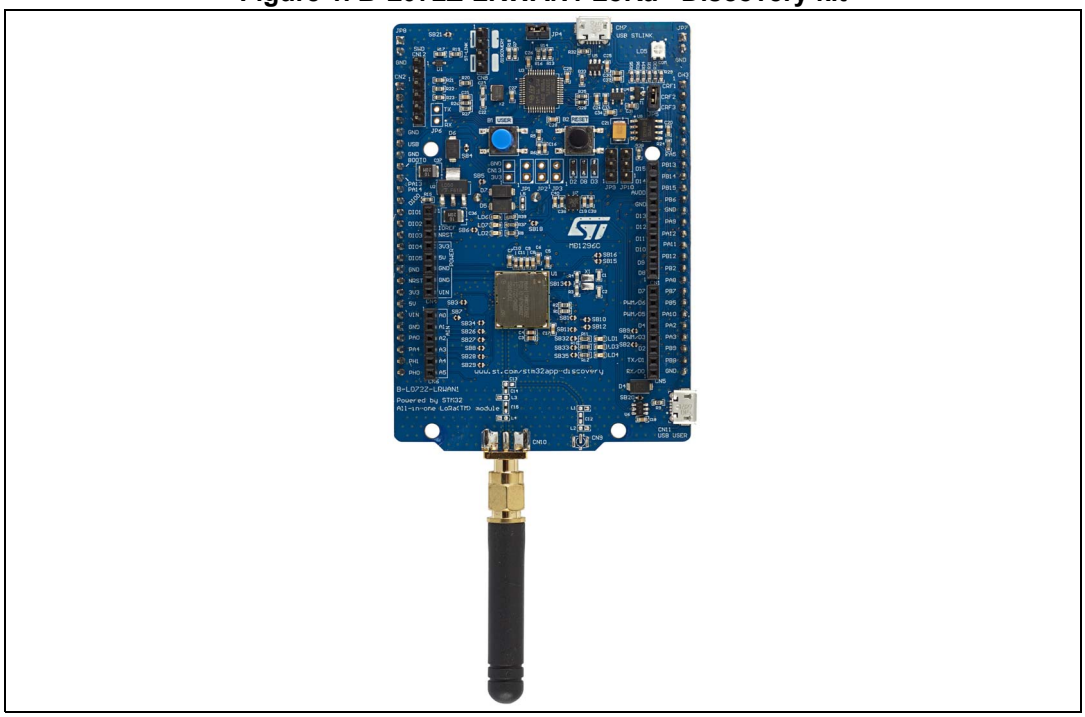
UM2159
User manual

Getting started with Ultra-low-power STM32L0 and LoRa® Discovery kit

Introduction

The LoRa® Discovery kit (B-L072Z-LRWAN1) is an RF Discovery board featuring the CMWX1ZZABZ-091 LoRa® module from Murata. This module incorporates the SX1276 low-power transceiver which features a LoRa® long-range modem. This module supports high-performance and OOK/FSK modulations. The transceiver is controlled by an STM32L072CZY6 microcontroller embedded in the module. A complete and certified LoRaWAN™ middleware stack, compliant with the LoRaWAN™ specification and running on the STM32L072CZY6 microcontroller, provides support for bi-directional end-devices in Class A and Class C protocols and for end-device activation either via Over-The-Air Activation (OTAA) or via Activation-By-Personalization (ABP). For all the details refer to the *STM32 LoRa® software expansion for STM32Cube* (UM2073) User manual, at the *www.st.com* website. This document describes the hardware environment to build the system and to run an application based on the B-L072Z-LRWAN1 Discovery kit.

Figure 1. B-L072Z-LRWAN1 LoRa® Discovery kit



1. Picture is not contractual.

Contents

List of figures

1 Hardware configuration

1.1 Features

The B-L072Z-LRWAN1 Discovery kit offers the following features:

- A CMWX1ZZABZ-091 LoRa® module from Murata embedding:
  - STM32L072CZY6 microcontroller featuring 192 Kbytes of Flash memory, 20 Kbytes of RAM, 20 Kbytes of EEPROM
  - SX1276 low-power transceiver which features a LoRa® long-range modem
- ARM® mbed™ (see http://mbed.org)
- On-board ST-LINK/V2 with selection mode switch to use the kit as a standalone ST-LINK/V2 (with SWD connector for programming and debugging)
- Board powered through the USB bus or from an external 3V or 5V supply voltage or battery
- Six LEDs:
  - LD7 (red/green) for USB communication
  - LD2 (red) for 3.3V power-on
  - Four user LEDs: LD1 (Green), LD2 (red), LD3 (blue) and LD4 (red)
- Two push-buttons (user and reset)
- USB with Micro-B connector for the CMWX1ZZABZ-091 modue
- Arduino™ connector to plug Arduino/Mbed compatible expansion board.
- Extension header for a quick connection to the prototyping board and an easy probing

1.2 System requirement

- Windows® OS (XP, 7, 8,10), Linux 64-bit or macOS™
- USB Type-A to Micro-B cable
- ST-LINK/V2

1.3 Development toolchains

- Keil® MDK-ARM(a)
- IAR™ EWARM(a)
- GCC-based IDEs including free SW4STM32 from AC6
- ARM® mbed™ online

a. On Windows® only.

1.4 Powering up the Discovery kit

The B-L072Z-LRWAN1 Discovery kit can be powered up from three sources:

- USB ST-LINK: to power the board from the USB connector CN7, use the 'Type-A to Micro-B' USB cable and connect it between the host and the USB connector CN7 of the board
- External sources: DC power supply can be inserted in the GND and 3V (or 5V) pin
- Battery case: insert three AA batteries in the battery case at the bottom of the board

1.5 Reset the Discovery kit

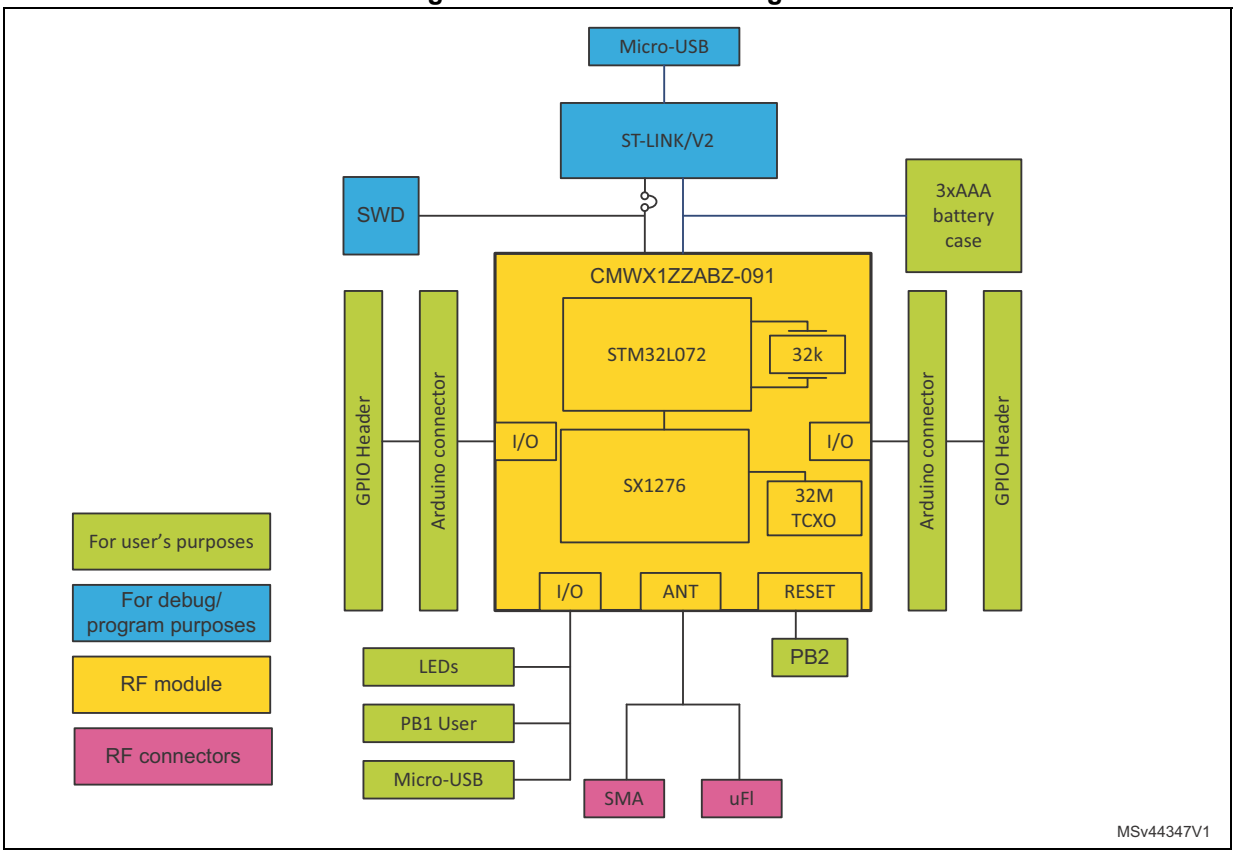
There are three ways to reset the B-L072Z-LRWAN1 Discovery kit:

- Push the reset button (B1) mounted on the B-L072Z-LRWAN1
- Remove and reinsert the USB cable
- The STM32 can also be reset by debuggers

1.6 Hardware block diagram

The B-L072Z-LRWAN1 Discovery kit is designed around the CMWX1ZZABZ-091 module from Murata. *Figure 2* illustrates the connections between the CMWX1ZZABZ-091 and its peripherals (STLINK/V2, push-button, LEDs, USB and connectors).

Figure 2. Hardware block diagram



2 Firmware demonstration

2.1 Factory default firmware

The demonstration software is preloaded in the STM32 Flash memory in factory.

This example requires two B-L072Z-LRWAN1 kits. This demonstration consists in establishing a simple Rx/Tx RF link between the two LoRa® objects.

By default the boards are blinking their LEDs (LED1, LED2, LED3 and LED4). Each LoRa® object starts as a master and transmits a "Ping" message, then each of them waits for an answer. The first LoRa® object receiving a "Ping" message becomes a slave and answers the master with a "Pong" message, which starts the ping-pong game between them. The master then blinks only the red LED (LED4) and the slave blinks only the blue LED (LED3).

Both kits output information about their activity on a serial COM port with the following configuration:

- Baud rate: 115200 bauds
- Data: 8 bit
- Parity: none
- Stop: 1 bit
- Flow control: none

The respective output of the kits looks like the following:

on Ping side (master)

txDone

OnRxDone

RssiValue=-15 dBm, SnrValue=26

rxDone

...PING

OnTxDone

txDone

OnRxDone

RssiValue=-15 dBm, SnrValue=27

rxDone

...PING

OnTxDone

txDone

OnRxDone

on Pong side (slave)

OnTxDone

txDone

OnRxDone

RssiValue=-14 dBm, SnrValue=27

rxDone

...PONG

OnTxDone

txDone

OnRxDone

RssiValue=-14 dBm, SnrValue=27

rxDone

...PONG

OnTxDone

txDone

OnRxDone

2.2 I-CUBE-LRWAN

The demonstration firmware provided with the B-L072Z-LRWAN1 Discovery kit is the PingPong example from the I-CUBE-LRWAN package.

Other examples are provided inside the I-CUBE-LRWAN expansion package. The middelware stack (I-CUBE-LRWAN) enables the user to easily develop LoRa® applications. It offers a set of dedicated APIs and configuration templates to build end-devices (LoRa® objects) able to join a LoRa® network and to communicate through LoRa® technology. For more details refer to the "*STM32 LoRa® software expansion for STM32Cube*" User manual (UM2073) at the *www.st.com* website.

3 Revision history

Table 1. Document revision history

Date	Revision	Changes
27-Jan-2017	1	Initial release.