local voltage regulator, also includes the footprint for the future integration of the eREC PCB (***Figure 1***c,xi), and a connector for interfacing with the microelectrode arrays (MEA) developed in WP2 (***Figure 1***c,xii).

Both the eFUS and eREC PCBs were design for demonstration purposes only and were made large for easy of testing. In future versions, the PCBs will be made with a smaller dimension such that it matches the requirements for implantation, set in WP4. In ***Figure 1***d, the full system is shown, with the Relay Station connected to the eFUS and eREC PCBs. Furthermore, both the Relay Station and GUI will be developed further throughout the project as required by the performance of the system and the different requirements of the experiments. For example, in the case of the eFUS chip, given its beam-steering capabilities in 3D, the GUI might include in the future automated focusing search patterns where the focal spot is automatically changed in 3D according to specific spatial and time steps, such that the expected electrical recording signature is obtained.

3. Experimental Characterization

To demonstrate how the proposed Relay Station can be used in rat experiments, it was mounted with Velcro straps on the back of a 3D printed model of a rat, with similar dimensions to the Sprague Dawley rats used in the experiments of WP4 (***Figure 2***a). The Velcro straps were placed in two slits in the Relay Station PCB, one on the left side and one on the right side, clearly visible in ***Figure 1***a. After this assembly, the Relay Station was connected to a host computer via a USB cable, and to an oscilloscope with two voltage probes, for measuring relevant signals in the Relay Station ***Figure 2***b. The Host computer featured a graphical user interface, custom designed for interfacing with the MCU in the Relay Station, and with the PMU in a future version (***Figure 2***c). The interface with the Relay Stations allows for the control of the eREC (programming the chip and requesting data) and eFUS chips (setting ultrasound waveform shape and focal spot coordinates), as shown in ***Figure 2***c. Measurements have also shown that the MCU can produce the control signal required by the eFUS chip to define the ultrasound waveform duty cycle, with examples shown for a duty cycle of 10%, 50% and 75% (***Figure 2***d). The power supply levels required by the eFUS chip were also measured with the correct levels (***Figure 2***e), as expected, and a digital bitstream produced by the MCU and encoding the focal spot coordinates was also recorded, with a partial section shown in ***Figure 2***f.

4. Conclusions

This report described the design and test of a Relay station PCB to be used as a wearable backpack during behavioral rat experiments. The design was described including the different blocks of the system, as well as the interface between relay station and eREC and eFUS PCBs. The system was showcased by being mounted on a 3D printed model of a rat, and controlled by a custom-designed graphical user interface, for which future versions will be used in future *in vivo* experiments. This report is accompanied by a demonstration video which is disseminated via the UPSIDE project social media accounts.