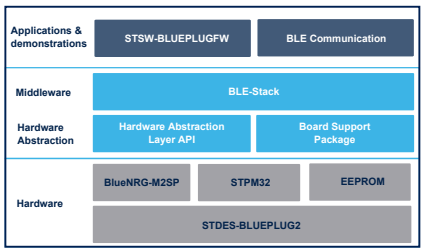
STSW-BLUEPLUGFW

Data brief

Firmware for the STDES-BLUEPLUG2 reference design



Features

- Wireless connectivity over BLE
- Zero cross detection
- Dimming using TRIAC
- Android application (ST BLE PLUG available on Google Play) to:
  - measure energy parameters (metering)
  - set the time to put the load ON or OFF (scheduling)
- NFC interface to configure the design and store the logs (RFU)
- Source code freely available with developer-friendly license terms

Description

STSW-BLUEPLUGFW software enables STDES-BLUEPLUG2 reference design to measure and control electrical devices plugged in via a standard outlet.

The embedded STPM32 measures the electrical parameters and sends them to the BLUENRG-M2SP module over USART.

The BLUENRG-M2SP transmits the data received via Bluetooth to the ST BLE PLUG Android app to display them on the metering panel.

The app can be used to turn the load ON/OFF, as well as for scheduling, dimming features and metering parameters.

Product summary	
Firmware for the STDES-BLUEPLUG2 reference design	STSW-BLUEPLUGFW
Smart plug reference design based on BlueNRG-M2SP	STDES-BLUEPLUG2
Very low power application processor module for Bluetooth® low energy v5.2	BLUENRG-M2SP
Applications	Wireless Connectivity Smart Home

1 Detailed description

State Machine

The State Machine describes the flow of the operations running in the program. Here, the state machine routine is divided into three parts:

1. Initialization and configuration of the peripherals
2. Metering data and BLE Stack Tick
3. Interrupt routine

Peripheral Initialization

It is related to the initialization of:

- System
- BLUENRG-M2SP platform
- GPIO pins
- STPM32
- RTC timer
- BLE Profiles Initialization:
  - MAC, GAP Role - Device is in Peripheral Role, GATT-Device is in Server mode
- Services
  - One service with two characteristics
    - Notification is used to send metering data to Android app
    - Write characteristics to get commands form the Android app
- Authentication
  - Use for Device Bonding
  - TX Power Set to set the output power level

Metering data and BLE Stack Tick

The BLE Stack Tick function executes the processing of all Host Stack layers. This function has to be executed regularly to process incoming Link Layer packets and Host Layers procedures. The function is followed by the App tick, which connects the app to the firmware and runs the application state machine.

If the app is connected to the BLUENRG-M2SP, every second the following functions are executed:

- retrieval of the metering data, such as energy parameters, voltage and current from STPM32, and their processing for the app panel
- arrangement of the data in packets and related transmission to the ST BLE PLUG Android application via Bluetooth

Interrupt routines

Two interrupts are used in the program:

- ZCR interrupt: zero crossing rate defines the rate at which the signal crosses zero signal level, from positive to negative or back. Here ZCR triggers an interrupt routine in which the firing of the TRIAC for load dimming is managed according to the user settings
- Manual mode: a user button is provided on the board to turn the load ON/OFF. This can be helpful when the user does not have the app. By pressing the button once, the load will turn ON at 100% intensity or turn OFF.

Figure 1. **State machine description**

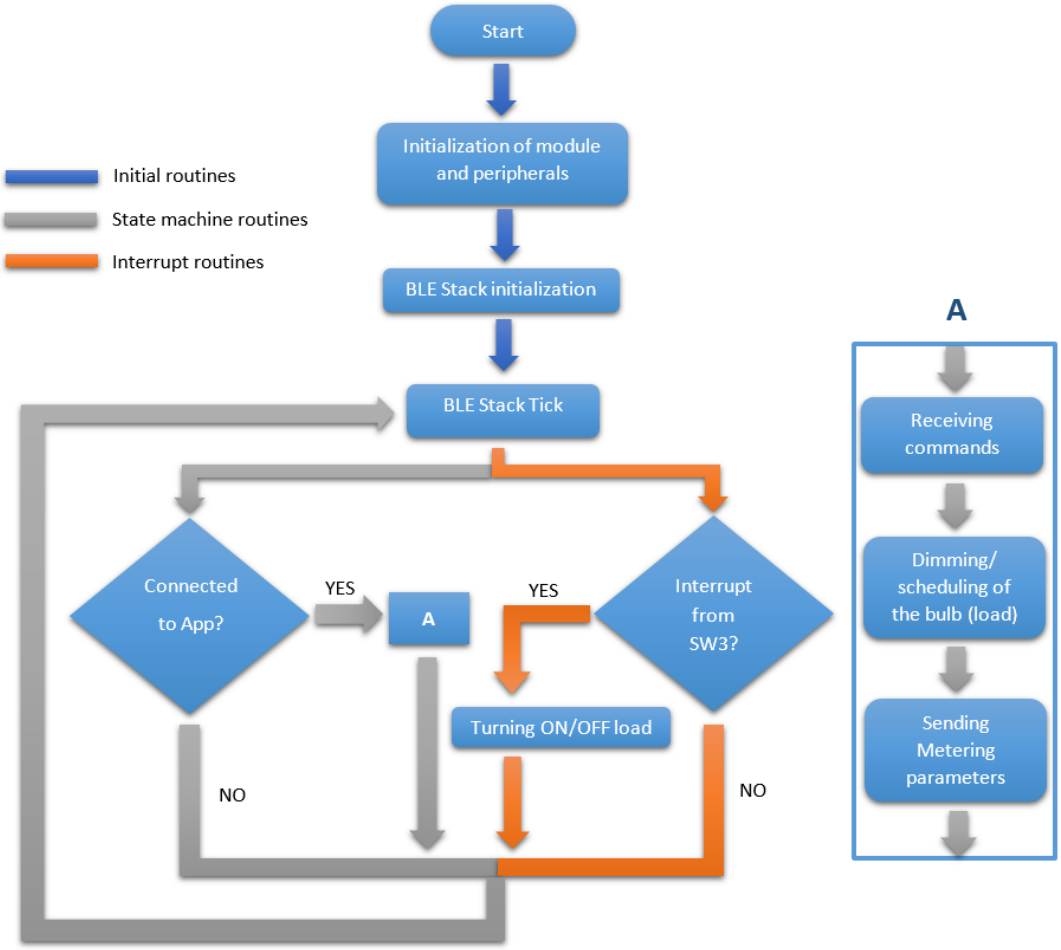
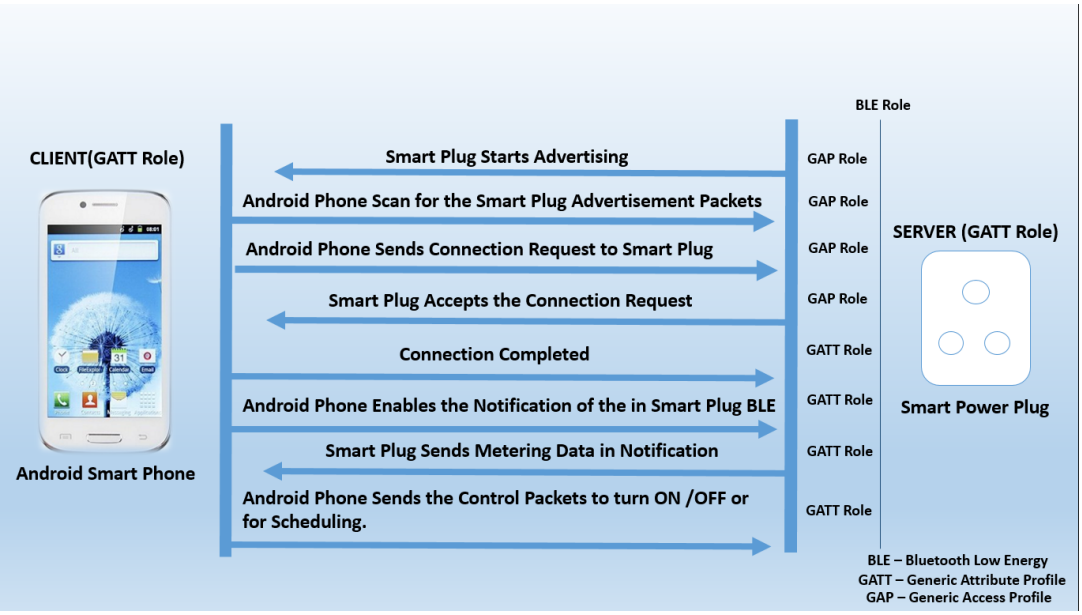


Figure 2. **Functioning principle**



Revision history

Table 1. **Document revision history**

Date	Revision	Changes
17-May-2021	1	Initial release.