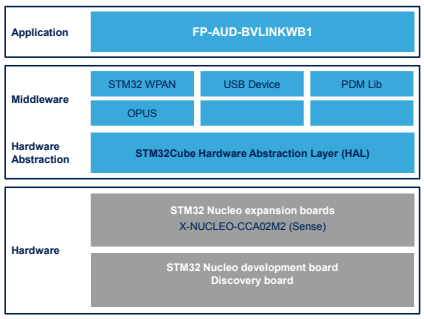
FP-AUD-BVLINKWB1

Data brief

STM32Cube function pack for STM32WB MCU featuring advanced audio streaming over Bluetooth 5.0 using Opus codec



STM32 Open Development Environment

STM32 Cube

Product summary	
STM32Cube function pack for STM32WB MCU featuring advanced audio streaming over Bluetooth 5.0 using Opus codec	FP-AUD-BVLINKWB1
Digital MEMS microphone expansion board based on MP34DT06J for STM32 Nucleo	X-NUCLEO-CCA02M2
Bluetooth 5 and 802.15.4 Nucleo pack including USB dongle and Nucleo-68 with STM32WB55 MCUs	P-NUCLEO-WB55
Complete demonstration and development platform for the STM32W5MMG module	STM32WB5MM-DK
BLE sensor application for Android and iOS	STBLESensor
Applications	Sound Sensing Bluetooth Low Energy

Features

- Complete firmware to implement full-duplex communication or stereo music streaming over Bluetooth 5.0 using Opus codec for both encoding and decoding
- A BlueVoiceOPUS customized profile for audio over BLE, including an easy-to-use set of APIs to exploit advanced Opus functionality (source code available)
- Third-party Opus v1.3 (downloadable from https://www.opus-codec.org) middleware: an open, royalty-free and highly versatile audio codec that is standardized by the Internet Engineering Task Force (IETF) as RFC 6716
- Digital audio signal acquisition and processing
- Audio out playback through USB
- Sample implementation available for X-NUCLEO-CCA02M2 connected to a P-NUCLEO-WB55 and for STM32WB5MM-DK
- Compatibility with STBLESensor app, to perform full-duplex audio streaming at 16 kHz and speech-to-text or to receive stereo music at 48 kHz from devices supporting BLE 4.2 or higher
- Free, user-friendly license terms

Description

FP-AUD-BVLINKWB1 is an STM32Cube function pack that performs full-duplex voice streaming or stereo music streaming over BLE using the advanced Opus compression algorithm.

The application runs on P-NUCLEO-WB55 connected to an X-NUCLEO-CCA02M2 or on STM32WB5MM-DK and includes drivers and middleware for BLE and digital MEMS microphones. It also includes the complete Opus audio codec (v 1.3) as third-party middleware to perform bidirectional and simultaneous audio streaming between two STM32WB.

The peripheral module can also communicate in full-duplex mode (bidirectional audio at 16 kHz) with a mobile device running the STBLESensor app, or receive stereo music at 48 kHz from the same app.

The software with the suggested combination of STM32WB and ST devices can be used, for example, to develop wireless audio communication systems for smart home or wearable applications.

The Opus algorithm provides the flexibility to achieve high audio quality even at low bitrates, and the STM32WB has the low power capabilities to allow the development of applications featuring very low consumption.

1 Detailed description

1.1 What can you do with STM32Cube function packs?

STM32Cube function packs leverage the modularity and interoperability of STM32 Nucleo and X-NUCLEO boards together with STM32Cube and X-CUBE software to create function examples for some of the most common use cases of different application technologies.

These software function packs are designed to exploit the underlying STM32 ODE hardware and software components as much as possible to best satisfy the requirements of final user applications.

Moreover, function packs may include additional libraries and frameworks that are not present in the original X-CUBE packages, thus enabling new functionalities allowing real and usable system for developers.

1.2 What is STM32Cube?

STM32Cube is a combination of a full set of PC software tools and embedded software blocks running on STM32 microcontrollers and microprocessors:

- STM32CubeMX configuration tool for any STM32 device; it generates initialization C code for Cortex-M cores and the Linux device tree source for Cortex-A cores
- STM32CubeIDE integrated development environment based on open-source solutions like Eclipse or the GNU C/C++ toolchain, including compilation reporting features and advanced debug features
- STM32CubeProgrammer programming tool that provides an easy-to-use and efficient environment for reading, writing and verifying devices and external memories via a wide variety of available communication media (JTAG, SWD, UART, USB DFU, I2C, SPI, CAN, etc.)
- STM32CubeMonitor family of tools (STM32CubeMonRF, STM32CubeMonUCPD, STM32CubeMonPwr) to help developers customize their applications in real-time
- STM32Cube MCU and MPU packages specific to each STM32 series with drivers (HAL, low-layer, etc.), middleware, and lots of example code used in a wide variety of real-world use cases
- STM32Cube expansion packages for application-oriented solutions

1.2.1 How does this STM32Cube function pack complement STM32Cube?

This software is based on the STM32CubeHAL hardware abstraction layer for the STM32 microcontroller. The package extends STM32Cube by providing a board support package (BSP) for the MEMS microphone expansion board, P-NUCLEO-WB55 and STM32WB5MM-DK, as well as middleware components for audio acquisition, communication with other BLE devices, USB streaming of recorded signals and a dedicated profile for audio streaming over BLE (*bvopus_service_stm*).

The third party Opus (v1.3) middleware is included in the function pack.

The BlueVoiceOPUS profile defines a BLE service which includes one characteristic for audio transmission and one for optional control messages. In a full-duplex system, both sides of the communication (central and peripheral) can act as a server of information. Periodic notifications containing compressed audio data are sent from the central node acting as a server to the peripheral node acting as a client, and vice versa.

The BlueVoiceOPUS service is responsible for audio encoding and periodic data transmission on the server side and for received data decoding on the client side.

The drivers abstract low-level hardware details and allow the middleware components and applications to access the devices in a hardware-independent fashion.

The package includes a sample application that developers can use to start experimenting with the code. It enables audio acquisition, compression and transmission over BLE from the module acting as a transmitter to the module acting as a receiver, which is responsible for audio decompression and USB streaming of audio data to a PC.

The system is recognized by the PC as a standard microphone, and any freeware or commercial audio recording software can be used to interface with it. Both the central and the peripheral modules can act as a transmitter and a receiver at the same time, enabling full-duplex voice streaming.

The peripheral module can also perform full-duplex communication with a mobile device running the STBLESensor app or receive and decode stereo music at 48 kHz streamed by the same app.

Revision history

Table 1. **Document revision history**

Date	Version	Changes
02-Jul-2019	1	Initial release.
18-Nov-2019	2	Updated all content to reflect v.1.1.0 software release.
02-Mar-2021	3	Updated all content to reflect v.2.0.0 software release.