USB-Connect
Operating Description
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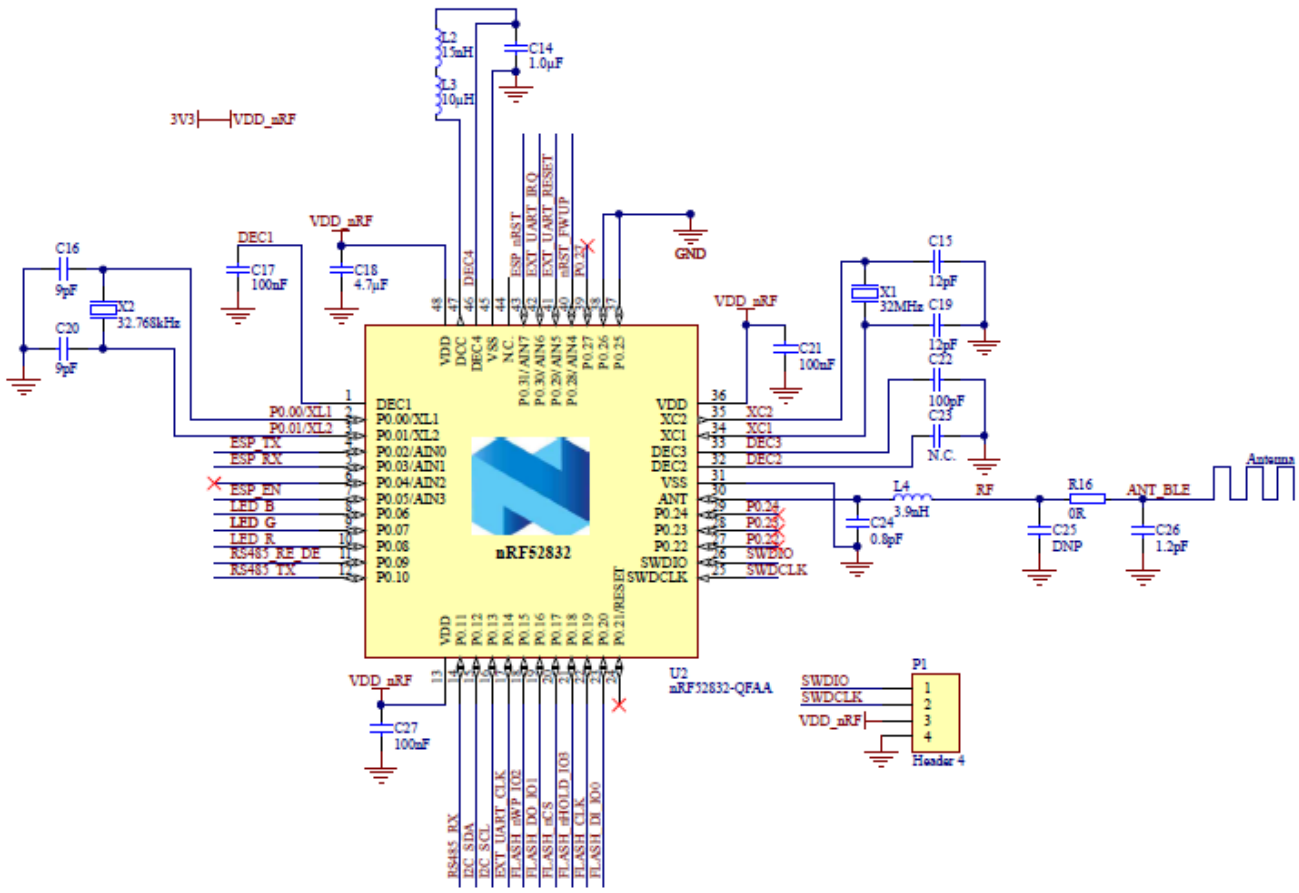
Overview

The Connected Service Tool (CST) is a device intended for use by qualified technicians to monitor, troubleshoot, and upgrade water boilers distributed by US Boiler. Capable of communicating either over BLE, the device can pair with a mobile phone app to relay information both directly to the technician and to the cloud using the phones cellular connection.

Theory of Operation

- Functional components of the device include: a single-board computer with integrated BLE radio.
- Depending on the boiler type the CST is to be connected to, the device will either draw power from the boiler itself via either an RJ12 or RJ45 connection, as the boilers are capable of supplying 24V AC, or 24V DC on these interfaces depending on the model.
- The CST use case: The device is used as a BLE service tool, in which case the device is connected to a boiler and communicates information about the boiler to the user's phone for visualization within an application. The device may be left attached to the boiler to collect data over a long period of time.

Figure 1



Antenna and Grounding

The USB-Connect Connected Service Tool utilizes a Nordic nRF52832 semiconductor to manage Bluetooth communication. The antenna is connected to the chip at the ANT connection. Antenna is a board trace that is integral with the board. No external antenna is used. Chip is installed on a grounding pad that is connected to terminal VSS. Terminal VSS is connected to ground. When device is in use, USB-Connect ground is connected to boiler's earth ground. Refer to figure 1 for more information.

Specifications:

Bluetooth frequency band:	v4.0, 2400 to 2483 MHz.
Modulation type:	GFSK,
Data Rate Speed:	1 Mbps,
Antenna Type:	trace drawn on the PCB
Crystal Frequency:	32 MHz
Antenna Gain:	See Table A below.

Frequency [MHz]	Antenna Efficiency [%]	Antenna Peak Gain [dBi]
2400	14.0	-2.0
2405	13.7	-2.1
2410	13.8	-2.2
2415	13.6	-2.5
2420	13.0	-2.7
2425	13.3	-2.9
2430	13.3	-2.7
2435	13.9	-2.7
2440	13.8	-3.0
2445	13.3	-3.3
2450	13.6	-3.5
2455	13.1	-3.7
2460	12.9	-4.0
2465	13.0	-4.2
2470	12.0	-4.5
2475	12.2	-4.5
2480	11.5	-4.7
2485	11.1	-4.9
2490	11.2	-4.6
2495	10.8	-4.8
2500	11.0	-4.6

Table A

Antenna Gain