	SYS_DCIN							
							+5V	Pin 37	Pin 38	SYS_DCIN							
GND	GND	GND	GND	GND	GND	GND	GND	Pin 39	Pin 40	GND	GND	GND	GND	GND	GND	GND	GND

Figure 12: Low Speed Connector Signals on DragonBoard-410c

#### 3.2.2 Low Speed Connector signals on VoicePlatform Board

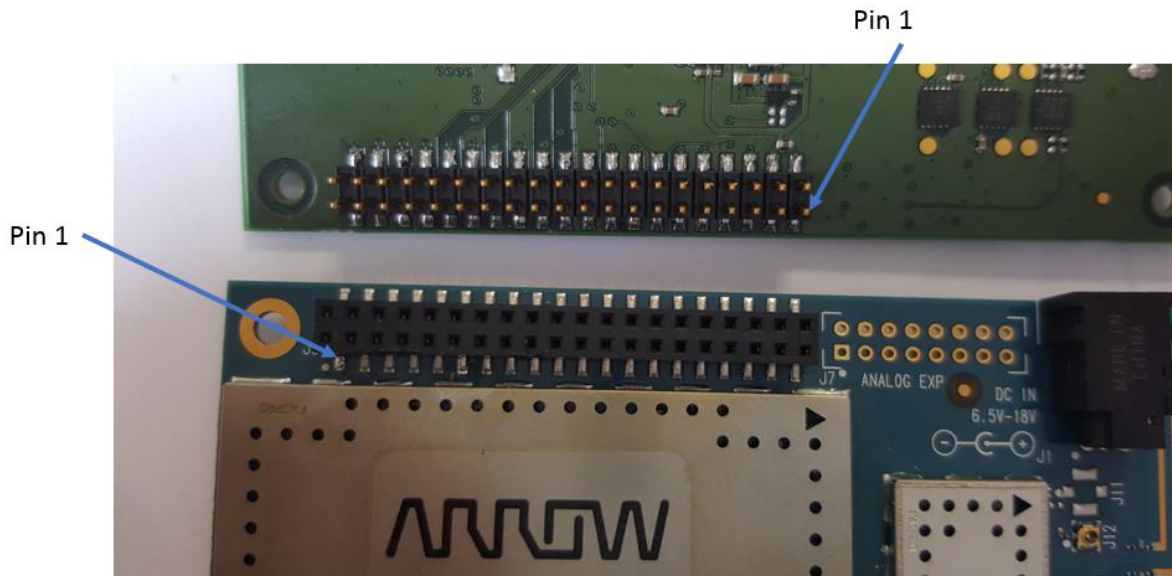


Figure 13: Low Speed Connector Signals on VoicePlatform Board



The assembly of the Mezzanine board with the Dragonboard should be take like that. The use of space is necessary to keep the Mezzanine board in place.



**Figure 14: Assembly Mezzanine and DragonBoards**

### 3.2.3 Power supply input

The main power supply is a wall plug connected to the DragonBoard-410c, the Mezzanine boards are not self-powered. The Mezzanine Boards, respectively the VoicePlatform Board and the Mic Arrays Boards, are powered by DragonBoard-410c:

- VoicePlatform Board is powered by +5V and SYS-DCIN available from Low Speed connector
- Mic-Arrays-Boards are powered by +5V available from Low Speed connector. The +5V DC supplying the Mic-Arrays-Boards is made available over USB-C cable by VoicePlatform Board, when a Linear or a Circular Arrays has been identified/recognized.

### 3.3 HDMI and USB connectors

A HDMI connector is available on the board to connect it to a screen.

If you want to connect an HDMI cable, this one need to be present at the boot of the board. If no cable is detected at the boot, the graphic interface is deactivated.

Two USB type A and one micro-USB connector are available on the board.

The 2 USB type A can be used to connect a keyboard or a mouse to navigate in the graphic interface.

The micro-USB connector is used as a debug interface.

NOTE: when the micro-USB interface is used, it deactivates the 2 other USB ports.

## 4 Functionalities

### 4.1 Record data

The record is established by one the two Mic Array boards connected to the Voiceplatform Mezzanine board like the diagram below.

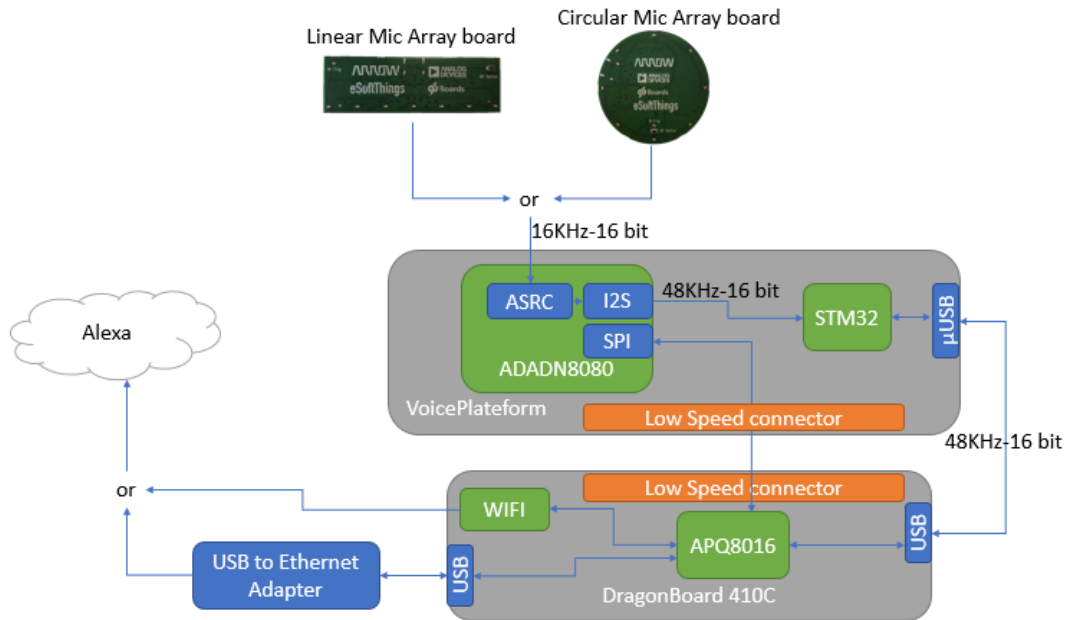


Figure 15 : Record data

### 4.2 Playback data

The link between Alexa Voice Service and the sound heard on the speaker is routed like that.

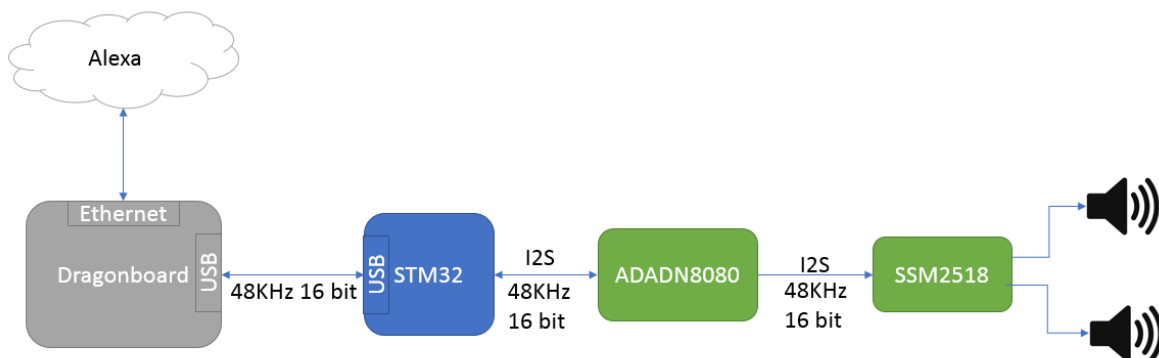


Figure 16: Playback data

The Ethernet link is defined by a USB to Ethernet external adapter. The other solution is to use directly the WIFI natively present on the Dragonboard.

The audio link is maintained in 48KHz 16 bit in stereo.

## 5 Setup

### 5.1 Start the system

Connect all cables before supplying power.

1. Connect ADADN8080 Mezzanine board micro-USB to the Dragonboard 410c board (via the USB hub is used).
2. Connect the Circular (or Linear) microphone array board to the ADADN8080 Mezzanine board Type-C USB.
3. Connect USB Ethernet adapter Ethernet cable to a local area network shared by your PC.
4. Connect loudspeaker to ADADN8080 Mezzanine board “Left-SPK” connector.
5. Connect loudspeaker to ADADN8080 Mezzanine board “Right-SPK” connector.
6. Ensure no jumper is installed on the ADADN8080 Mezzanine board.

Optional:

1. Connect Dragonboard 410c board “HDMI” connector to a screen.
2. Connect USB hub to Dragonboard 410c board “USB” connector.
3. Connect USB mouse to the USB hub.
4. Connect USB keyboard to the USB hub.
5. Use a USB Ethernet adapter to connect to the internet (if you don't want to use wifi)

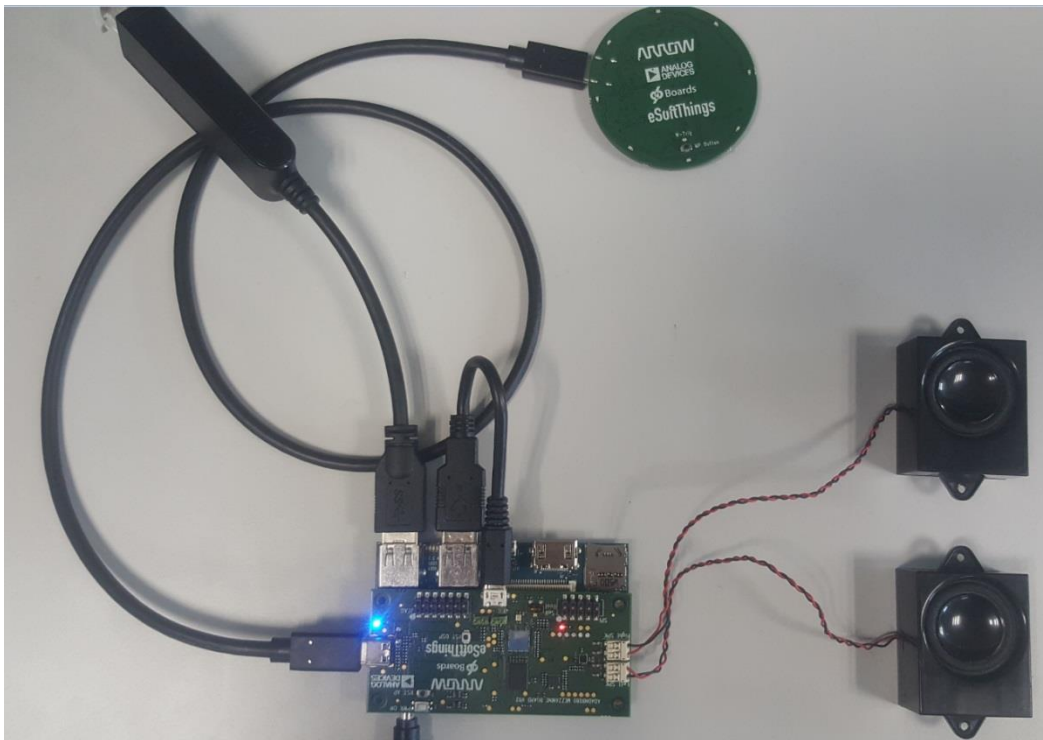


Figure 17: Voice Platform Demo kit assembly

## 5.2 Verify Setup

The Dragonboard 410c board will automatically load and run the demonstration voice interface application, booting can take approximately 1 minute.

The Mezzanine board has two led on. the blue led close to the Type-C connector and the red led close to speakers' connectors.

After boot is complete, the microphone array board should display blue led animation one time. If blue led animation is not displayed, invert the USB cable Type-C to Type-C inside the microphone array board Type-C connector or inside the Mezzanine board.

To test the setup (depends of what version of the software you have):

### **Voice trigger version:**

Say "Alexa" or press the trigger button (MP Button).

### **Manual trigger version:**

Press the trigger button (MP Button).

When the trigger is active both the microphone array trigger LED, green LED, and one of the DOA indicators blue LED on the topside of the ADADN8080 Mezzanine board should illuminate.

**NOTE: the board must be connected to the internet. You can connect via wifi (in that case the wifi need to be configured) or via a USB/Ethernet adapter.**

## 5.3 Setup volume

The audio volume can be changed within the Linux Debian volume settings when Dragonboard 410c board is connected to an HDMI screen and an USB mouse is used to navigate into settings.

## 5.4 Guide to evaluating the Voice UI performance

The demo is intended to be used in real-time, to demonstrate the ADADN8080 far-field voice trigger and voice command functionality. We recommend breaking your evaluation into 3 different test scenarios:

- Test Scenario 1: Voice trigger word test.
- Test Scenario 2: Voice trigger word test with interferer.
- Test Scenario 3: Complete voice interface example using Amazon's AVS client

**NOTE:** Test scenarios 3 requires configuring the Dragonboard 410c board client application which is discussed in more detail in the next section.

**5.4.1 Test Scenario 1: Voice Trigger**



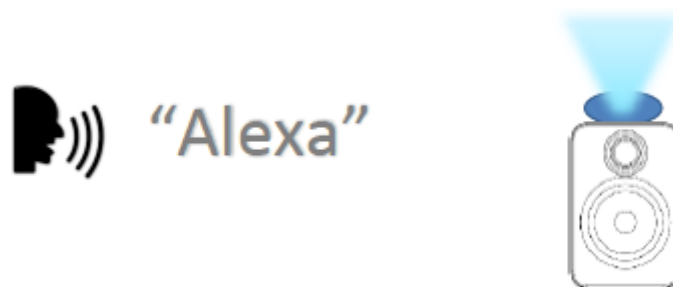
Locate the microphone array board parallel to the plane of the floor, locate a talker (or reference loudspeaker) at various distances and directions from the microphones. Say “Alexa” and verify that the indicator LEDs turn on when the trigger word is detected. You can test the trigger word performance from as far as **5-10 meters** in a relatively quiet environment.

**5.4.2 Test Scenario 2: Voice Trigger with Interferer**



Locate the microphone array board parallel to the plane of the floor, locate a talker (or reference loudspeaker) at various distances and directions from the microphones. Introduce an interfering audio signal(s) into the room, either natural or artificial, for example white noise, babble, machine noise, background TV/music. Say “Alexa” and verify that the indicator LEDs turn on when the trigger word is detected.

**5.4.3 Test scenario 3: Amazon AVS example system**



The AVS client is automatically started at power on.

Locate the microphone array board parallel to the plane of the floor, locate a talker (or reference loudspeaker) at various distances and directions from the microphones. Say “Alexa” and verify that the indicator LEDs turn on when the trigger word is detected, then ask for a command. You can test performance from as far as 5-10 meters in a relatively quiet environment.

AVS Commands to Try:

“Alexa, What time is it? »

“Alexa, What is the weather?”

*“Alexa, What is the weather in Boston?”*

*“Alexa, Tell me a joke”*

*“Alexa, Sing Happy Birthday”*

...

## 6 Installing Debian and Alexa SampleApp

### 6.1 Install Debian

#### 6.1.1 Download debian

We are using the the Debian Linux distribution provided by linaro.

We are using the version "dragonboard-410c-sdcard-installer-buster-359.zip" available on this website:

<http://releases.linaro.org/96boards/dragonboard410c/linaro/debian/latest/>

In the archive you'll find a sdcard image. Flash this image with command:

```
$ sudo dd if=dragonboard-410c-sdcard-installer-buster-359.img  
of=/dev/mmcblk0 bs=4M oflag=sync status=noxfer
```

**Note: the sdcard path may differ (here /dev/mmcblk0).**

#### 6.1.2 Install Debian

Once the sdcard is ready, here is how you install it on the dragonboard:

- Power-off dragonboard and insert sdcard
- At the back on the dragonboard you'll find a 4-position switch. Put switch n°2 "SD BOOT" in position 1.
- Power-on dragonboard and follow the graphical interface installation process.
- Once installation is finished: take out sdcard, put the switch back in position 0 and reboot the board.
- After reboot, the debian should start (connect an HDMI screen and mouse/keyboard to use the Debian).

#### 6.1.3 Update linux kernel

The Linux kernel of this Debian need to be updated to allow SPI to work.

We provide a new kernel image boot-db410c.img.

We use fastboot to reflash the new kernel. Fastboot is an android tool.

To use fastboot you need to:

- Connect the dragonboard to your PC via the micro-USB cable
- Start the dragonboard in fastboot mode
- Use the fastboot tool on your PC to communicate with the dragonboard and reflash the new kernel

You can install fastboot on your PC with command:

```
$ sudo apt-get install android-tools-adb android-tools-fastboot
```

To start the board in fastboot mode:

- Power-off dragonboard
- Push button VOL- (on top of the dragonboard, unplug the mezzanine board to access this volume button)
- Power-on dragonboard while keeping button pressed
- Release button after 5 seconds

To make sure your board is in fastboot mode use command:

```
$ fastboot devices
```

Once your board is recognized, flash the new kernel with command:

```
$ fastboot flash boot boot-db410c.img
```

Then reboot the board (unplug and replug power).

## 6.2 Install Alexa SampleApp (easy install)

The SampleApp easy install allow you to setup Alexa quickly on your board by using an already compiled binary (no need to rebuild the whole SDK).

For this installation we use the provided archive “easy\_install”. Copy this archive on the dragonboard and unpack it on the desktop (use a USB drive to copy it from your PC to the dragonboard). You should end up with a directory alexa on your Desktop :  
/home /linaro/Desktop/alexa

In the archive you’ll find:

- **/startup\_scripts**: scripts needed to configure mezzanine board
- **SampleApp**: alexa voice recognition application
- **/lib\_alexa**: folder containing libraries for the SampleApp
- **/database**: empty folder that will be used by alexa to store future database
- **AlexaCLientSDKConfig.json**: configuration file for alexa.
- **get\_alexa\_lib.sh**: script to download dependencies

**NOTE; for the installation you will need an internet access (use wifi or USB/ethernet dongle).**

### 6.2.1 Install dependencies

To use the SampleApp several dependencies are necessary. Download them with the script “get\_alexa\_lib.sh”:

```
$ cd /home/linaro/Desktop/alexa  
$ ./get_alexa_lib.sh
```

### 6.2.2 Update configuration file

Before starting the application, you’ll have to modify the configuration file and replace the clientID and productID fields by your own IDs.

To get these IDs you need to create an amazon developer account, register your product and create a security profile. Once it’s done download the file config.json related to your security profile. You will find a clientID and productID in this file, copy these IDs in the file “AlexaCLientSDKConfig.json”.

Here are the instructions to create the security profile:

<https://github.com/alexa/avs-device-sdk/wiki/Create-Security-Profile>

Once the configuration is done, you can run the SampleApp for the first time (see section 6.4).



### 6.3 Build Alexa SampleApp SDK

For this installation we use the provided archive “sdk\_build\_install”. Copy this archive on the dragonboard and unpack it on the desktop (use a USB drive to copy it from your PC to the dragonboard).

In the archive you’ll find:

- **/startup\_scripts**: scripts needed to configure mezzanine board
- **/database**: empty folder that will be used by alexa to store future database
- **/alexa\_build**: empty folder that will be used to build the SDK
- **get\_alexa\_lib.sh**: script to download dependencies
- **get\_portaudio.sh**: script to download portaudio library

#### 6.3.1 Install dependencies

To build the SampleApp several dependencies are necessary. Download them with the script “get\_alexa\_lib.sh”:

```
$ cd /home/linaro/Desktop/alexa
$ ./get_alexa_lib.sh
```

You will also need the library portaudio.

A script is provided to download, extract and build portaudio (get\_portaudio.sh).

```
$ cd /home/linaro/Desktop/alexa
$ sudo ./get_portaudio.sh
```

In case the script fails, download the package “pa\_stable\_v190600\_20161030.tgz” and build it manually (a readme is provided in the package):

<http://www.portaudio.com/download.html>

#### 6.3.2 Get and patch SDK

The first step is to clone the SDK with command:

```
$ git clone https://github.com/alexa/avs-device-sdk.git
```

**NOTE: we are using the SDK v1.10.**

Next step is to apply the provided sdk patch (to allow SDK to recognized the mezzanine board keyword detection).

Copy the file “sdk\_patch.patch” in directory /home/linaro/avs-device-sdk.

Apply patch with command:

```
$ cd /home/linaro/Desktop/alexa/avs-device-sdk
$ git apply sdk_patch.patch
```

Then go to directory /alexa\_build (the SDK will be built in that directory) and run the command cmake:

```
$ cd /home/linaro/Desktop/alexa/alexa_build
$ cmake /home/linaro/Desktop/alexa/avs-device-sdk -
  DSENSORY_KEY_WORD_DETECTOR=OFF -DGSTREAMER_MEDIA_PLAYER=ON -DPORTAUDIO=ON -
  DPORTAUDIO_LIB_PATH=/home/linaro/Desktop/alexa/portaudio/lib/.libs/libporta
  udio.a -DPORTAUDIO_INCLUDE_DIR=/home/linaro/Desktop/alexa/portaudio/include
```

Now the SDK is ready to be built.

### 6.3.3 Create memory swap on sdcard

The dragonboard may run out of memory building the SDK.

We advise you to use a sdcard to create a swap space following this guide: [https://www.96boards.org/documentation/consumer/guides/sd\\_swapspace.md.html](https://www.96boards.org/documentation/consumer/guides/sd_swapspace.md.html)

Here is a copy of the guide:

Insert a sdcard in your PC and format it:

```
$ sudo gdisk /dev/mmcb1k0
```

You will be presented with the following prompts. Use provided inputs. Where an input is not offered, simply press < Enter >

```
Command (? for help): o
This option deletes all partitions and creates a new protective MBR.
Proceed? (Y/N): y

Command (? for help): n
Partition number (1-128, default 1): <Enter>
First sector (34-123764702, default = 2048) or {+-}size{KMGTP}: <Enter>
Last sector (2048-123764702, default = 123764702) or {+-}size{KMGTP}: 8G
Current type is 'Linux filesystem'
Hex code or GUID (L to show codes, Enter = 8300): 8200
Changed type of partition to 'Linux swap'

Command (? for help): n
Partition number (1-128, default 2): <Enter>
First sector (34-123764702, default = 16779264) or {+-}size{KMGTP}: <Enter>
Last sector (2048-123764702, default = 123764702) or {+-}size{KMGTP}:
<Enter>

Current type is 'Linux filesystem'
Hex code or GUID (L to show codes, Enter = 8300): <Enter>
Command (? for help): w

Final checks complete. About to write GPT data. THIS WILL OVERWRITE
EXISTING
PARTITIONS!!

Do you want to proceed? (Y/N): y
```

Then format the 2 partitions with commands:

```
$ sudo mkfs -t ext4 /dev/mmcblk0p2
$ sudo mkswap /dev/mmcblk0p1
```

You can now take out sdcard of PC and plug it in the dragonboard.

On the dragonboard, edit the file /etc/fstab and add the following line:

```
$ sudo vim /etc/fstab
## Add the following line:
/dev/mmcblk1p1 none swap sw 0 0
## this will save and exit you out of vim
<esc>:wq
You can now reboot the dragonboard410c:
$ sudo reboot now
```

### 6.3.4 Build SDK

To build SDK run command make in your directory /alexa\_build (this may take a few hours):

```
$ cd /home/linaro/Desktop/alexa/alexa_build
$ make
```

The build may stop with an error message related to PortAudio (errorCode=-9985). If it happens, try to rebuild entirely the portaudio library and then launch make once again for alexa SDK:

```
$ cd /home/linaro/Desktop/alexa/portaudio
$ autoreconf -if
$ ./configure
$ make clean
$ make
$ cd /home/linaro/Desktop/alexa/alexa_build
$ make
```

### 6.3.5 Generate configuration file

The last step is to generate the configuration file.

You need to create an amazon developer account, register your product and create a security profile. Once it's done download the file config.json related to your security profile.

Here are the instructions to create the security profile:

<https://github.com/alexa/avs-device-sdk/wiki/Create-Security-Profile>

Once you have your config.json file, copy it in directory /home/linaro/Desktop/alexa/avs-device-sdk/tools/Install

Then run the script genscript with these parameters (parameters are the device serial number, the database path, the SDK source code path and where to store the output file)

```
$ cd /home/linaro/Desktop/alexa/avs-device-sdk/tools/Install
```

```
$ bash genConfig.sh config.json 001 /home/linaro/Desktop/alexa/database
/home/linaro/Desktop/alexa/avs-device-sdk
/home/linaro/Desktop/alexa/alexa_build/Integration/AlexaClientSDKConfig.js
on
```

You are now ready to run the SampleApp for the first time.

## 6.4 Running SampleApp for the first time

Before running the SampleApp, make sure the mezzanine board is configured. To configure it, run the script “init\_adivp.sh”.

```
$ cd /home/linaro/Desktop/alexa/startup_scripts
$ ./init_adivp.sh
```

Once the mezzanine is configured, start SampleApp with command:

For the easy install:

```
cd /home/linaro/Desktop/alexa/
LD_LIBRARY_PATH=/home/linaro/Desktop/alexa/lib_alexa ./SampleApp
./AlexaClientSDKConfig.json
```

For the SDK build installation;

```
$ cd /home/linaro/Desktop/alexa/alexa_build/SampleApp/src
$ sudo ./SampleApp ../../Integration/AlexaClientSDKConfig.json
```

When running the SampleApp for the first time, the application will give you a code to enter in your amazon developer account. After copying that code, the SampleApp should be able to connect and you can start using Alexa.

Once your SampleApp is running successfully, you can launch it automatically at startup.

## 6.5 Starting SampleApp automatically at boot

First let's edit the init script.

If you open the script “init\_adivp.sh” you'll find at the end of the file 2 commented lines.

These lines allow the script to start the SampleApp automatically.

Uncomment one of these line (depending of what installation mode you used).

Next step is to allow the init\_script to be automatically started at the boot.

To do it, go to directory /startup\_scripts/boot\_config and launch the script “configure\_boot.sh”.

The script is going to create a new systemctl service for the init\_adivp script.

```
$ cd /home/linaro/Desktop/alexa/startup_scripts/boot_config
$ ./configure_boot.sh
```

You can now reboot, the SampleApp should start automatically at startup.

## 6.6 Useful linux commands

### 6.6.1 Connect via SSH

You can connect to the dragonboard via SSH (the ID is “linaro” and the password is “linaro”).

The dragonboard need to be connected to your network (via wifi or a USB/Ethernet dongle) and you need to know the dragonboard IP address.

You can get the IP address with command (dragonboard need to be connected to a screen and a keyboard to do it):

```
$ ip addr show
```

Once you have it you can connect via SSH with command (password is “linaro”):

```
$ ssh -x linaro@<IP_address>
```

### 6.6.2 Turn-off Alexa via command line

Alexa SampleApp is started at the boot via systemctl service (if you followed the Alexa installation manual).

You can stop the service manually with command:

```
$ sudo systemctl stop alexa.service
```

### 6.6.3 Get Alexa SampleApp log

You can get the logs of the alexa SampleApp with command:

```
$ sudo systemctl status alexa.service
```

## 7 Upgrade STM32

This part explains how to flash the STM32 firmware “.dfu” for the mezzanine board with the DFU mode.

To flash the board, you will need the software “dFuSe” provided by STMicroelectronics:

[http://www.st.com/content/st\\_com/en/products/development-tools/software-development-tools/stm32-software-development-tools/stm32-programmers/stsw-stm32080.html](http://www.st.com/content/st_com/en/products/development-tools/software-development-tools/stm32-software-development-tools/stm32-programmers/stsw-stm32080.html)

### 7.1 Start the board in DFU mode

To start the board in DFU mode, connect the 2 DFU pins with a jumper before power on.

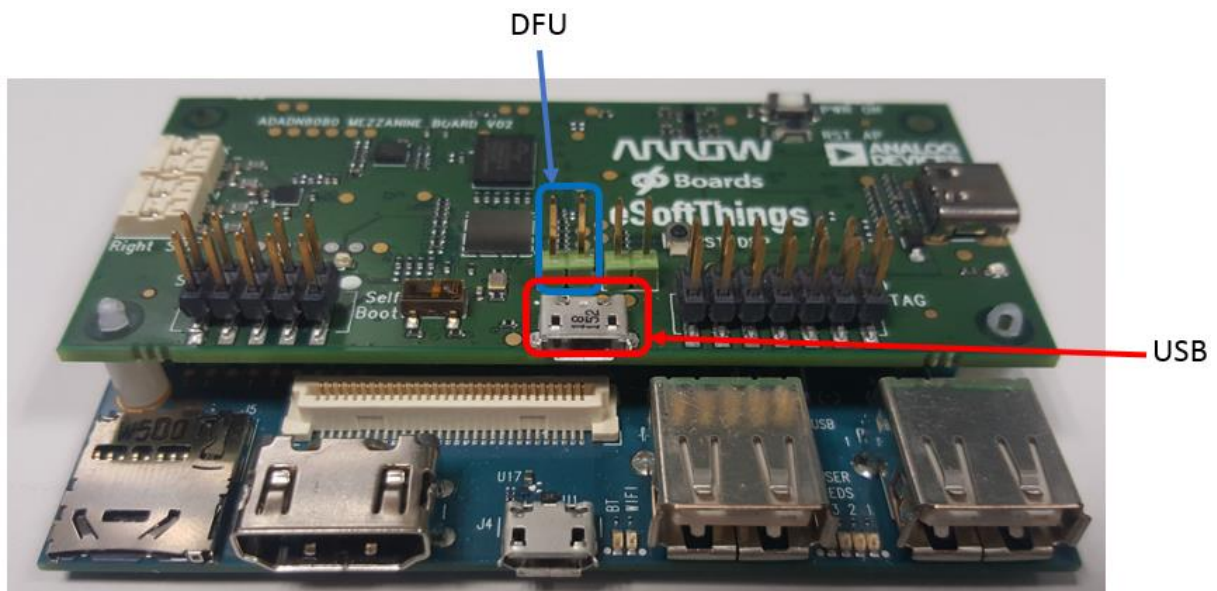


Figure 18: Mezzanine board DFU pins

This way, when you connect the Mezzanine board USB port to a PC, it is recognized as a “STM32 BOOTLOADER” device by windows.

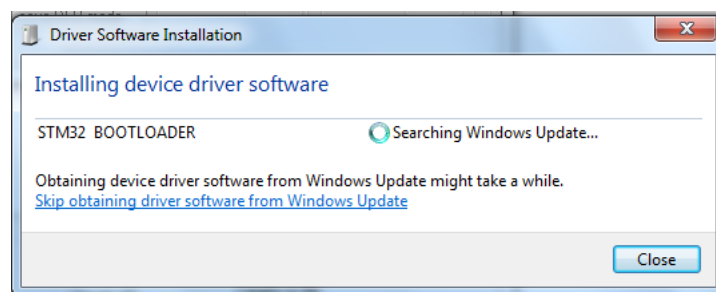


Figure 19: The STM32 should be recognized by windows

## 7.2 Upgrade Firmware STM32

To load a new firmware, execute the Windows software “DfuSe Demo”.

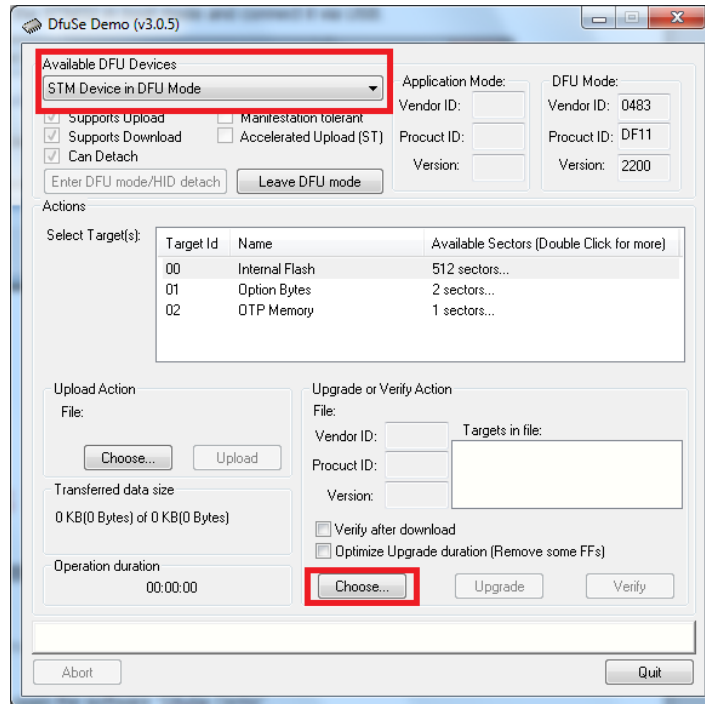


Figure 20: Detect the STM32

The STM32 should be recognized in “Available DFU Devices”. Click on “Choose” to select the DFU file to load.

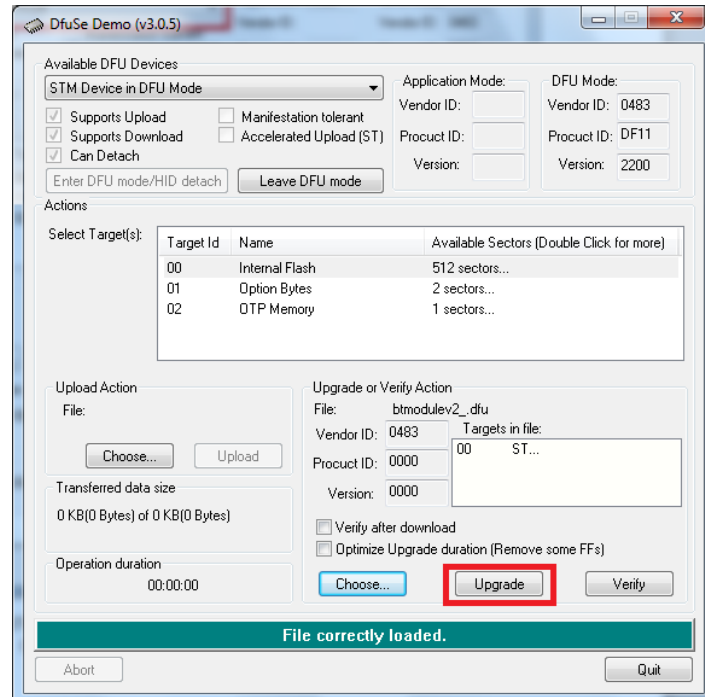


Figure 21: Upgrade STM32 firmware

Once you have selected your firmware you should get the blue message “File correctly loaded”. Then you can click on “Upgrade”. The program is going to erase the STM32 memory and load the new firmware. This process may take several minutes.

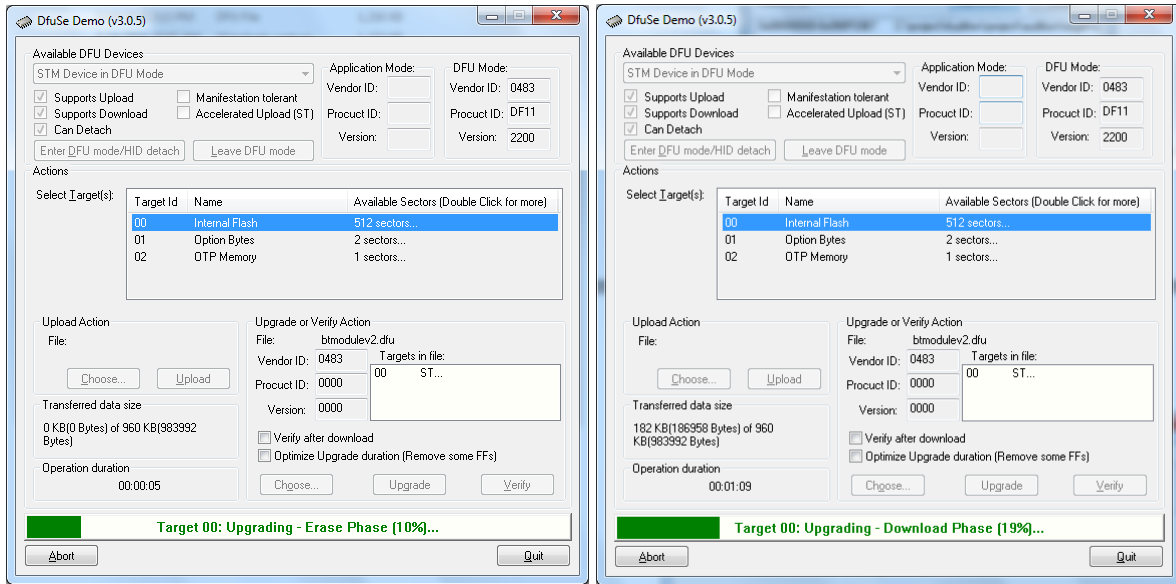


Figure 22: Flashing running: erasing phase

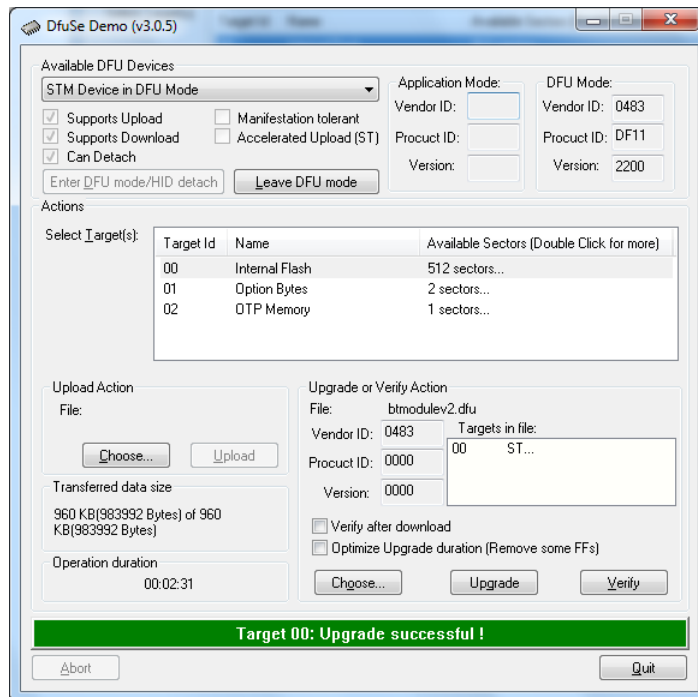


Figure 23: Flashing successful

Now you can remove the DFU jumper and restart the board.

The board should be recognized as a sound card by the PC after reboot.



## 8 Appendices

### 8.1 Architecture block diagram

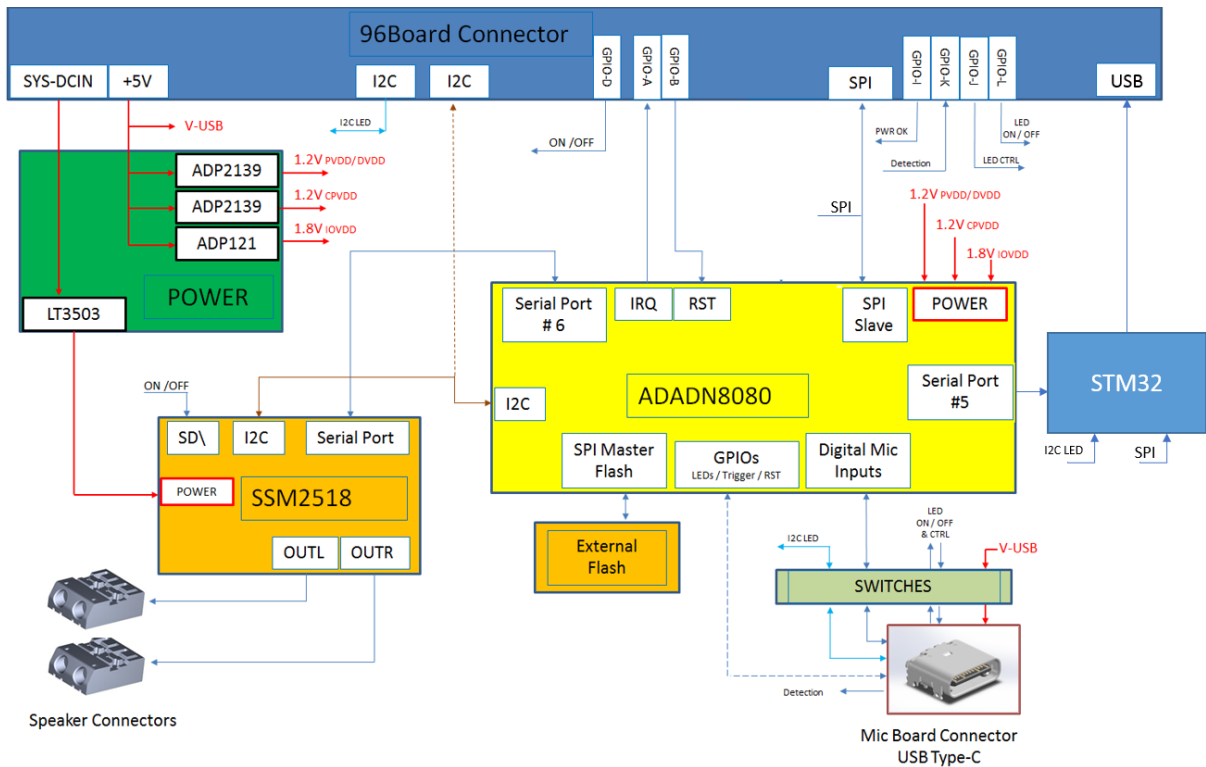


Figure 24: Architecture Block Diagram

### 8.2 Bill of materials

Qty	Value	Manufacturer	Manufacturer_PN	Description
8	10nF	Any	Any	CAP 10nF,50V,0402,X7R
30	100nF	Any	Any	CAP 100nF,50V,0402,X5R
11	1uF	Any	Any	CAP 1uF,25V,0402,X5R
7	4.7uF	Any	Any	CAP 4.7uF,25V,0603,X5R
1	10uF	Any	Any	CAP 10uF,6.3V,0402,X5R,20%
1	100pF	Any	Any	CAP 100pF,50V,0402,X7R
30	100nF	Any	Any	CAP 100nF,6.3V,0201,X5R,10%
13	1uF	Any	Any	CAP 1uF,6.3V,0402,X5R
4	470pF	Any	Any	CAP 470pF,50V,0402,X7R
2	12pF	Any	Any	CAP 12pF,50V,0402,NPO
1	30V 500mA	FAIRCHILD	MBR0530	DIOSCH 30V,500mA,MBR0530,SOD-123
1	40V 1A	ON SEMI	MBRM140T1	DIOSCH 40V,1A,MBRM140,SOD-123
1	1N4148WS	ON SEMI	1N4148WS	DIO 75V, 150mA, SOD-323F
1	TPD2EUSB30A	TEXAS INSTRUMENTS	TPD2EUSB30ADRTR	DIOTVS-USB3 3.6V,5A,SOT-3-DRT

1	2x5P_2.54MM	MOLEX	15916102	CONN HEADER 2 x 5 POS 2.54MM SMT
1	2x7P_2.54MM	MOLEX	15916142	CONN HEADER 2 x 7 POS 2.54MM SMT
1	87831-4029	MOLEX	87831-4029	CONN HEADER 2x20Pos, TH Vertical
1	1054500101	MOLEX	1054500101	CONN USB-C 2x12POS RIGHT ANGLE SMT
2	104238-0210	MOLEX	1042380210	SPEAKER-TERMINAL 2Pos, SMT Horizontal, 160V-3A
1	47589-0001	MOLEX	47589-0001	CONN μUSB-AB,5Pos, Right Angle,Gold
1	BLUE	KINGBRIGHT	APTD1608LVBC/D	LED BLUE CLEAR 0603 SMD
1	RED	KINGBRIGHT	KP-1608SURC	LED RED CLEAR 0603 SMD
2	1uH	MURATA	DFE252012P-1R0M	IND 1uH,4.2A,42mOHM, SMD_2.5X2_1.2
1	2.2uH	MURATA	DFE201612E-2R2M	IND 2.2UH,2.4A,116mR,0806
1	80ohm 0.1A	MURATA	DLP11TB800UL2	IND-CM 100mA,80OHM, SMD_1.25X1_0.3
1	120Ohm 1A	TAIYO YUDEN	BKP1005HS121-T	FERRITE BEAD 1A,120OHM,0402
2	470R	Any	Any	RESMET 470R,0402,1/16W,1%
68	0R	Any	Any	RESMET 0R,0402,1/16W,1%
1	33K	Any	Any	RESMET 33K,0402,1/16W,1%
14	10K	Any	Any	RESMET 10K,0402,1/16W,1%
7	100K	Any	Any	RESMET 100K,0402,1/16W,1%
1	15K	Any	Any	RESMET 15K,0402,1/16W,1%
1	82K	Any	Any	RESMET 82K,0402,1/16W,1%
3	2.2K	Any	Any	RESMET 2.2K,0402,1/16W,1%
2	1K	Any	Any	RESMET 1K,0402,1/16W,1%
4	0R	Any	Any	RESMET 0R,0603,1/10W
1	1.96K	Any	Any	RESMET 1.96K,0402,1/16W,1%
2	B3U-1000P	OMRON	B3U-1000P	SW-TACT-SPST-NO 12V,50mA, SMD
1	TACT-NO	PANASONIC	EVQP2402M	SW-TACT-SPST-NO 2.4N,15V,20mA,3.5x4.7mm_2.5mm
1	SLIDE-SPDT	CJS	CJS1200TB1	SW-SLIDE-SPDT 6V,0.1A, SMD
6	NLAS4684MNR2G	ON SEMI	NLAS4684MNR2G	IC-SW Dual SPDT Analog Switch, DFN-10
2	ADG3301BKSZ	ANALOG DEVICES	ADG3301BKSZ	IC 1-BIT LEVELTRANSLATOR, SC70-6
1	LTC4308	LINEAR TECHNOLOGY	LTC4308	I2C VOLT-LEVEL TRANSLATOR DFN-8_Pad
2	SN74LVC2G125YZPR	TEXAS INSTRUMENTS	SN74LVC2G125YZPR	DUAL BUS TRI-STATE BUFFER/LINE DRIVER, DSBGA-8
1	ADP2139ACBZ-1.2-R7	ANALOG DEVICES	ADP2139ACBZ-1.2-R7	IC-BUCK Step-Down DC-To-DC Converter 1.2V 800mA, WLCSP-6
1	ADP121-ACBZ12R7	ANALOG DEVICES	ADP121-ACBZ12R7	IC-BUCK Linear-Regulator-150mA, WLCSP-4
1	LT3503	LINEAR TECHNOLOGY	LT3503	IC-BUCK Step-Down Switching-Regulator 1A, DFN-6

1	ADP2139ACBZ-1.8-R7	ANALOG DEVICES	ADP2139ACBZ-1.8-R7	IC-BUCK Step-Down DC-To-DC Converter 1.8V 800mA, WLCSP-6
1	ADADN8080	ANALOG DEVICES	ADADN8080BCBZRL	IC-DSP Cadence Tensilica HiFi 4 Voice Interface and Audio Processor for Machine Learning, WLCSP-144
1	CYPRES_S25FS512S	CYPRESS	S25FS512SDSBHV213	IC-MEM FLASH NOR 512Mbit-1.8V-SPI, BGA-24
1	SSM2518CBZ-R7	ANALOG DEVICES	SSM2518CBZ-R7	IC-OPAMP Digital Input Stereo, 2 W, Class-D Audio Power Amplifier, WLCSP-16
1	STM32L476QGI	ST	STM32L476QGI6	ARM CORTEX-M4 32BIT MCU+FPU 1MB FLASH, UFBGA132
1	FC-135	EPSON	FC-135 32.7680KA-A3	QTZ 32.768KHz,20PPM,12.5PF,3.2X1.5MM
1	24.576MHz	IQD	LFSPXO056217	OSC 24.576MHZ,50PPM,1.8V,2.X1.6MM