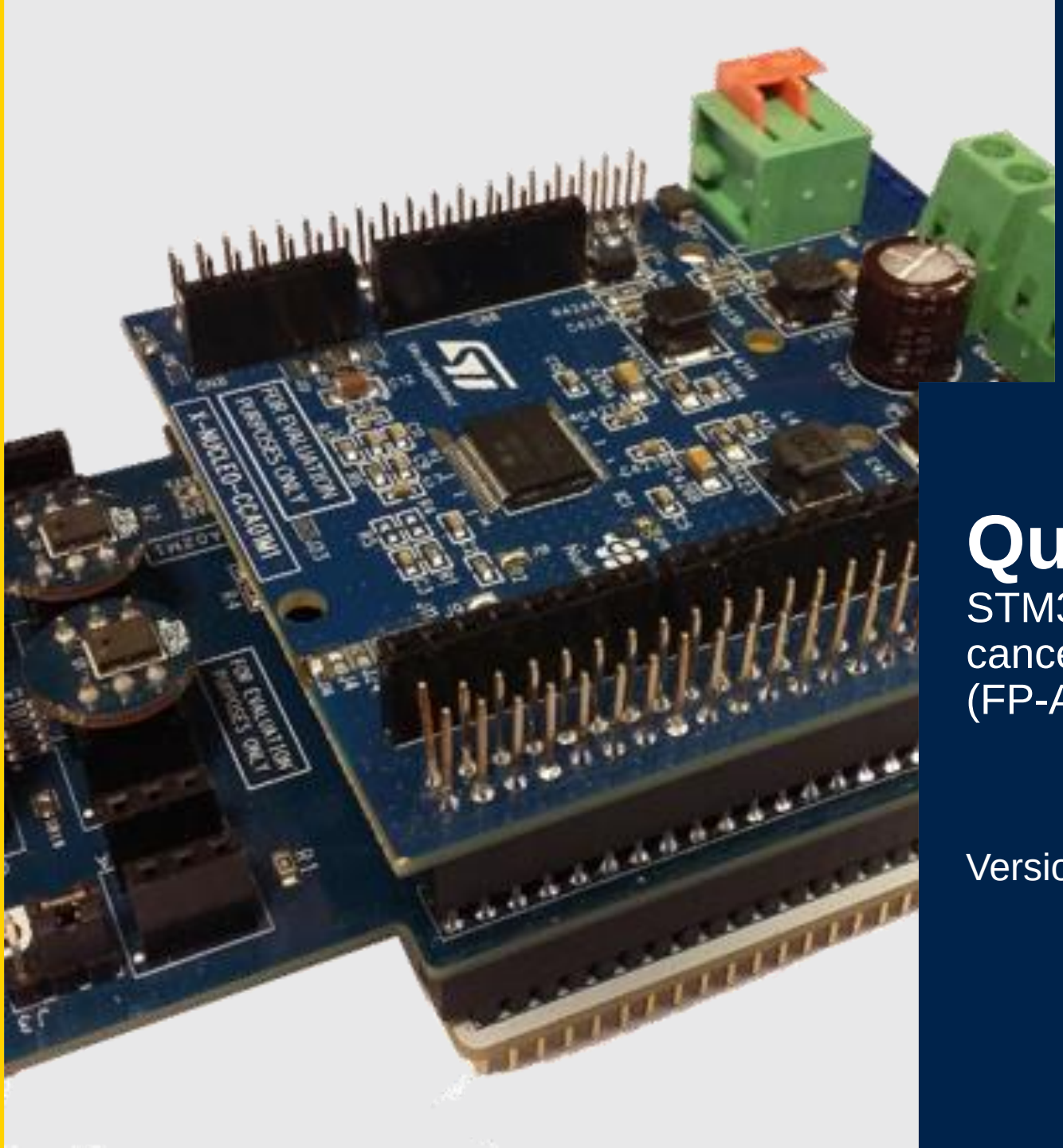

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Quick Start Guide

STM32Cube function pack for acoustic echo cancellation
(FP-AUD-AEC1)

Version 1.0 (Jan, 2021)

Agenda

1. Hardware and Software overview
2. Setup & Demo Examples
3. Documents & Related Resources

1- Hardware and Software overview

X-NUCLEO-CCA02M2 MEMS Microphones expansion board

Hardware Overview

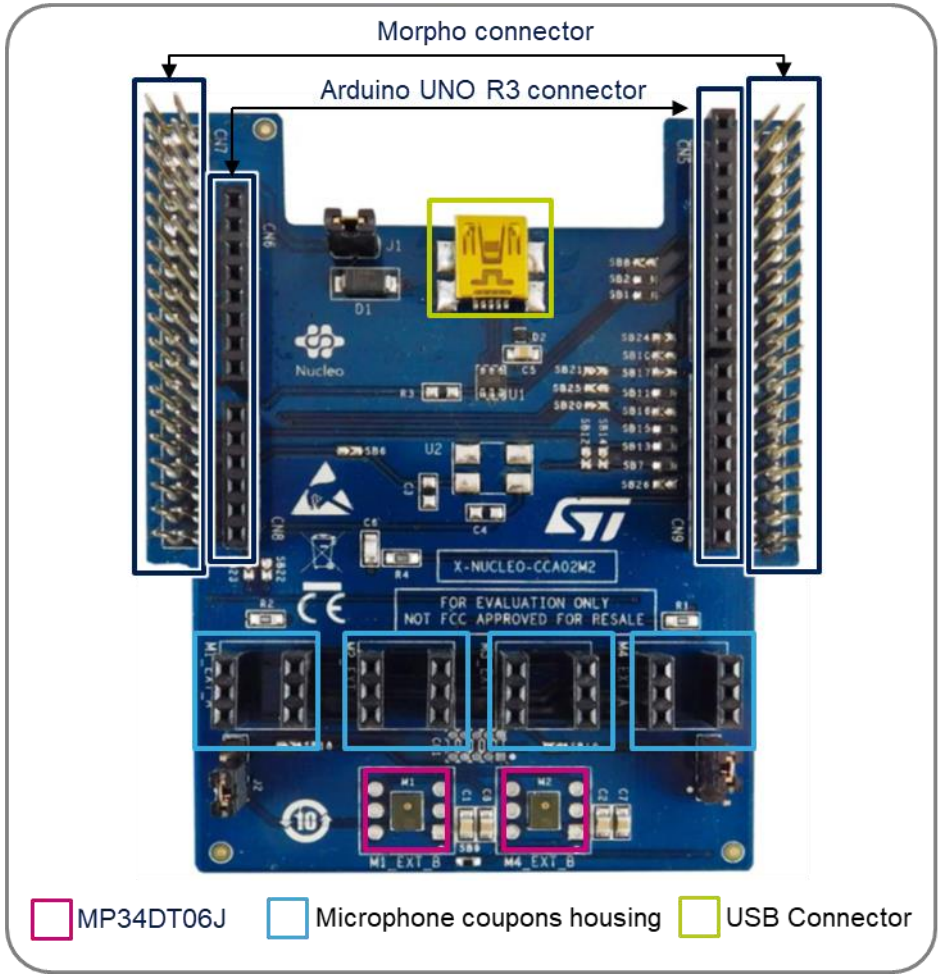
X-NUCLEO-CCA02M2 Hardware Description

The X-NUCLEO-CCA02M2 is an expansion board that has been designed around MP34DT06J digital MEMS microphone. It is compatible with the ST morpho connector layout and with digital microphone coupon boards such as STEVAL-MIC002V1, STEVAL-MIC003V1, STEVAL-MIC005V1 and STEVAL-MIC006V1.

The X-NUCLEO-CCA02M2 embeds two MP34DT06J microphones and allows synchronized acquisition and streaming of up to 4 microphones through I²S, SPI, DFSDM or SAI peripherals

Key Features

- 2 on-board MP34DT06J digital MEMS microphones
- 6 slots to plug in digital microphone coupon boards such as STEVAL-MIC002V1, STEVAL-MIC003V1, STEVAL-MIC005V1 and STEVAL-MIC006V1
- Synchronized acquisition and streaming of up to 4 microphones
- Compatible with STM32 Nucleo boards Equipped with ST morpho connector (upwards and downwards)
- Equipped with Arduino UNO R3 connector (upwards) to allow multiple boards
- RoHS and WEEE compliant



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X-NUCLEO-CCA01M1 Sound Terminal Expansion Board

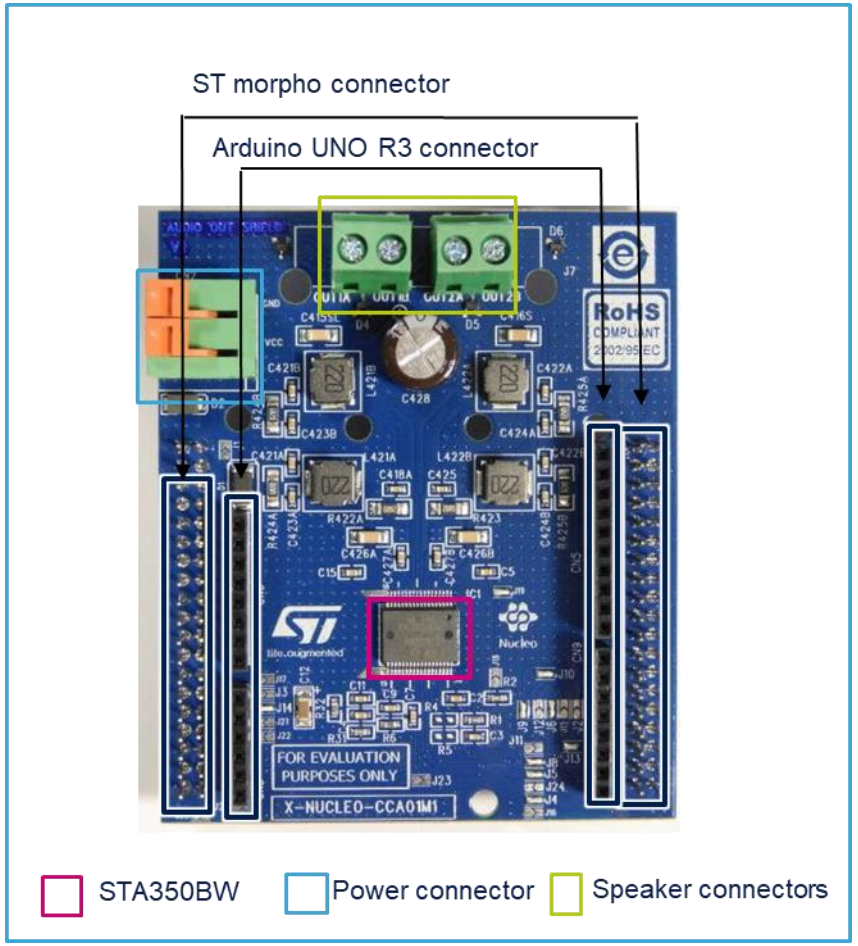
Hardware Overview

X-NUCLEO-CCA01M1 Hardware Description

The X-NUCLEO-CCA01M1 is an expansion board based on STA350BW Sound Terminal® device, a 2.1-channel high-efficiency digital audio output system. It enables the output of digital audio streams to a speaker pairs connected directly to the board and allows the evaluation of the STA350BW digital audio output component.

Key Features

- 2 channels of ternary PWM 2 x 50W @ 25 V 6 Ω
- FFX ™ 100 dB SNR and dynamic range
- I²C control with selectable device address
- Digital gain +48 dB -80 dB with 0.125 dB/step
- Two independent DRCs configurable as a dual-band anti-clipper (B2DRC) or independent
- limiters/compressors
- I²S input interface
- 3 coefficients banks for EQ preset storing with fast recall via I²C interface
- Up to 8 user-programmable biquads per channel
- Compatible with STM32 Nucleo boards
- Free comprehensive development firmware library and example compatible with STM32Cube firmware



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FP-AUD-AEC1
Software Overview

Software Description

FP-AUD-AEC1 is an STM32Cube function pack which features an example fully focused on acoustic echo cancellation and provides an implementation of a USB smart speaker use case with microphone.

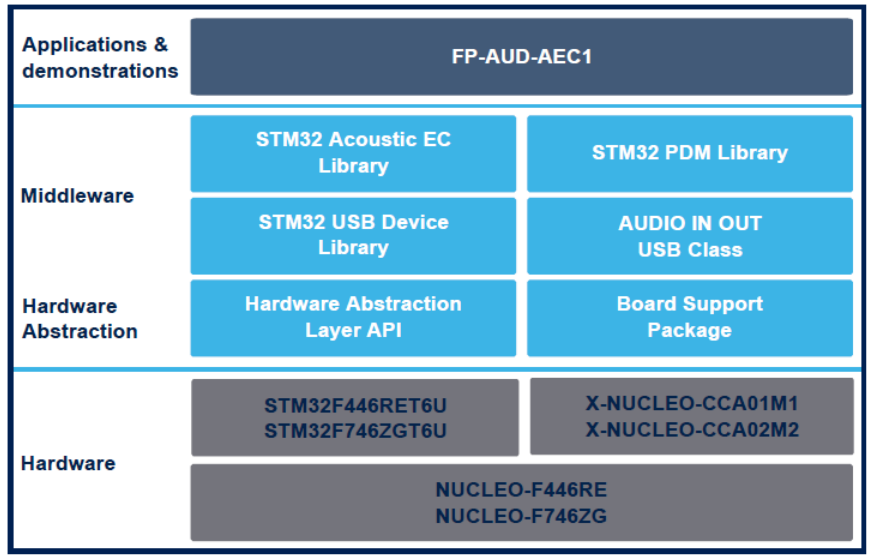
The package includes the AcousticEC library which provides an implementation for a real-time echo cancellation routine based on the MDF algorithm SPEEX implementation.

The function pack also includes an implementation example for NUCLEO-F446RE or NUCLEO-F746ZG development boards equipped with X-NUCLEO-CCA01M1 expansion board and X-NUCLEO-CCA02M2 expansion board.

Key features

- Specific example fully focused on acoustic echo cancellation
- Implementation of a USB smart speaker use case with microphone
- Based on STM32 AcousticEC library
- Support for audio in/out streaming via USB through a dedicated USB AUDIO IN OUT
- Based on STM32Cube software development environment for STM32 microcontrollers

Overall Software Architecture



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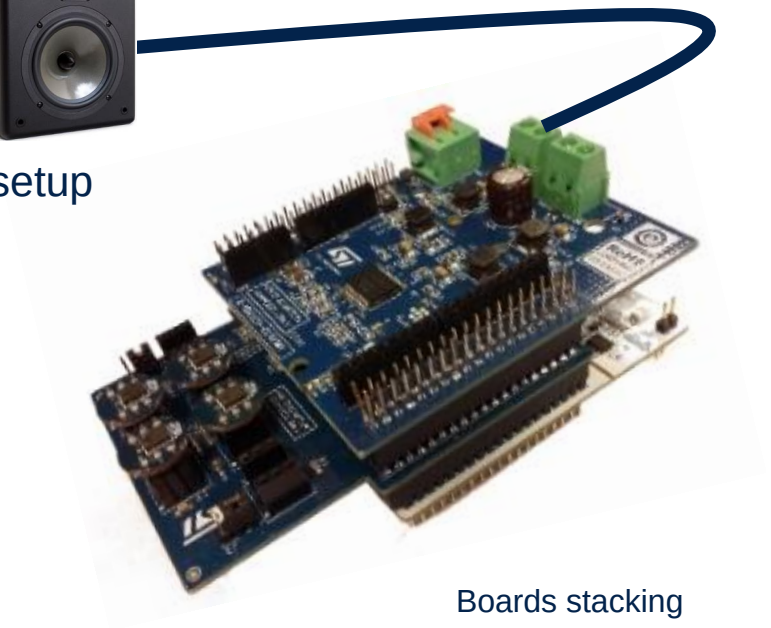
2- Setup & Demo Examples

HW prerequisites

- 1x STM32 Nucleo development board (NUCLEO-F446RE)
- 1x Sound terminal expansion board based on STA350BW (X-NUCLEO-CCA01M1)
- 1x Digital MEMS microphone expansion board (X-NUCLEO-CCA02M2)
- 1x 8 Ω passive speaker to be connected to the X-NUCLEO-CCA01M1 expansion board
- 2x USB type A to mini-B USB cable
- 1x Windows® PC/Laptop
- Please refer to the user manual for correct hardware setup

NUCLEO F446RE

X-NUCLEO-CCA01M1



Boards stacking

X-NUCLEO-CCA02M2

Mini USB Cable

Speaker

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Software and other prerequisites

- **STM32CubeProgrammer Software**
  - Download and install STM32CubeProgrammer
- **AEC demo**
  - Download the FP-AUD-AEC1 package from www.st.com, copy the .zip file contents into a folder on your PC. The package contains binaries and source code with project files (Keil, IAR, STM32CubeIDE) based on NUCLEO-F446RE
- **Third party audio player and acquisition software**
  - Audacity® is free, open source, cross-platform software for recording and editing sounds.
  - It is available for Windows®, Mac®, GNU/Linux®; and other operating systems.
  - Any sound player available (i.e.: Windows Media Player)

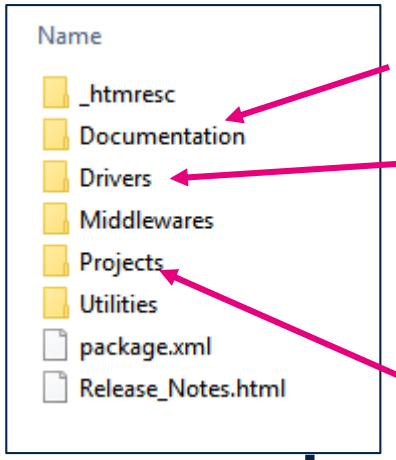
Setup & demo example

1 www.st.com

2 Select:
FP-AUD-AEC1

3 Download & unpack

STSW-STWINKT01 package structure



Docs

BSP, HAL drivers

Sample applications

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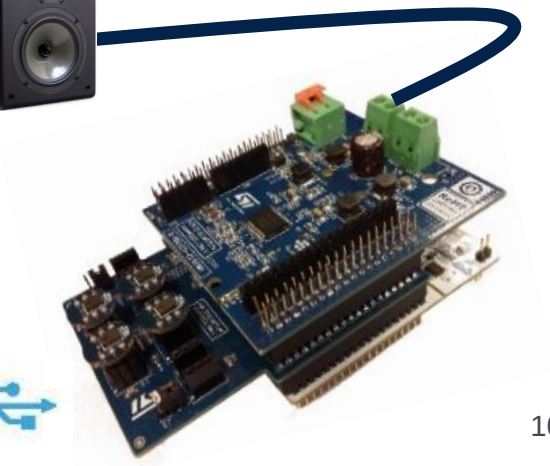

Use the pre-compiled binaries or re-compile the code customizing your device configuration

KEIL™ Tools by ARM · IAR SYSTEMS · STM32 CubeIDE

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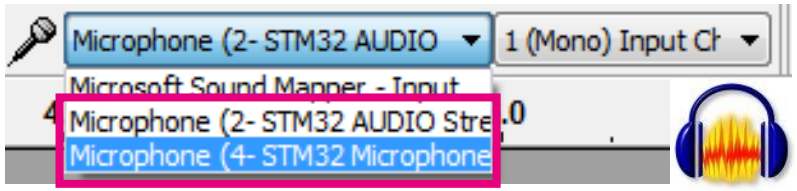
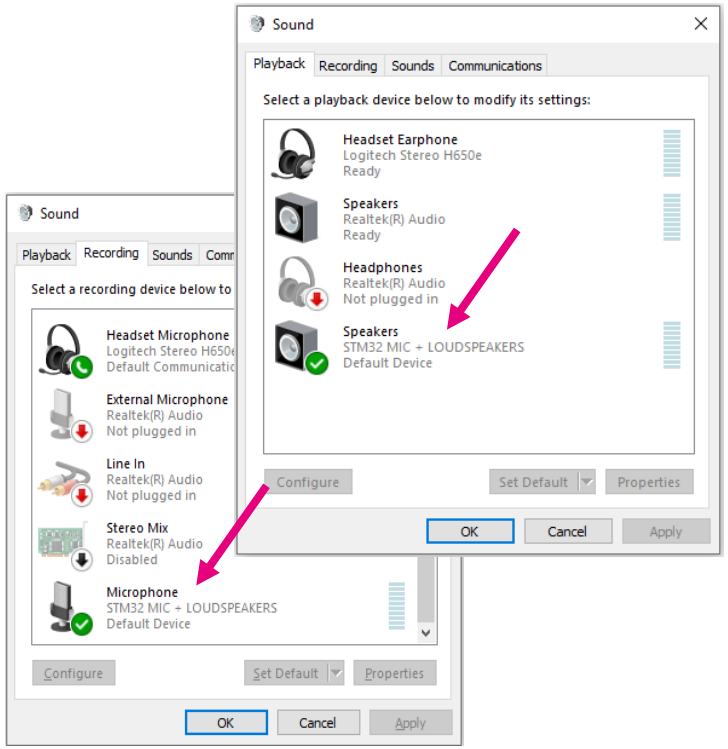
6 Open the preferred audio player and Audacity, select the right peripheral and click record.



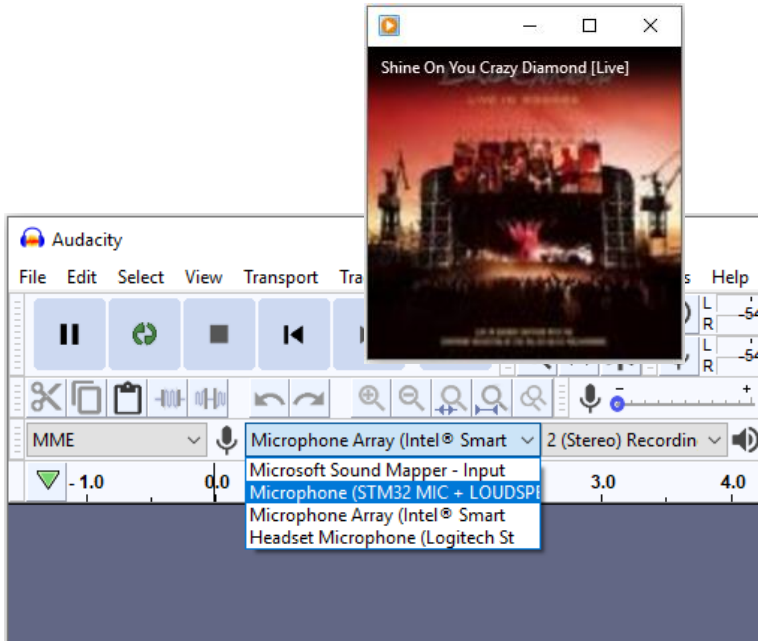
Speaker output

Run the application

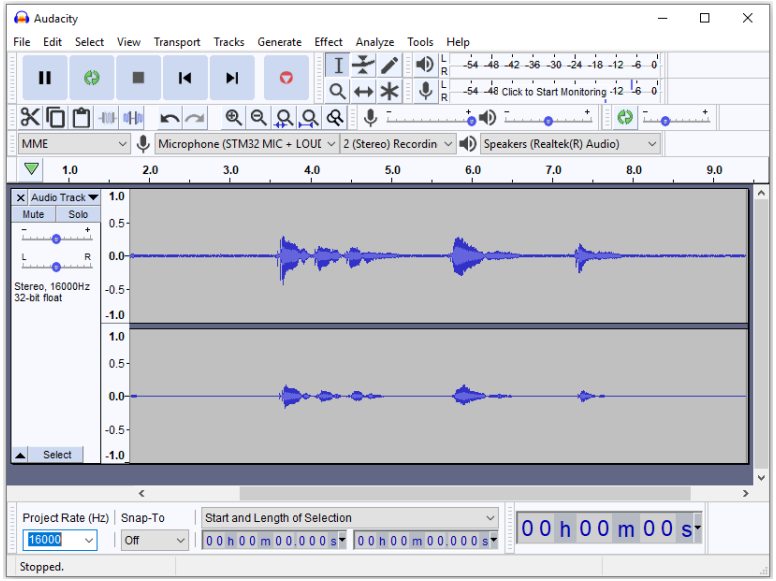
- Once downloaded the firmware, verify that Windows can recognize the device both as a standard USB microphone and speaker named STM32 MIC + LOUDSPEAKERS.



- Open the preferred sound player (here we use Windows media Player) and the sound recorder (here we use Audacity), selecting the device STM32MIC + LOUDSPEAKERS



- Start recording. 2 tracks are recorded:
  - The first is the noisy one from the omnidirectional microphone
  - The second is the processed one, with Acoustic Echo Cancellation enabled: noise and sound coming from the speaker is deleted



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3- Documents & Related Resources

Documents & Related Resources

FP-AUD-AEC1:

- **DB4393:** STM32Cube function pack for acoustic echo cancellation – **databrief**
- **UM2824:** Getting started with the STM32Cube function pack for acoustic echo cancellation – **user manual**

X-NUCLEO-CCA01M1:

- **Gerber files, BOM, Schematic**
- **DB2756**: Sound terminal expansion board based on STA350BW for STM32 Nucleo – **databrief**
- **UM1972**: Getting started with sound terminal expansion board based on STA350BW for STM32 Nucleo – **user manual**

X-NUCLEO-CCA02M2:

- **Gerber files, BOM, Schematic**
- **DB4016:** Digital MEMS microphone expansion board based on MP34DT06J for STM32 Nucleo – **databrief**
- **UM2631:** Getting started with the digital MEMS microphone expansion board based on MP34DT06J for STM32 Nucleo – **user manual**

Visit www.st.com for the complete list

Thank you

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