DALLAS RANGEMASTER NOISE REDUCTION
BUILD INSTRUCTIONS AND SIMULATION INFORMATION

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I recently did an in-depth analysis of the Dallas Rangemaster to determine why it was so susceptible to noise on the power line such as that from poor quality wall wart type power supplies. I published these results on the some guitar pedal builders groups on Facebook.

My conclusion was that a small change to the circuit consisting of two resistors and one capacitor would reduce the noise significantly while still preserving the unique audio characteristics if the circuit. The changes also allow it to run with a negative ground supply and make it suitable for use with daisy-chained pedal board supplies.

Under simulated conditions with 200mV peak to peak 100Hz ripple on the power line with the output measured at the half voltage setting of the output potentiometer this modification reduced the output noise from the circuit from 75mV to 400uV, that is an improvement by a factor of just under 200.

Since completing the work on the simulation and design change to reduce the Rangemaster's noise, I have designed a printed circuit board that allows the circuit to be built with the initial noise reduction modifications. The PCB also supports further standard modifications such as switchable input capacitors for changing the frequency response characteristics and changes to remove the DC content from the output potentiometer to minimise noise when adjusting the output level.

The next three pages have diagrams showing how to use the PCB to build out the circuit with various modifications plus also how to use the PCB to build the original Dallas Rangemaster for use with a negative ground (i.e. positive supply) to make it compatible with most modern guitar pedals so that it can be powered using a daisy chain power arrangement on a pedal board. All versions show the optional use of a 9v battery and have a true bypass switch included. Note that the original Dallas Rangemaster did not have a bypass switch or LED indicator, was permanently connected between the guitar and amplifier and only ran off battery power.

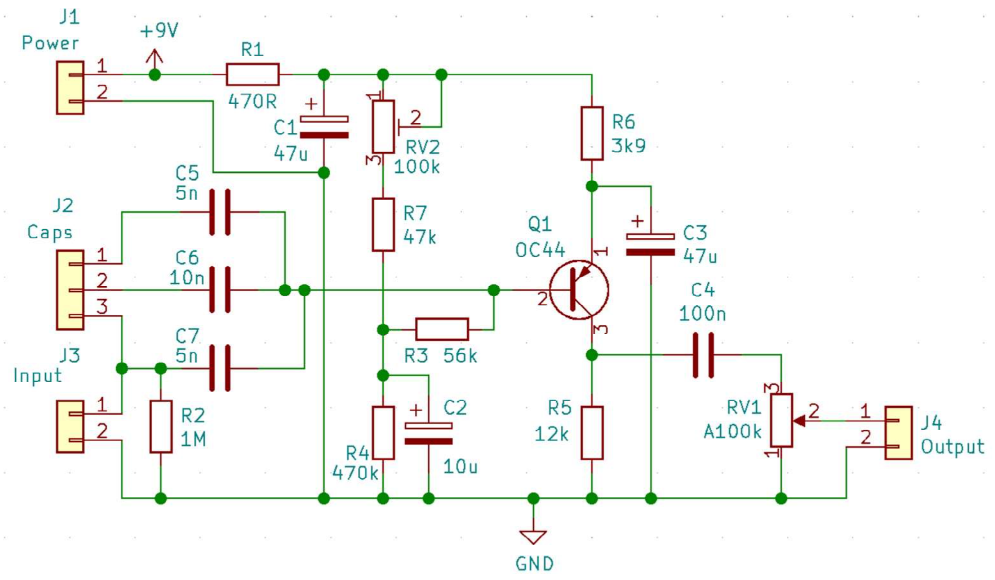
The last page of this document shows a fully annotated schematic of the setup used in simulation and describes the changes that will result in this improvement in performance. The circuit used for the LTSpice simulation clearly indicates what are part of the simulation test setup and the monitoring test points for data collection and what are the original and modified Rangemaster circuits.

It is important to note that these modifications to the Dallas Rangemaster circuit were designed so that they will not affect the original audio performance of the circuit and use the minimum number of additional components. They retain the original input impedance characteristics and they maintain the overall frequency response.

The changes to the design have been determined using an accurate simulation of the Rangemaster using an OC44 germanium transistor and a simulated Fender Stratocaster pickup and shunt capacitance on the input to simulate a typical length guitar cable.

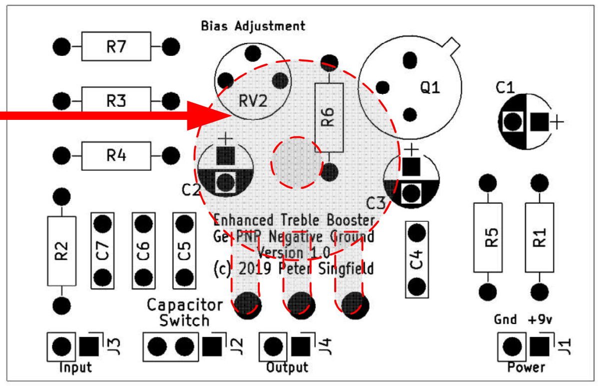
A simply change such as increasing the value of the 47uF capacitor on the power line of the original circuit has very little effect on the noise unless other changes are also made such as adding a series resistor in line with the power supply.

Schematic incorporating all the modifications

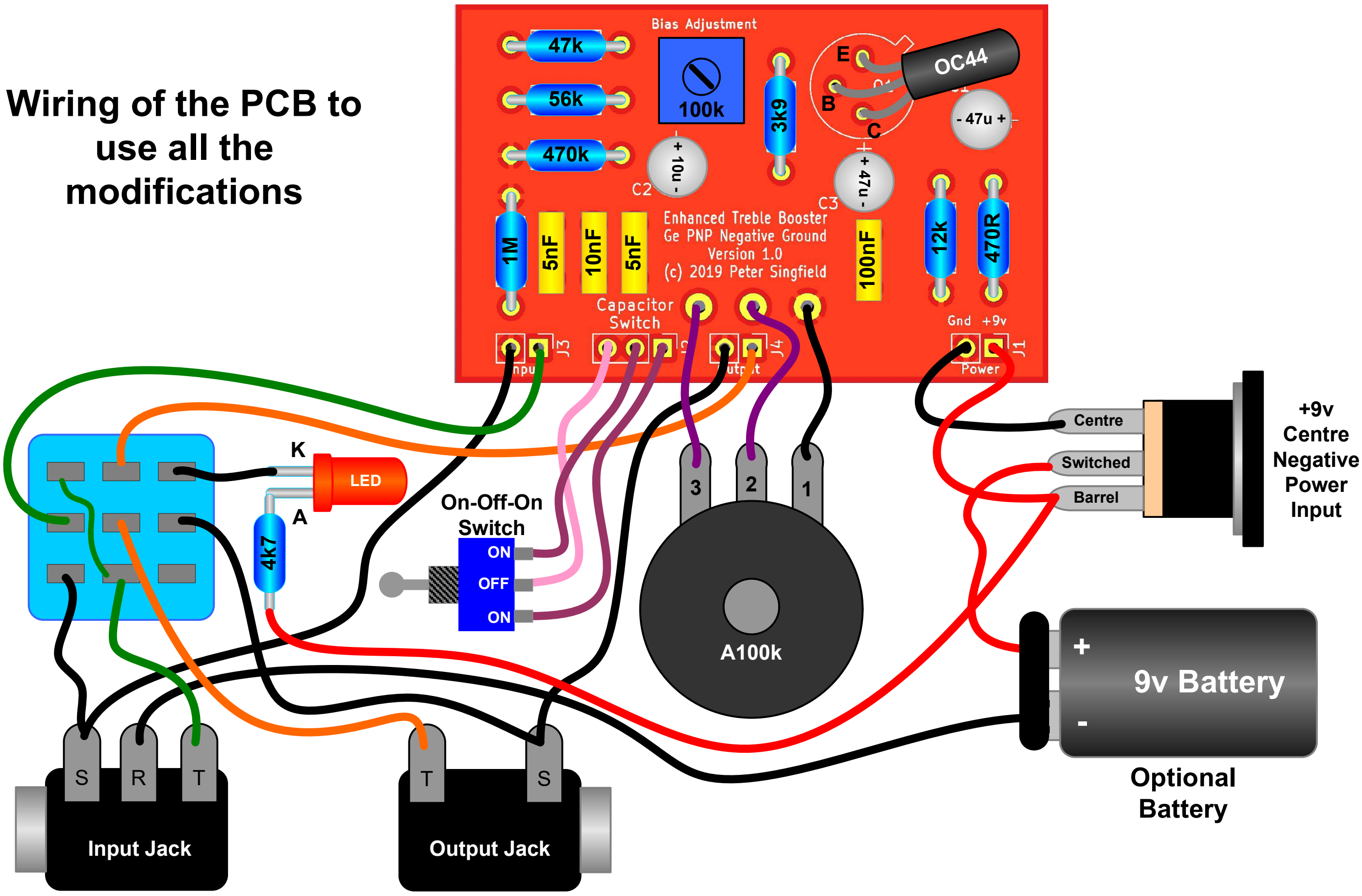


POT RV1 POSITIONED UNDERNEATH PCB

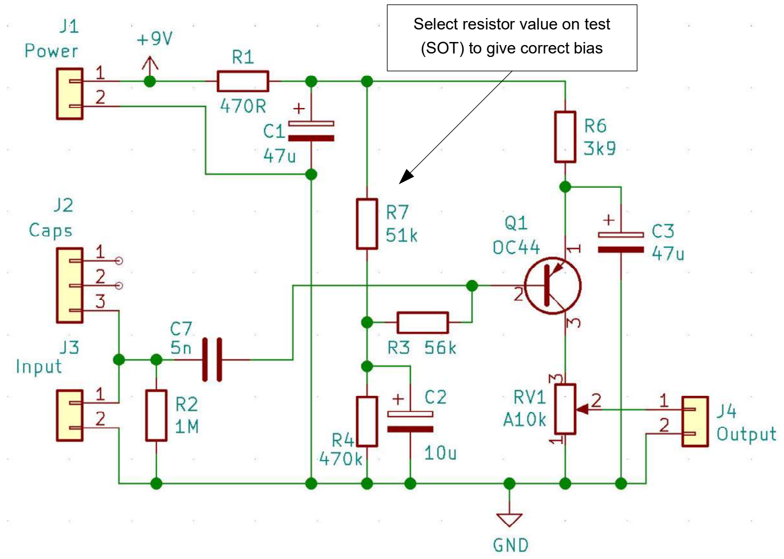
Component locations on PCB



Wiring of the PCB to use all the modifications



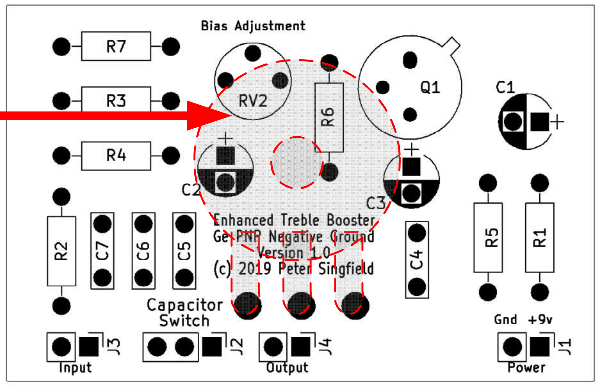
Schematic incorporating minimal modifications to reduce noise



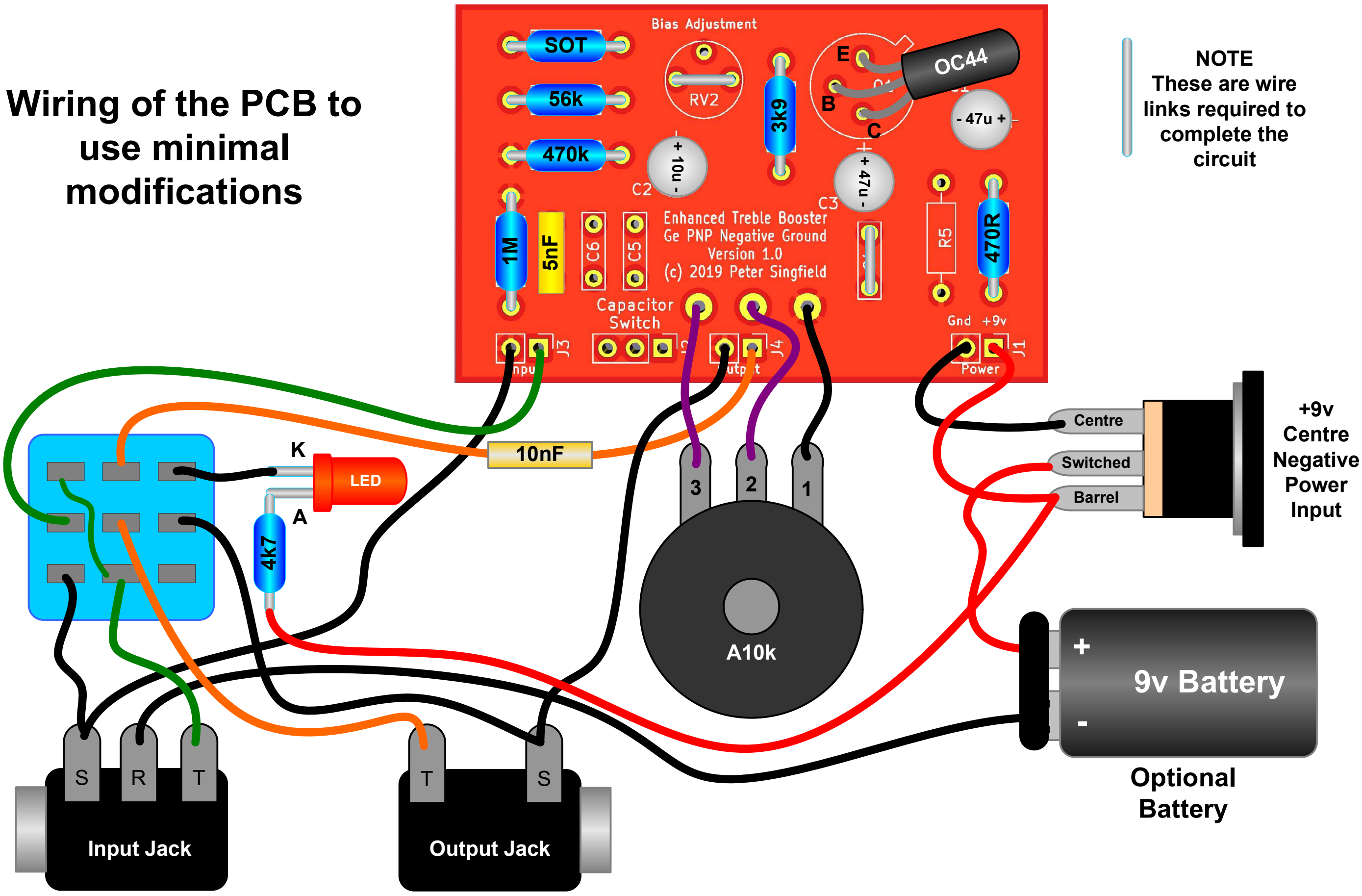
Requires external 10nF capacitor between PCB output and output jack

POT RV1 POSITIONED UNDERNEATH PCB

Component locations on PCB

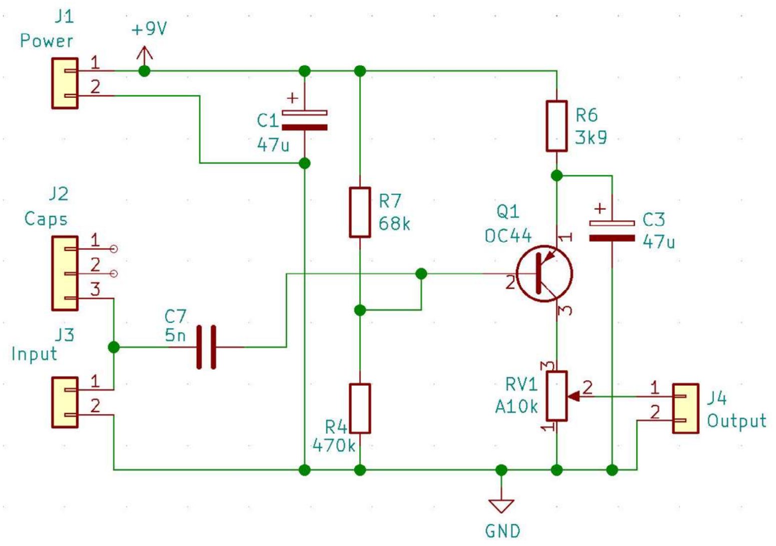


Wiring of the PCB to use minimal modifications



NOTE
These are wire links required to complete the circuit

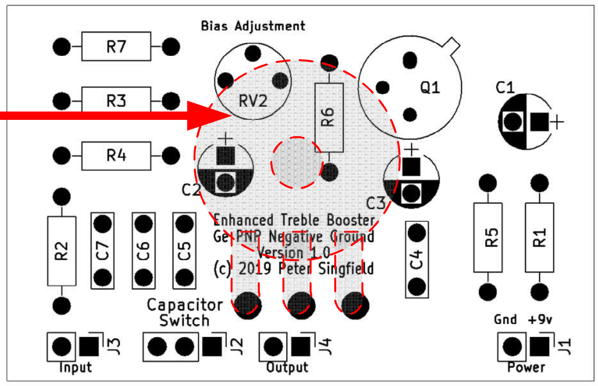
Schematic of original Rangemaster modified for negative ground



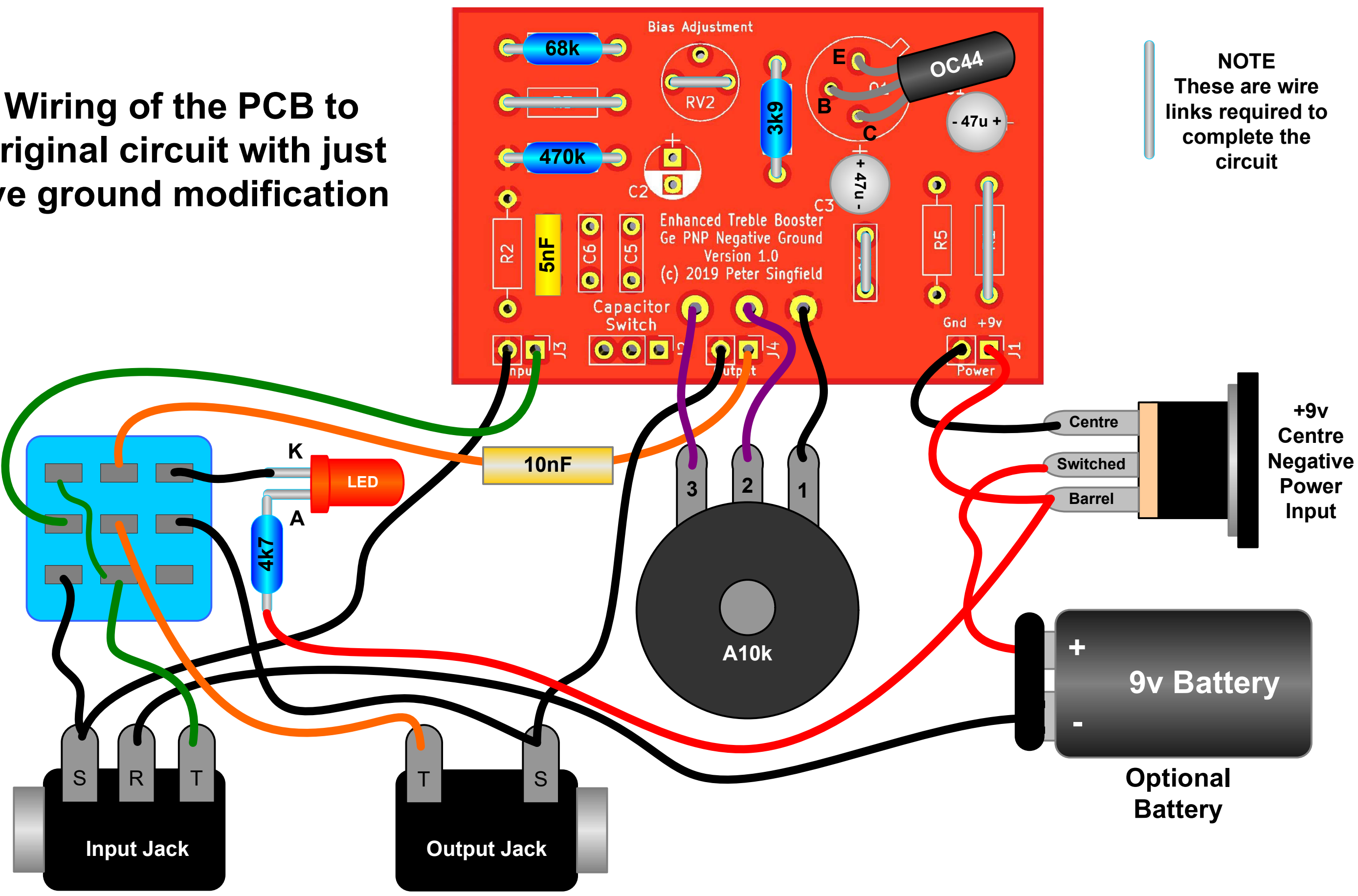
Requires external 10nF capacitor between PCB output and output jack

POT RV1 POSITIONED UNDERNEATH PCB

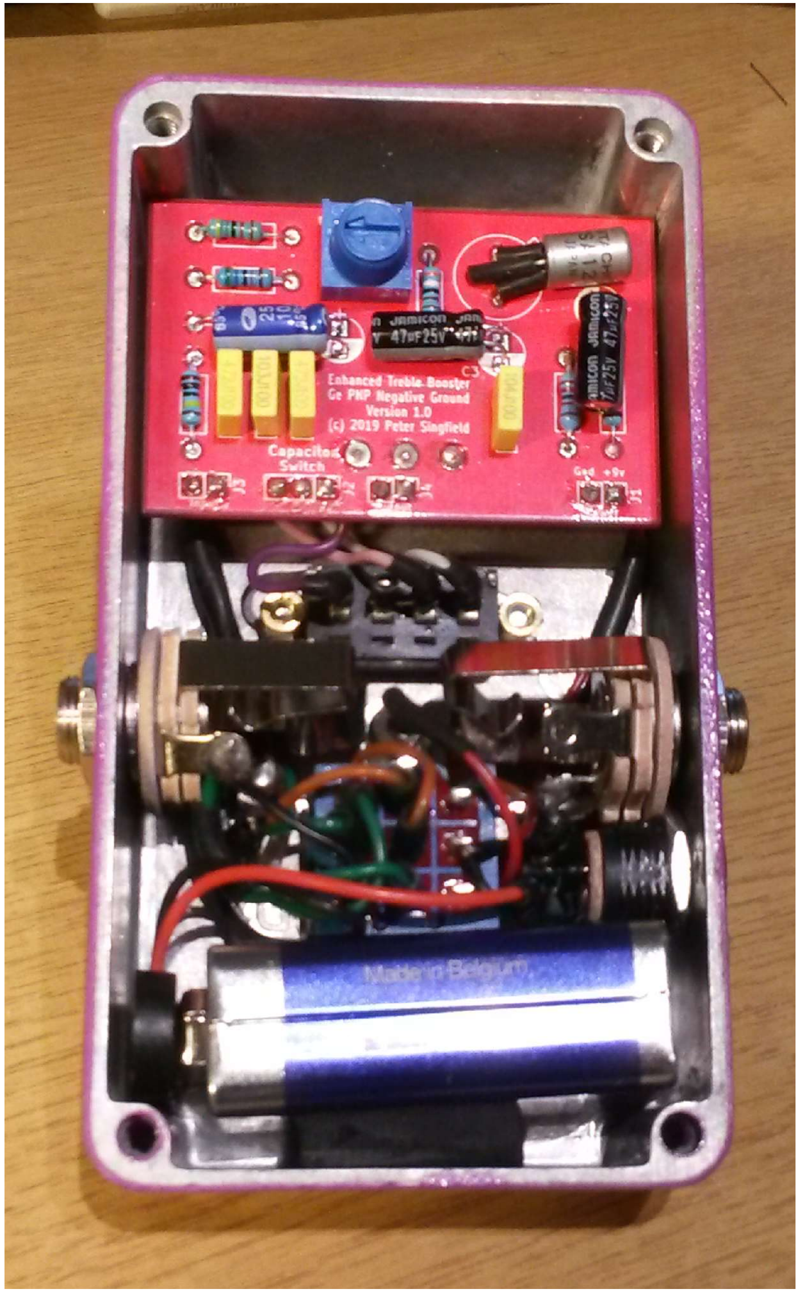
Component locations on PCB



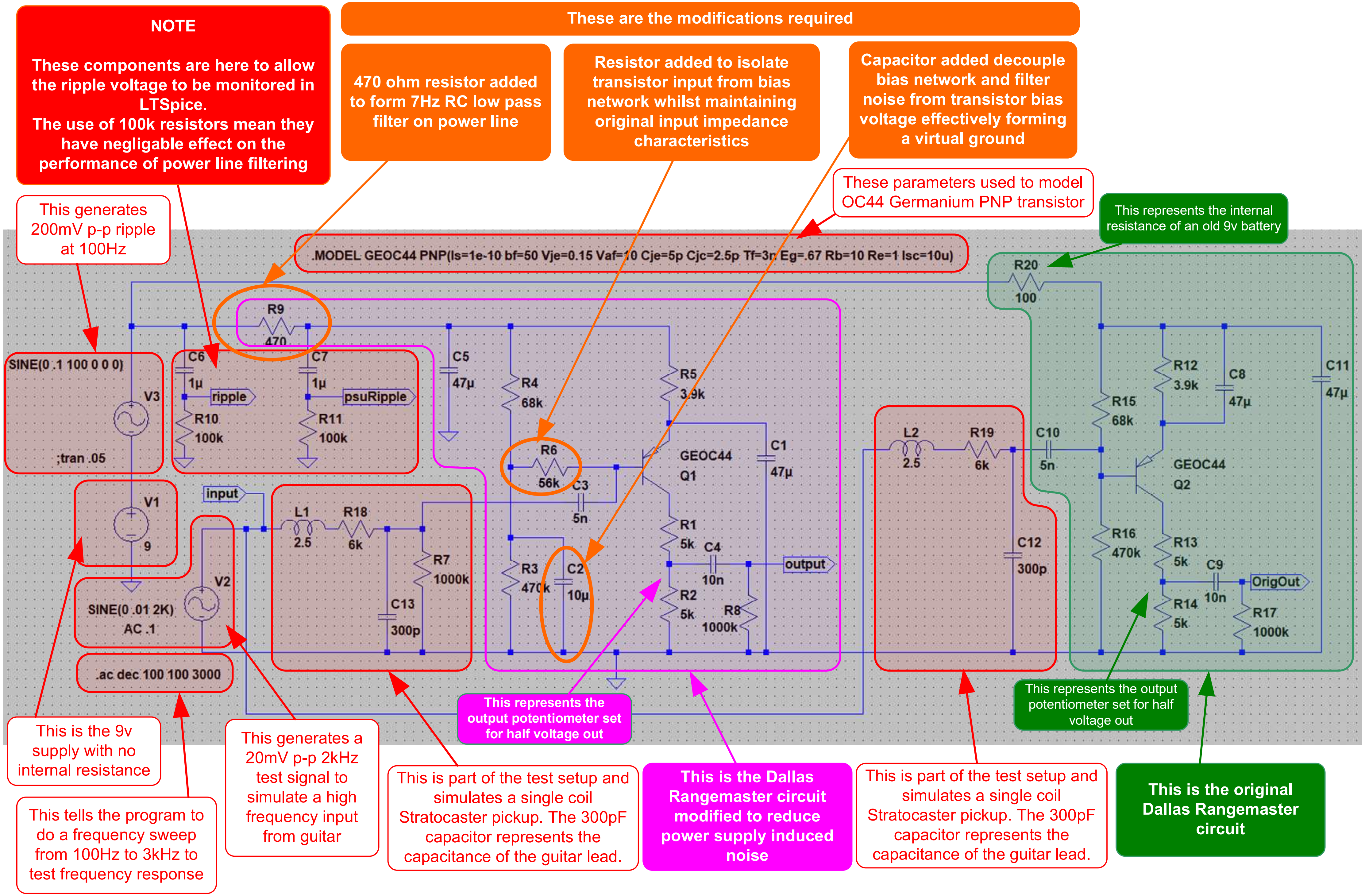
Wiring of the PCB to original circuit with just -ve ground modification

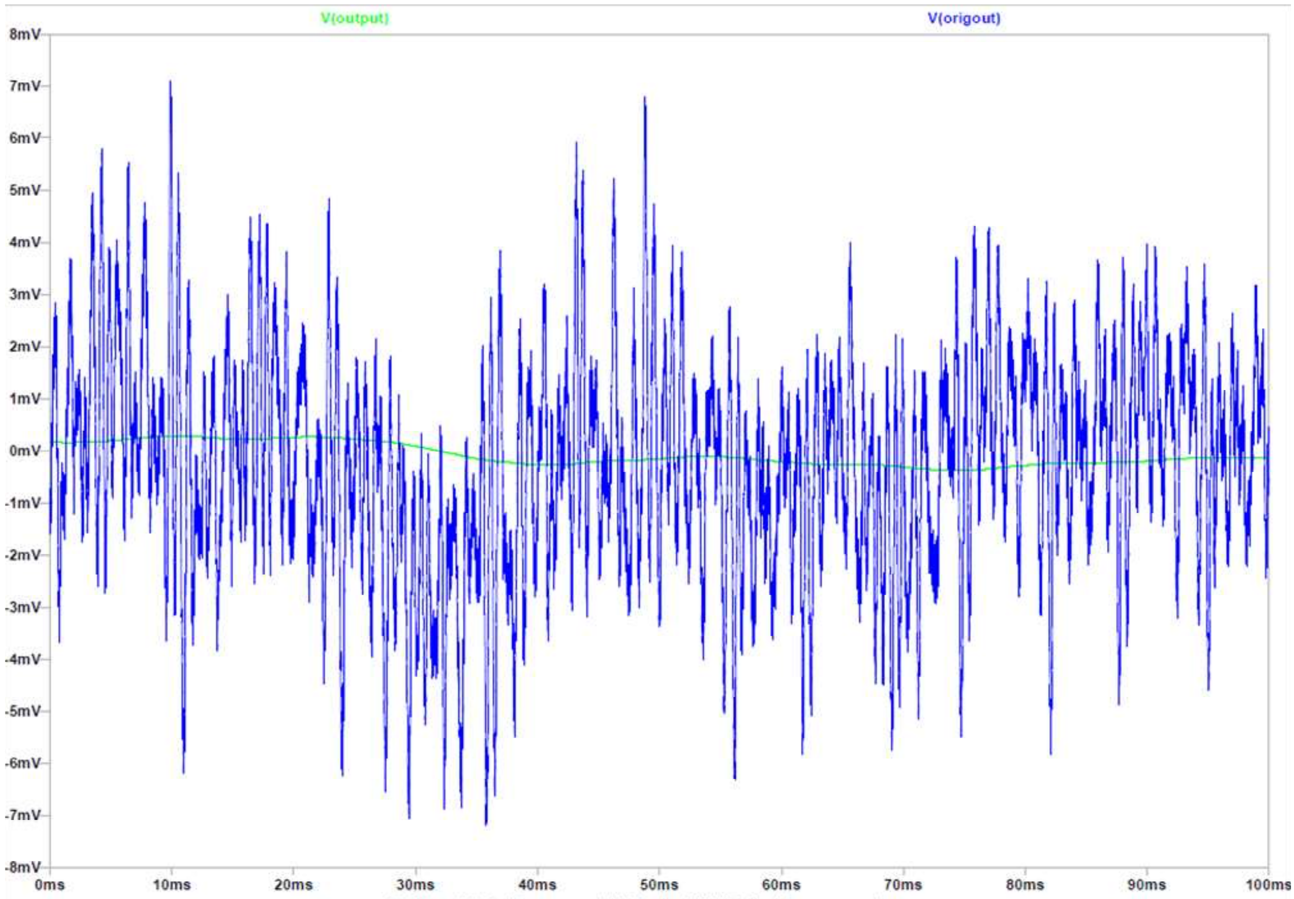



Min
Max
Tone
Low - High - Mid
ermanium
Treble Booster

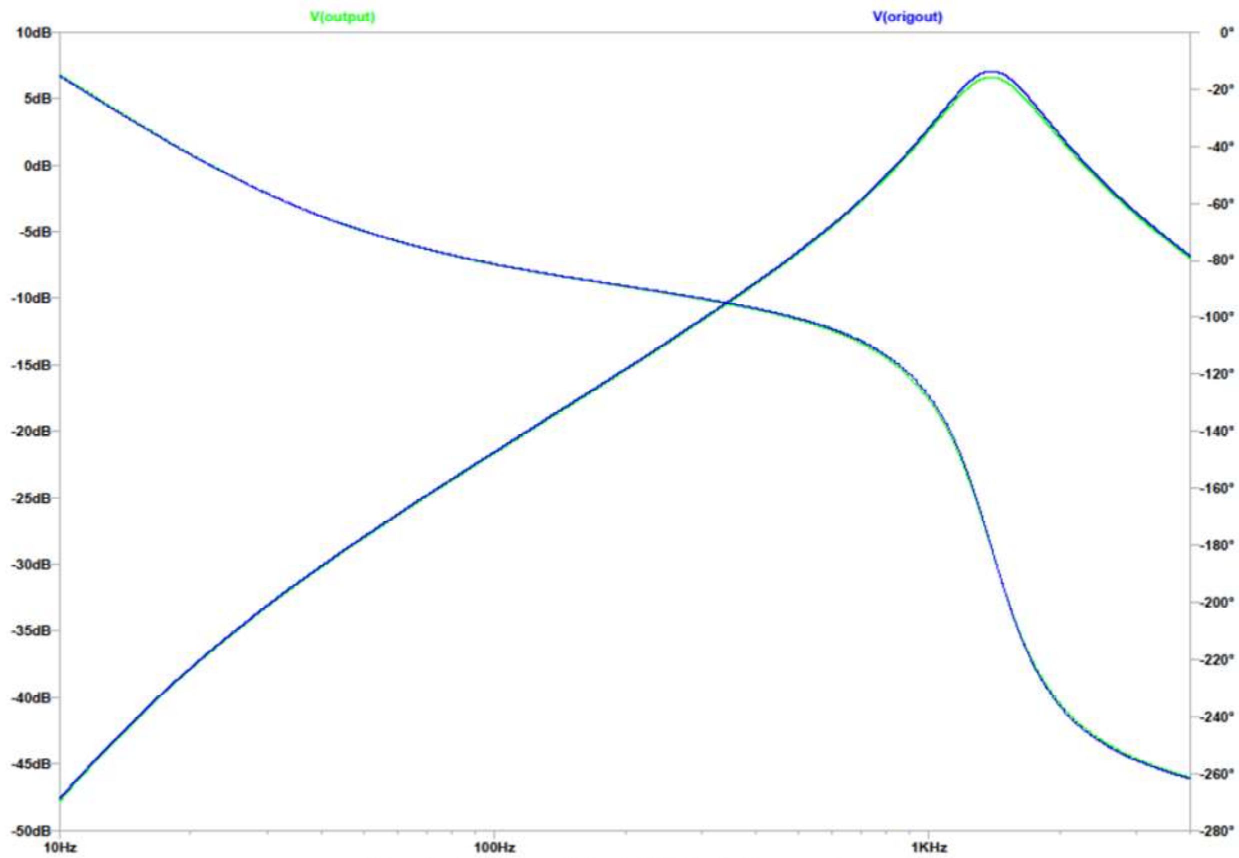

Enhanced Treble Booster
Ge PNP Negative Ground
Version 1.0
(c) 2019 Peter Singfield
Capacitor Switch
Gnd +9v
Made in Belgium

LTSpice Simulation Setup

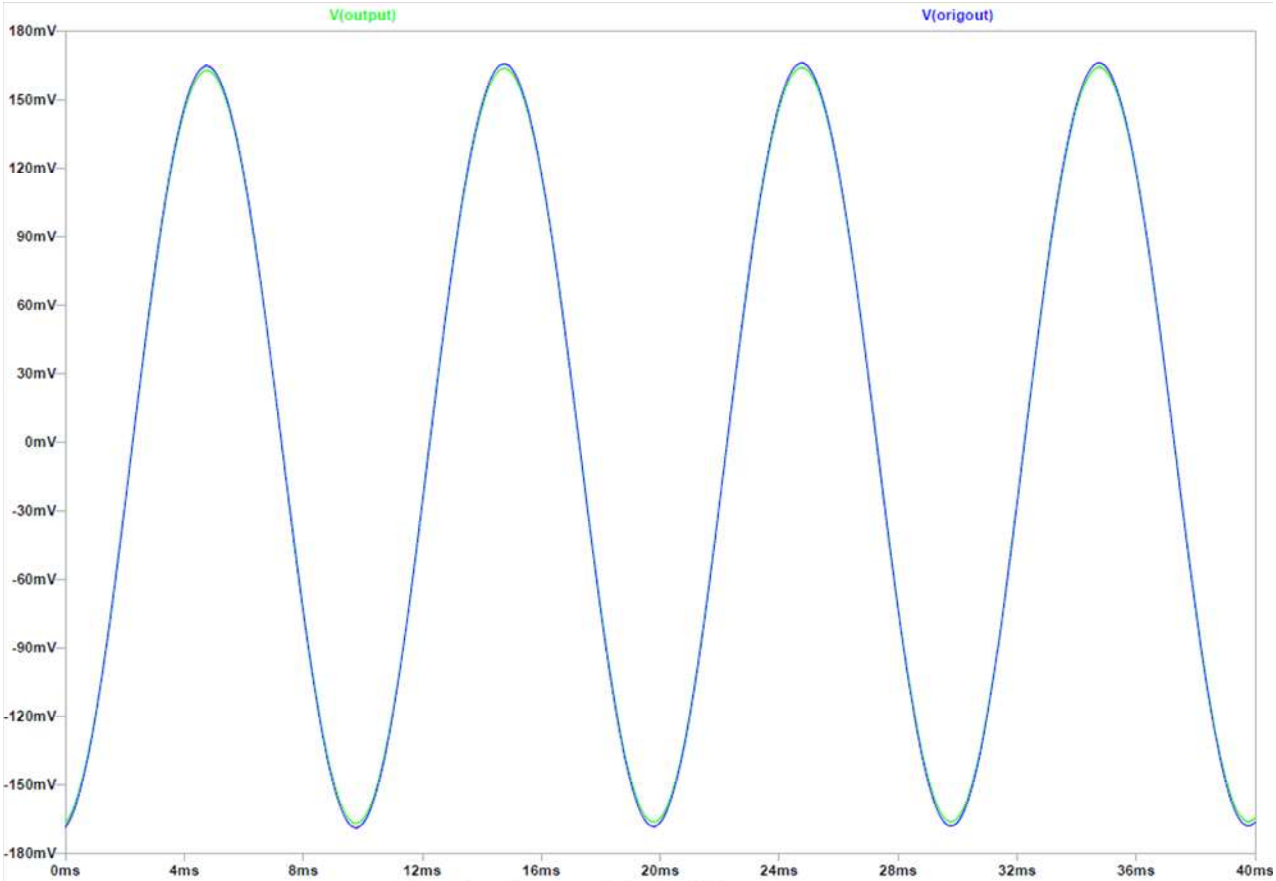




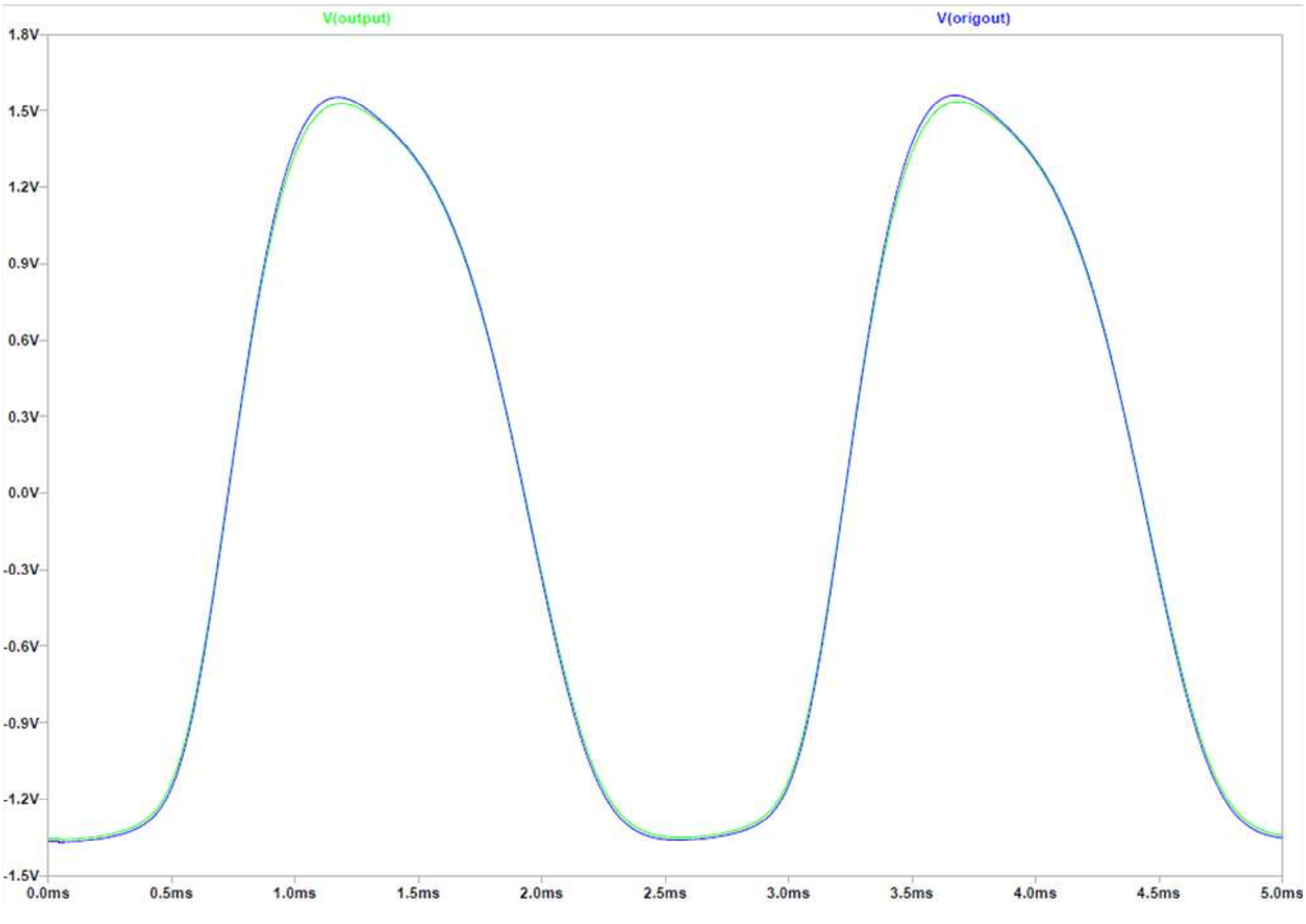
Output of original (blue) and modified (green) circuits with 0.5v p-p noise on power supply



Frequency response of original (blue) and modified (green) circuits



100Hz sinewave output of original (blue) and modified (green) circuits



400Hz overdriven output of original (blue) and modified (green) circuits