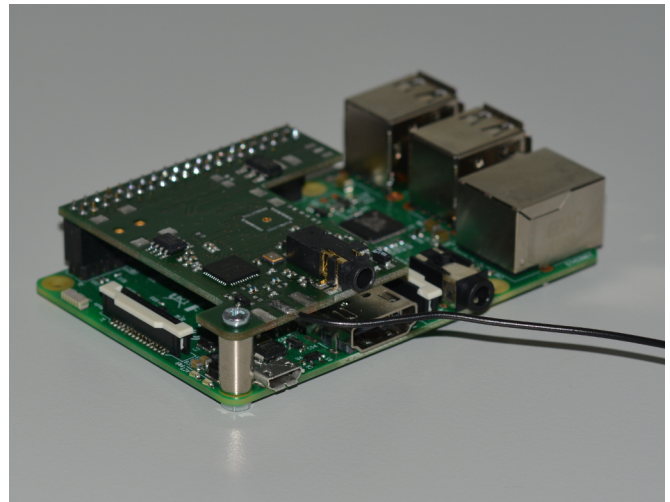# uGreen DAB Board Instructions v0.12

1   Introduction

This document describes
- the DAB Board features
- possible modifications on the pin-out layout
- the software for a terminal based radio
- document version history

2   Feature Description

- Silicon Labs Si4688 DAB and FM radio receiver with worldwide FM band support, RDS/RBDS decoder, HD-radio support, DAB/DAB+ support
- High-quality Texas Instruments 3-channel headphone amplifier connected to a 3.5 mm audio out.
- The 40 pin connector fits the Raspberry Pi 1 B+, Pi 2 B and Pi 3 boards and the board can be fixed to the Raspberry Pi with an additional screw. The Si4688 can be programmed using the SPI bus.
- The SPI chip select pins can be configured and the board is I2S output ready.
- Silicon Labs Firmware is supplied in the on-board flash storage.
- The terminal software for Raspbian and Linux operation systems allows easy remote control of the DAB Board, for example through a ssh connection. It supports automatic station scanning and station list storage and fast station selection and volume control.

3   Electronic configuration

The board features 7 bridges which can be closed/opened by soldering. This way, chip select pins for the Si468x and the serial flash memory can be moved to a different pin of the Raspberry Pi, which allows to connect several other third party components to the SPI bus. By default, the Si468x is connected to SPI0 (chip select CE0, Raspberry Pi physical pin 24) and the serial flash to SPI1 (chip select CE1, Raspberry Pi physical pin 26).

The I2S interface has to be enabled by soldering two bridges on the DAB Board. Then the physical pins 12, 35, 38/40 correspond to the DCLK, DFS and DOUT pins of the Si468x. If I2S is enabled in the Raspberry Pi operation system's kernel, I2S output from the Si468x can be recorded and playback is possible using the Raspberry Pi audio out connector as well.

Physical pin 16 is reserved for the RSTB pin of the Si468x and cannot be used for other purposes. If this pin is driven low, the Si468x is reset. If the pin is high, any voltage fluctuations on the power inputs of the Si468x must be avoided, otherwise this can result in permanent damage of the Si468x.

Pin 22 is reserved for the INTB of the Si468x.

The board requires the Raspberry Pi 5V and 3.3V power supplies.

Pin description

Table 1 shows a summary of the pin configuration.

Table 1

Raspberry Pi physical pin	Function	Possible configurations
1	3.3 V	
2	5 V	
12	Si468x DCLK	
16	Si468x RSTB	
19	Si468x/Flash MOSI	
21	Si468x/Flash MISO	
22	Si468x INTB	
23	Si468x/Flash SCLK	
24	Si468x chip select	If A1 is closed (default)
26	Flash chip select	If B1 is closed (default)
28	Si468x chip select	If A2 is closed
32	Flash chip select	If B2 is closed
35	Si468x DFS	If C is closed
38	Si468x DOUT	If D1 is closed
40	Si468x DOUT	If D2 is closed

Soldering Bridges

Figure 2 shows the soldering bridges and pin-out.

Figure 2
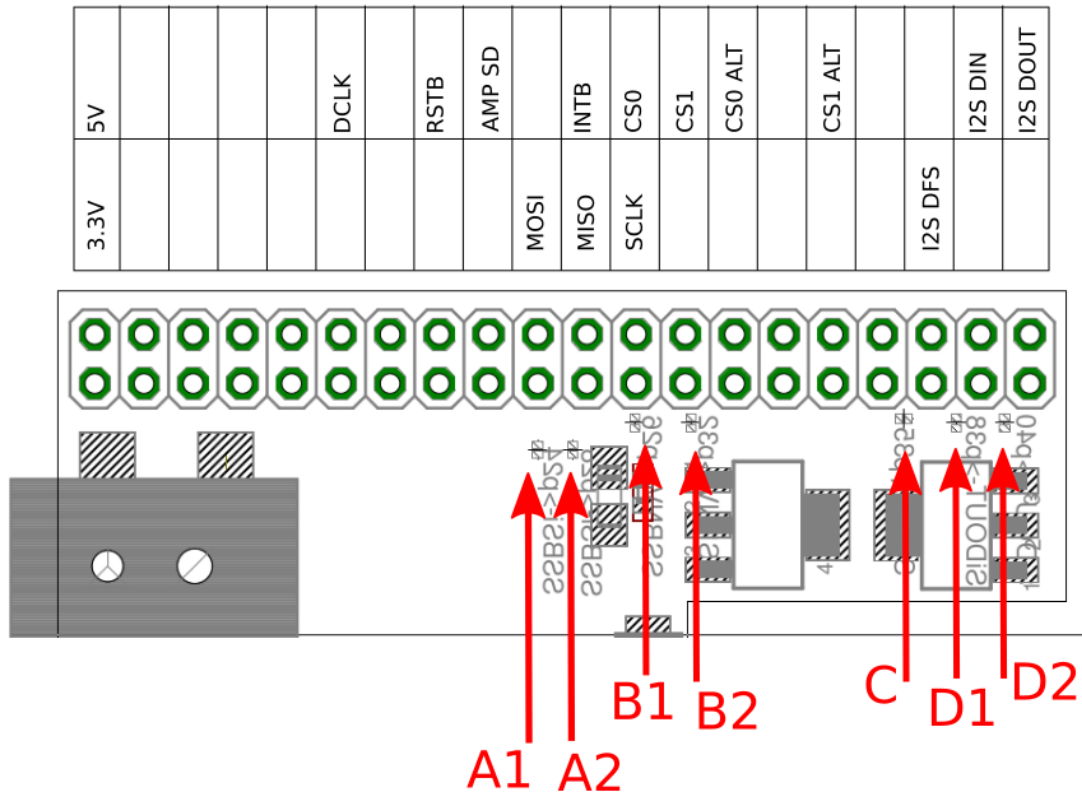
Important Remarks

- The board is not for plug & play – only connect to the Raspberry Pi when both are unplugged. Otherwise the headphone amplifier can boot in a faulty state.
- The Si468x features a RSTB which needs to be held low while supply voltage levels are not stable. Otherwise, the Si468x can be damaged. This is especially important if an application that holds RSTB high does not terminate correctly, without lowering RSTB again, while the board is unplugged.
- I2S functionality is supported by the board, but bridge C and D1 need to be connected and the Linux kernel needs an appropriate module.
- The board needs SPI to be enabled: type "sudo raspi-config" in a console and choose "Advanced Options" and enable "SPI". The board not only requires SPI, but also general GPIO ports to set the RSTB pin, therefore any software to access the board needs root privileges.

DC characteristics

Table 3 shows the DC characteristics of the board

Table 3

Parameter	Symbol	Test Condition	Min	Max	Unit
I total	I_T	Seperate 5V supply		60.9	mA
P total	P_T	Seperate 5V supply		296.0	mW
Supply Voltage 1	$I_{3.3}$		2.7	3.6	V
Supply Voltage 2	I_5		2.1	6.0	V
High Level Input Voltage	V_{IH}		2.3		V
Low Level Input Voltage	V_{IL}			1.0	V
High Level Output Voltage	V_{OH}		2.7		V
Low Level Output Voltage	V_{OL}			0.7	V

4   Terminal Software

There is a proprietary software available as a terminal program which offers simple radio functionality – upload of the firmware, automated station scanning and station selection. For the software, please contact dabboard@ugreen.eu. The software requires the DAB board to be run and is available under proprietary license only. Copy, change and distribution of the software is not allowed, however, the software and any future updates are freely available for customers of the Raspberry Pi DAB Board. If you obtained a copy of the software not directly from uGreen AG, please contact dabboard@ugreen.eu. The Raspberry Pi DAB Board can be run with any other suiting 3rd party software as well.

The software was tested and developed for the Raspbian operating system. On the first start the software will perform an automatic frequency scan which will take up to a minute. After that, the main program will start (see picture) and list all available DAB stations. Use the arrow keys to navigate through the stations, enter to select a station for playing, x to quit, q/w to decrease/increase the volume and ctrl+c to return to the terminal with the radio left on.
The software stores the station list to a file (do not change that), so at the next start, the main program will start automatically and no station scan is performed. To do a station scan again (because the Raspberry Pi was moved to another place with different stations available), select Rescan from the main menu. The stations shown contain also non-audio, pure data stations, such as TPEG services. Playing these do not lead to an audio signal.

The software has to be run with root privileges to allow access to the GPIO pins of the Raspberry Pi.

DAB Board

Start of the software is done by "sudo ./DABBoardRadio". Optionally, a service ID of a station can be given as a command line argument to start the radio and automatically start playing a specific station. The available service IDs can be read off from the stationlist.txt file after a station scan has been performed. To run the radio with a service ID argument, use the command "sudo ./DABBoardRadio -S 12345", where 12345 is an example of a service ID.
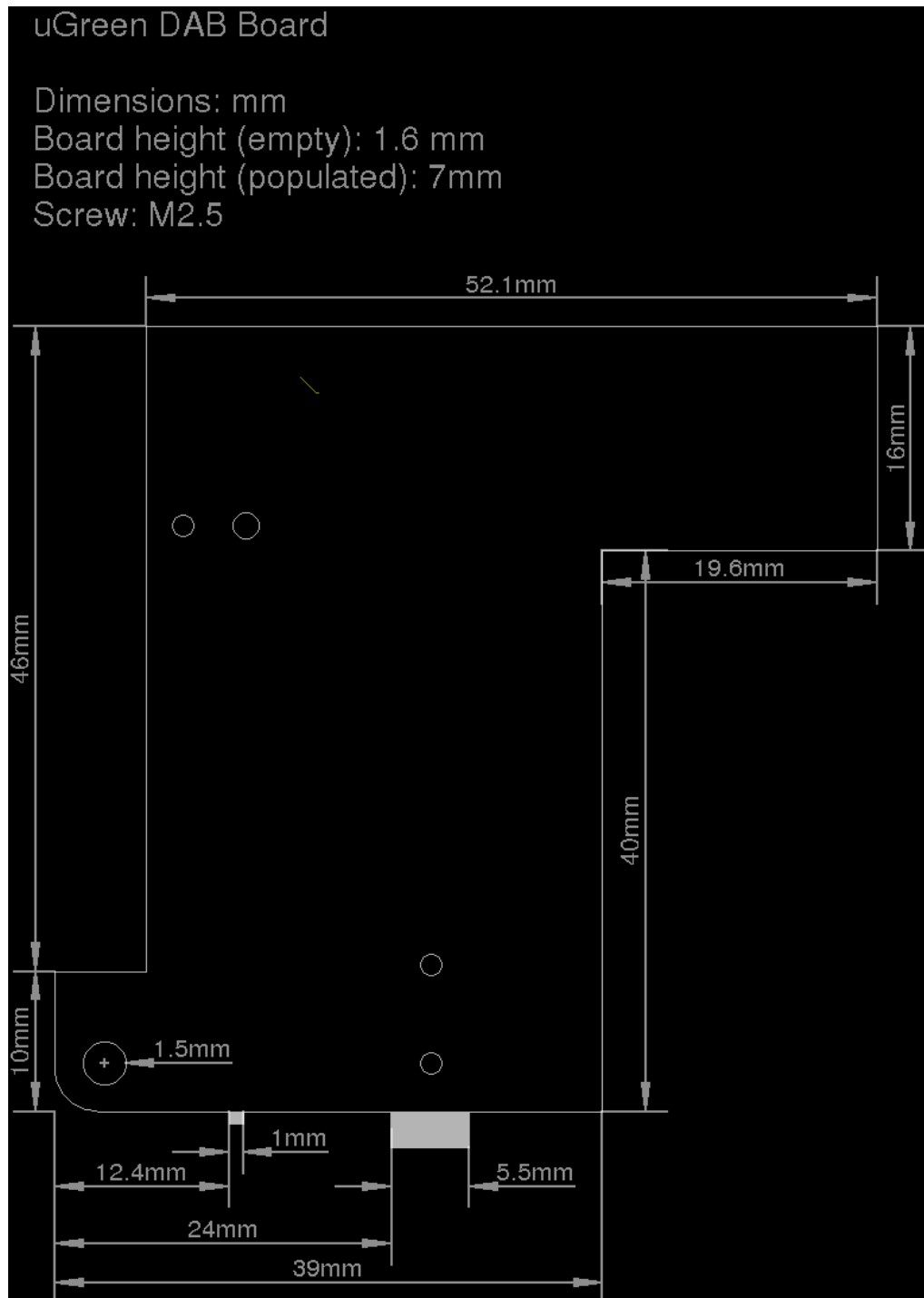
Figure 4
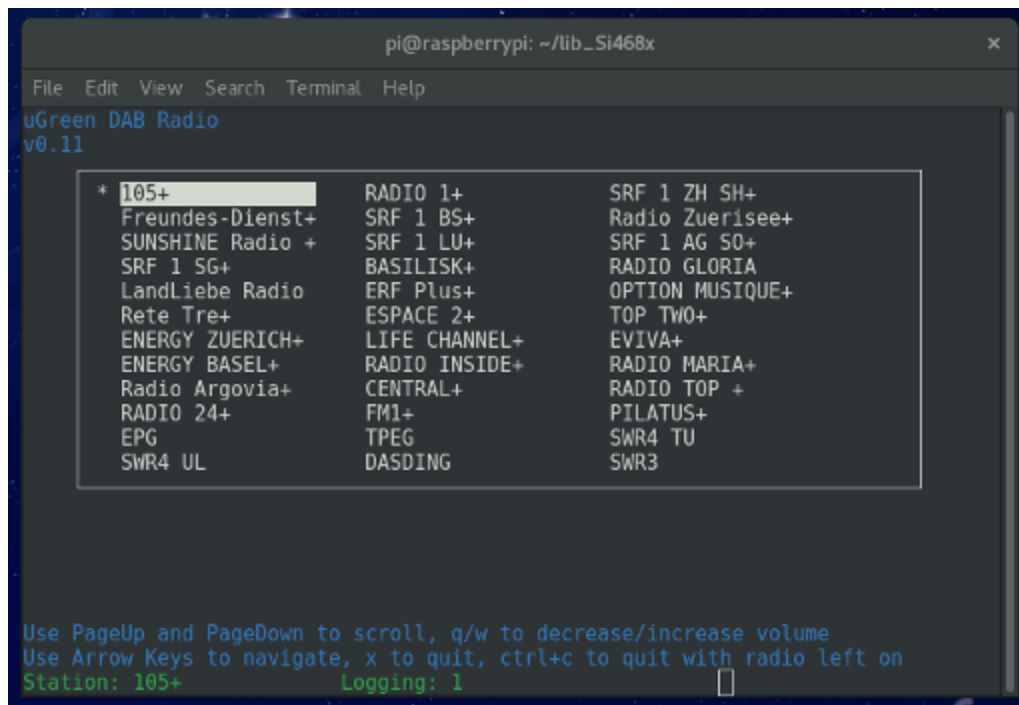
5   Board Dimensions

Figure 5 shows the board dimensions. The 1 mm wide area represents space needed for the antenna cable, the 5.5 mm wide area space for the 3.5 mm phone connector.

Figure 5

6   Document Version History

Revision v0.12

- Update of product picture.

Revision v0.11

- Added Figure 5 and board dimensions
- Added DC characteristics
- Added note on the start with station functionality of the software
- Updated function and pin description

Revision v0.1

- Non-production version

7 Contact Information

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