2.5W wireless charger transmitter evaluation board deconfiguration guide for 1-watt wearable applications

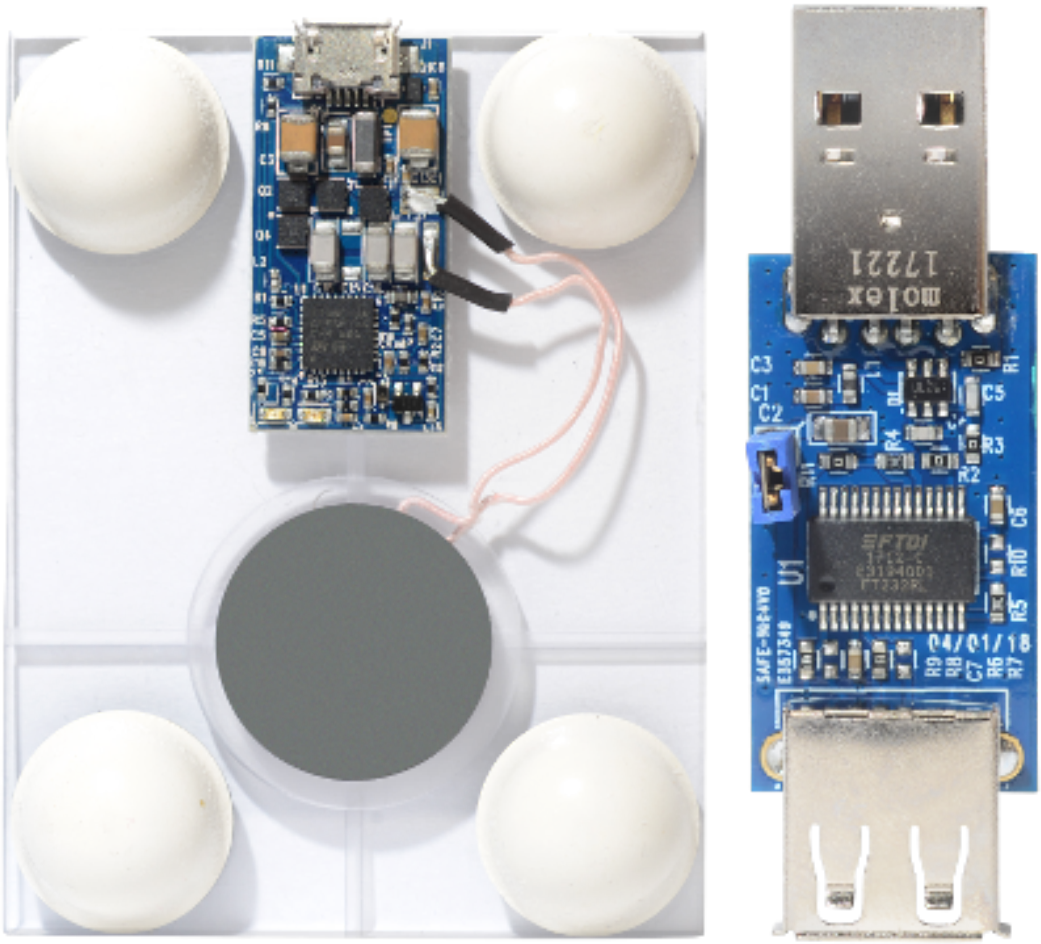
Introduction

The STEVAL-ISB045V1 evaluation kit includes the STEVAL-ISB045V1T wireless battery charger transmitter evaluation board based on the STWBC-WA digital controller, firmware and the STEVAL-WBCDNGV1 USB-to-UART dongle needed to use the STSW-STWBCGUI.

The STSW-ISB045FW firmware lets you modify LED and GPIO behavior, and customize I²C and UART signals. The layout is based on a cost-effective two-layer PCB.

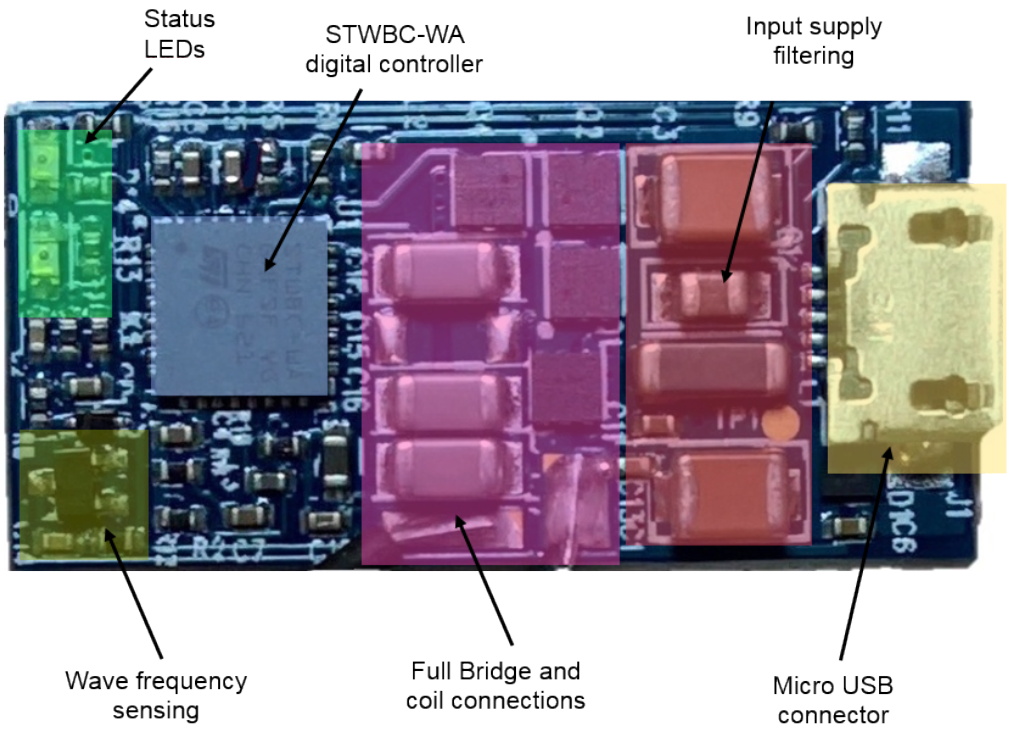
The ST website has tools for the STEVAL-ISB045V1 evaluation kit that allow you to access run time information such as regulation error, frequency and protocol status.

Figure 1. STEVAL-ISB045V1 evaluation board



1 Hardware architecture

Figure 2. **Transmitter board components with STWBC-WA controller**

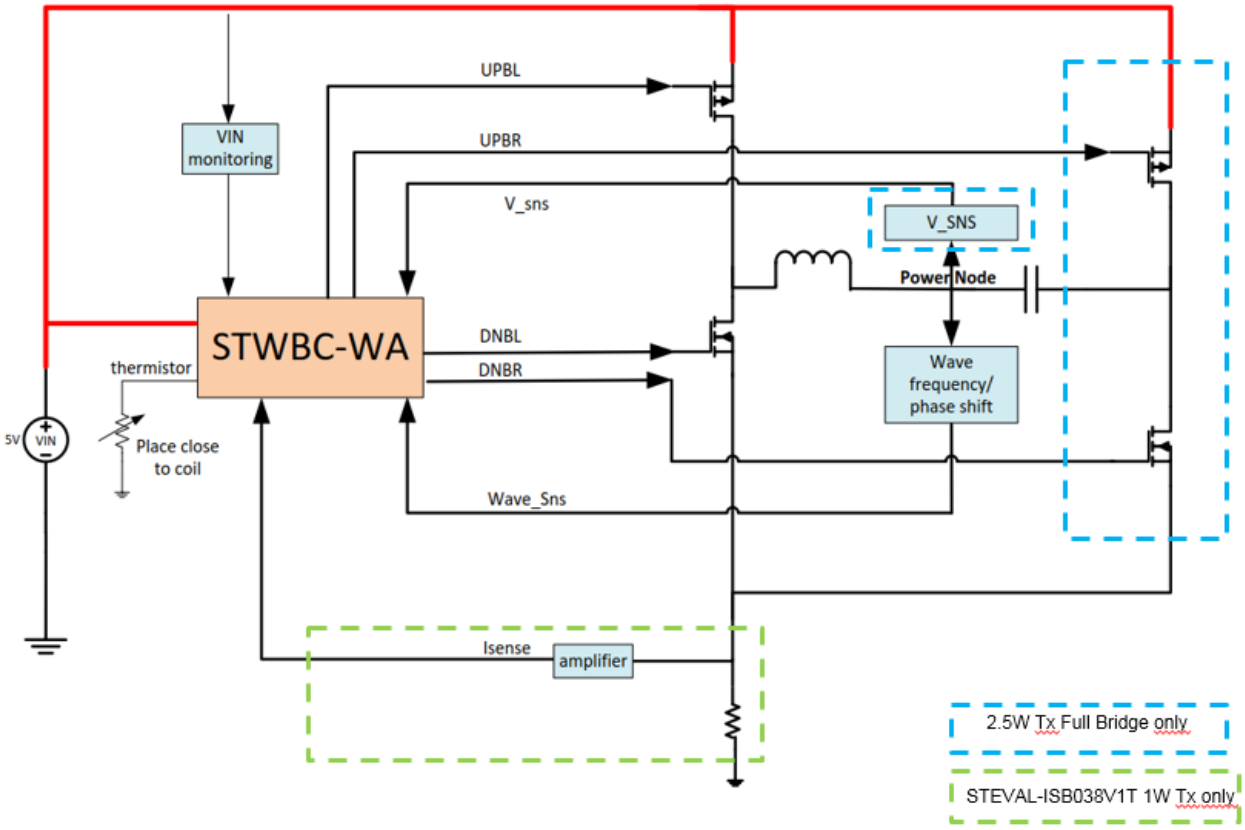


1.1 STWBC-WA wearable application architecture

1.2 Optimized architecture for 1-watt applications

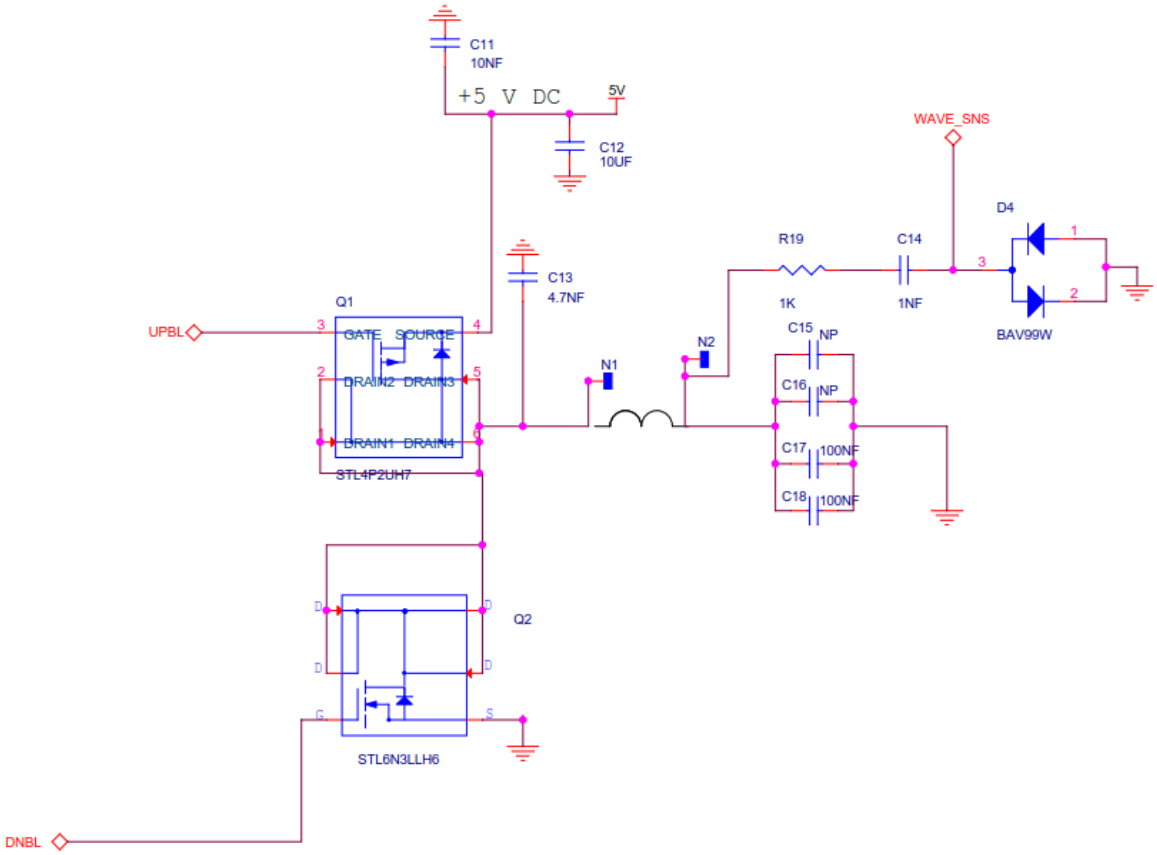
The following diagram shows a typical schematic for wearable applications.

Figure 3. **Wearable application block diagram**



We can modify the system to around 1 watt for low power applications by using only a half bridge and no current sense circuitry.

Figure 4. **Optimized 1-watt bridge schematics**

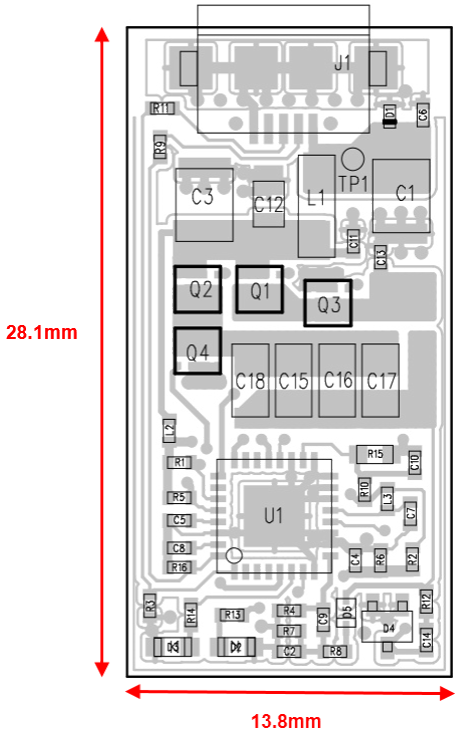


2 How to modify the STEVAL-ISB045V1T transmitter board hardware for 1 watt

Follow the steps below to transform the STEVAL-ISB045V1T transmitter board into 1 watt:

Step 1. Remove the Power MOSFETS Q2 and Q4 on the right side of the bridge.

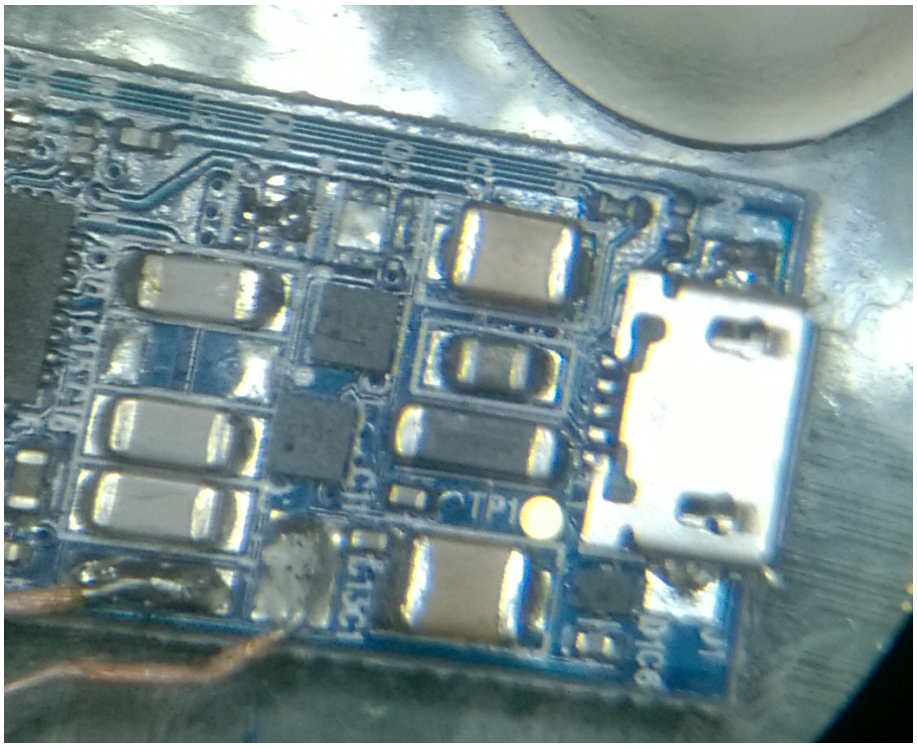
Figure 5. Board top with the MOSFETS Q2 and Q4 to remove



Step 2. Swap C16 with a 47 nF COG 1206.

Step 3. Solder a 0-ohm resistor on the footprint of Q4.
This provides a good GND connection on the right side of the capacitors

Figure 6. Zoom with 0-ohm resistor added on Q4

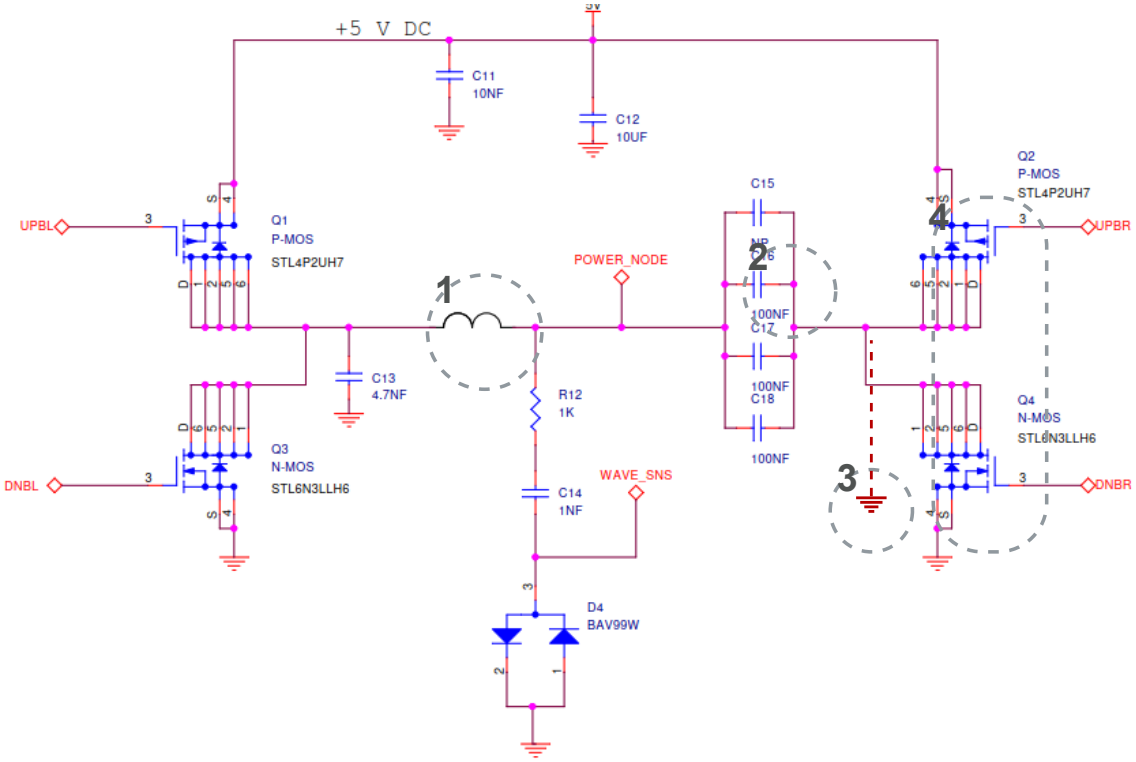


Step 4. Change the transmitter coil to match the Rx coil size.
We recommend the WT151512-22F from TDK or MQQTC151520S6R3 from Sunlord.

Note: Capacitor tuning can be adjusted according to the coil choice. Bridge frequency parameters can also be adjusted.

Figure 7. Schematic with changes for a 1-watt system

1. Wireless charging Coil to change
2. C16 capacitor to change from 100nF to 47nF COG 1206
3. Good GND connection to connect to tank capacitors
4. MOS to remove for half bridge configuration



3 How to update the STWBC-WA firmware

You must modify the STEVAL-ISB045V1T transmitter board hardware to use the updated STSW-ISB045FW firmware for 1 watt applications.

You can download the STSW-ISB045FW firmware with the STSW-STWBCGUI software package.

3.1 Download procedure

To download the firmware to the board, install the GUI software which allows complete board monitoring via UART signals. To use the STSW-STWBCGUI, UART signals must therefore be accessible.

3.2 How to download the STWBC-WA firmware with the STWBC GUI

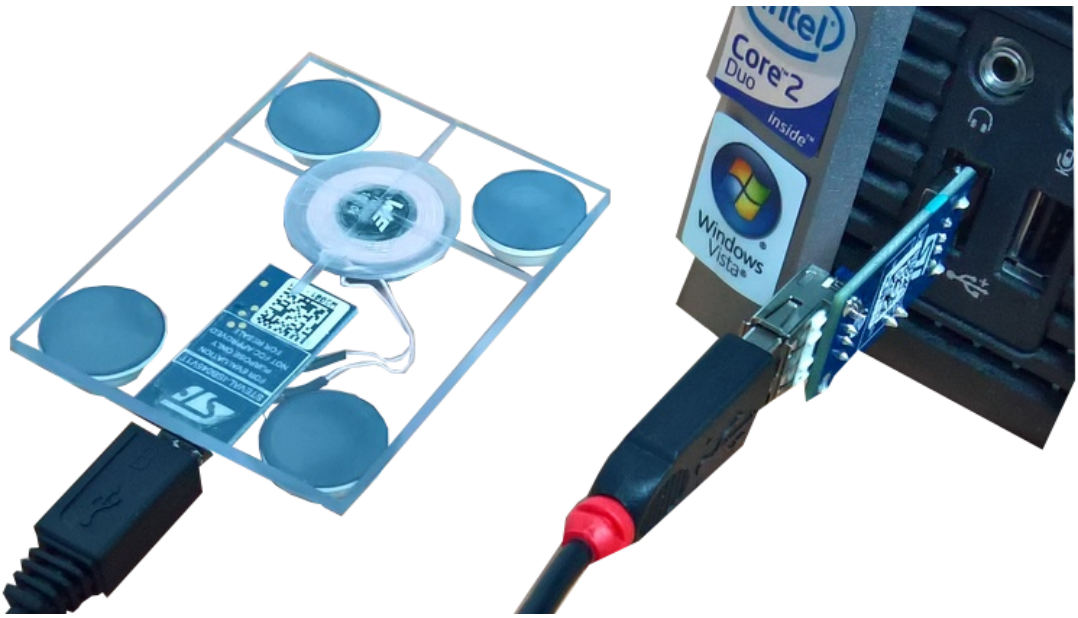
This section assumes that you have updated the firmware for your new application and are ready to download the new firmware onto the STWBC-WA controller.

you can use the STSW-STWBCGUI GUI to download the firmware onto the STWBC-WA controller via UART. The firmware is a cab file which contains 3 files.

Step 1. The UART RX/TX signals of the STWBC-WA are accessible on the micro-USB connector of the transmitter board (muxed respectively on USB_DP and USB_DM)

Step 2. Connect the USB to UART dongle to the transmitter board.
The transmitter board is powered through the USB dongle.

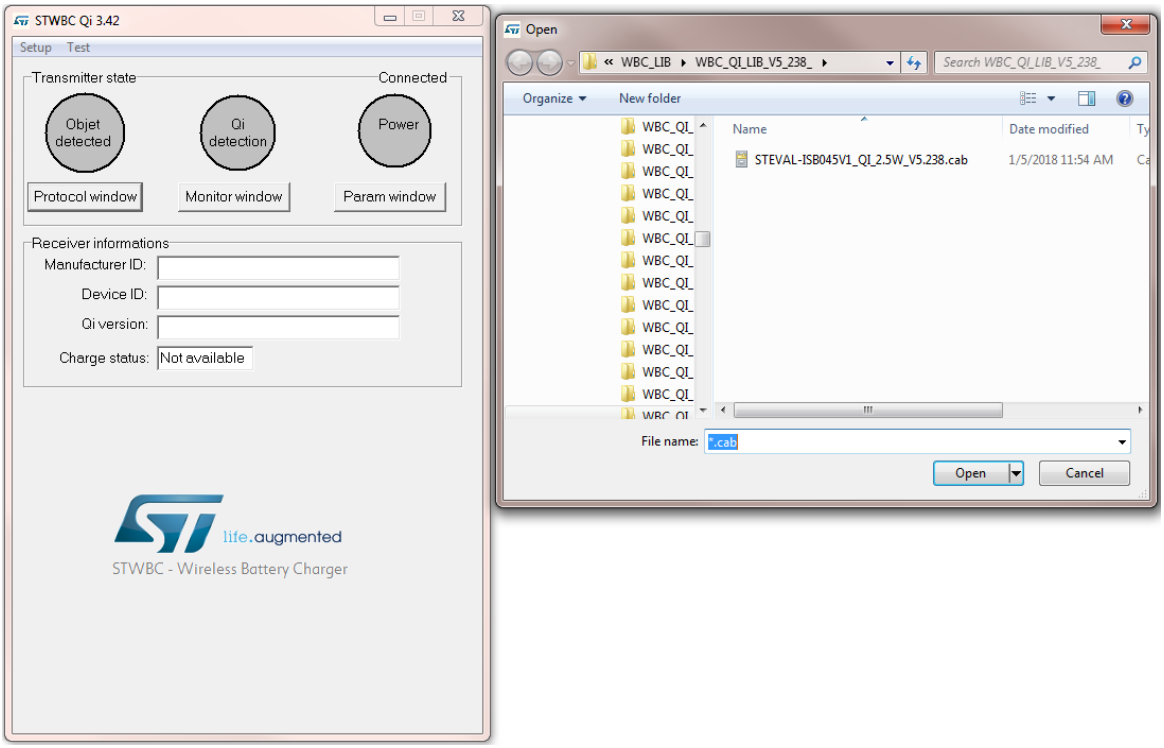
Figure 8. Dongle and transmitter board connections



Step 3. In the GUI, select [**Setup**]>[**Load FW to board**].

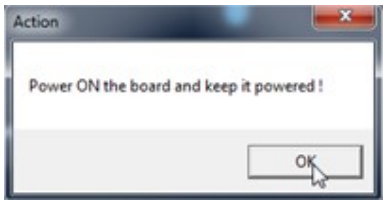
Step 4. Select the CAB file containing the firmware to download.

Figure 9. Firmware file selection



Step 5. Make sure the baord remains powered.

Figure 10. Power ON prompt



Step 6. Select [**OK**].

Step 7. Follow the download progress in the DOS window and power the board off when prompted.

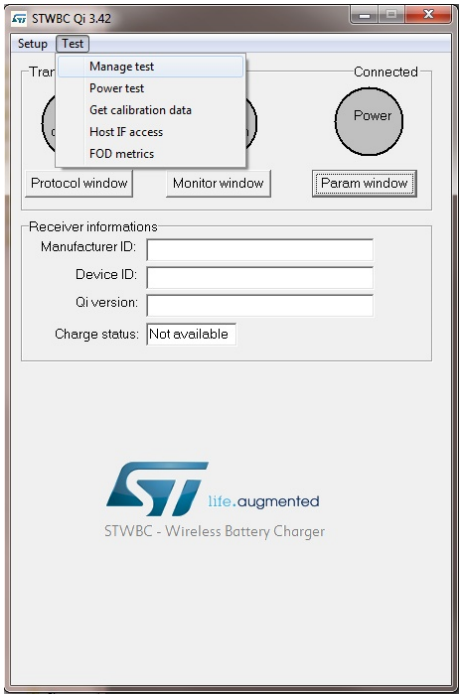
Figure 11. Download success message

3.3 How to recalibrate the board after a firmware update

It is very important to recalibrate the transmitter board after each firmware download to ensure reliable detection of the receiver when it is placed on the transmitter. Perform the calibration once after each new firmware download without a receiver placed on the transmitter.

Step 1. In the GUI, go to [**Test**]>[**Manage test**].

Figure 12. Test menu



Step 2. In the Test window, put “1” in the [**Test number**] field and click [**Start**].

Figure 13. Presence detection test

Once calibration is finished, “Test done” appears next to the [**Status**] field.

3.4 How to check and adjust bridge configuration

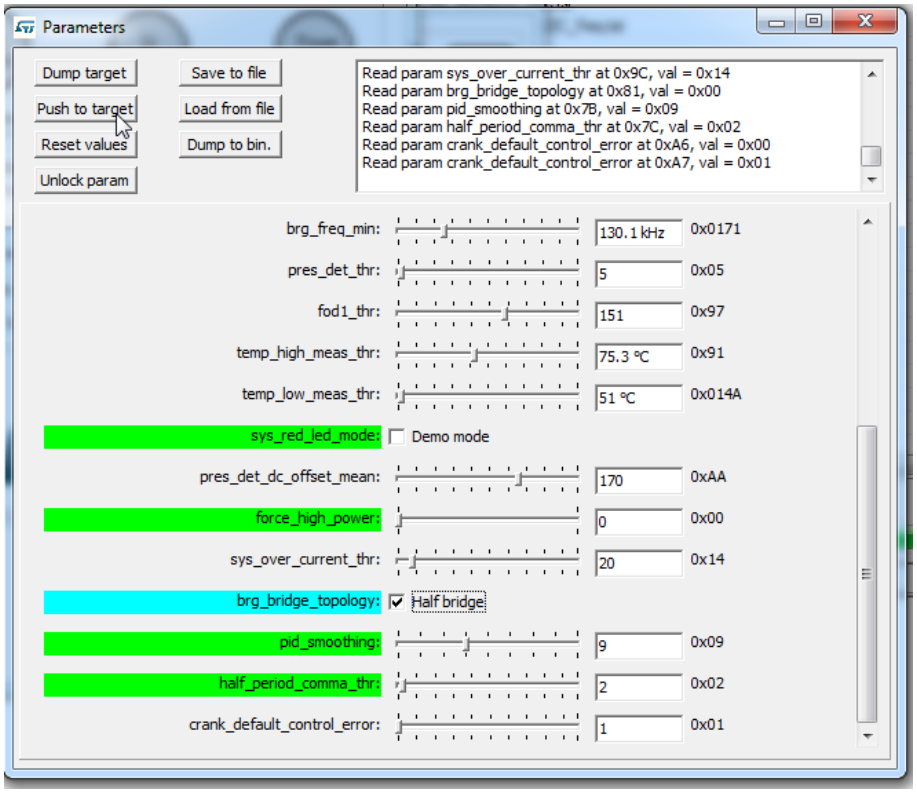
The first parameter to check after the firmware download is the bridge topology. This can be done in the STWBC GUI with the [**param window**] button.

Step 1. Ensure the [**brg_bridge_topology**] check box for Half bridge mode is selected.

This setting is necessary for the 1 watt configuration.

Step 2. If the check box is not selected, tick the box and save it into STWBC memory byb pressing the [**Push to target**] button.

Figure 14. STWBC GUI bridge configuration check

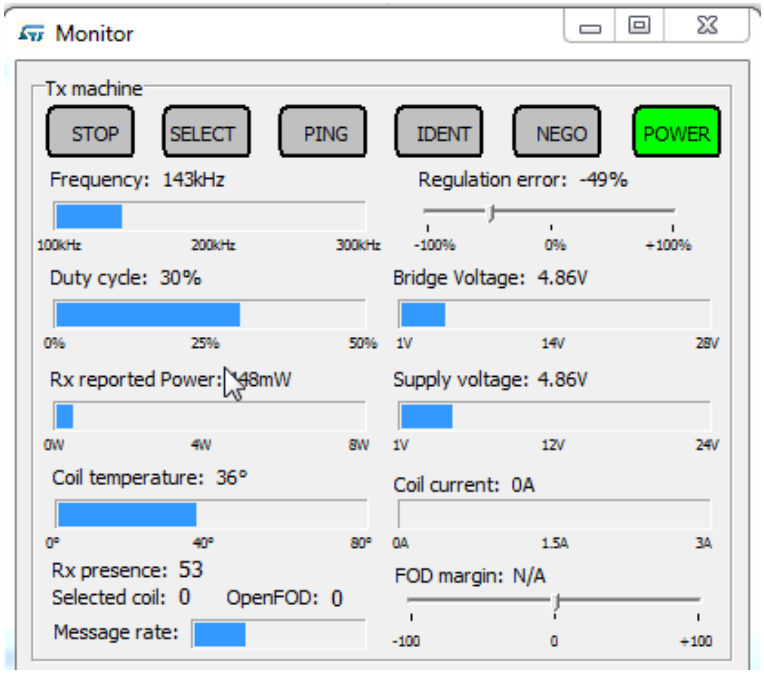


Step 3. Perform your initial testing with a receiver, and check the [**Regulation error**] and [**Duty cycle**] parameters in the Monitor window.

If the regulation error diverges too far from zero and the duty cycle rises up to 30%, the bridge frequency settings are not correct.

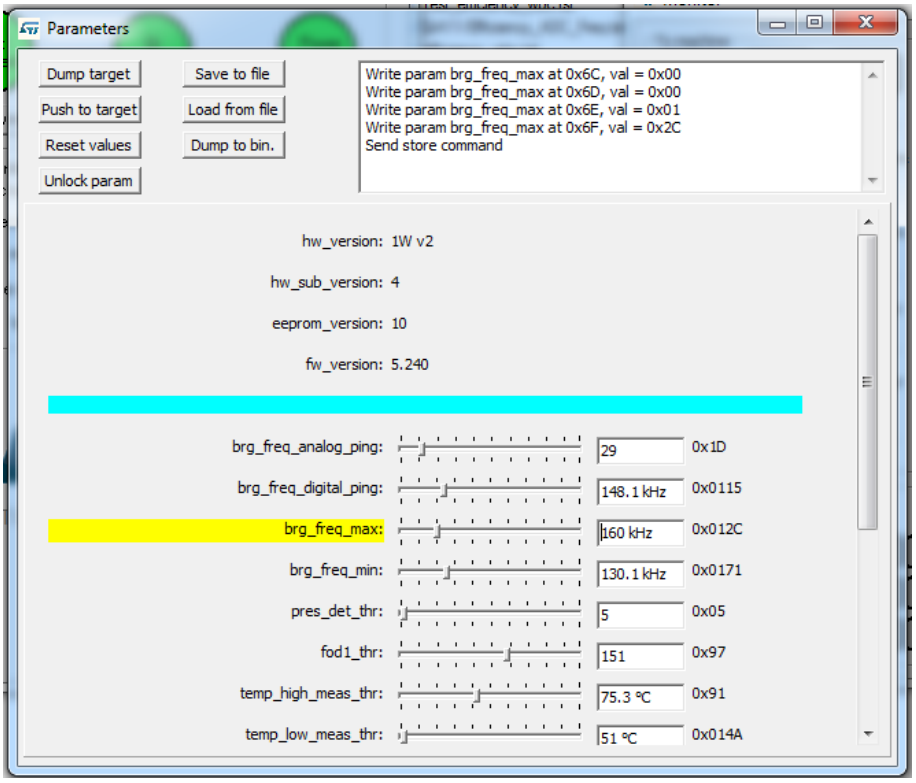
In this case, the max bridge frequency setting should be increased in the STWBC GUI.

Figure 15. **Regulation error and Duty Cycle parameters**



Step 4. In the Parameters window, increase the maximum bridge frequency in the [**brg_freq_max**] window. In the figure below, the max bridge frequency is increased to 160 Khz (for illustrative purposes)

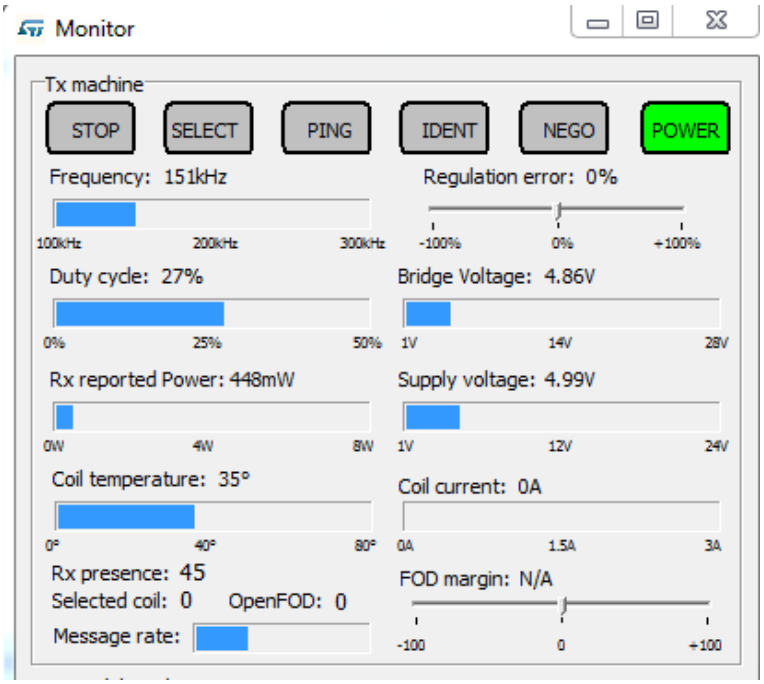
Figure 16. **Maximum bridge frequency parameter**



Step 5. To save the value in STWBC memory, click on the [**Push to target**] button.

Step 6. Review the Monitor window to check that the error converges to 0%, which is the target for appropriate power control.

Figure 17. **Monitor window with ideal Regulation error**



A References

Freely available at www.st.com:

1. Datasheet (DS11797): STWBC-WA – Digital controller for wireless battery charger transmitters for wearable and smartwatch applications.
2. Databrief (DB3531): STEVAL-ISB045V1 - 2.5 W wireless charger transmitter evaluation kit
3. User manual (UM2368): STWBC 2.5 W turnkey firmware description
4. Databrief (DB3410): STSW-STWBCFWDT - STWBC firmware downloader tool

Revision history

Table 1. **Document revision history**

Date	Version	Changes
06-Sep-2018	1	Initial release.

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