

# ECE Toolkit for Android

A low-cost, portable lab-bench for electrical engineers

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Cornell University Master of Engineering Design Project

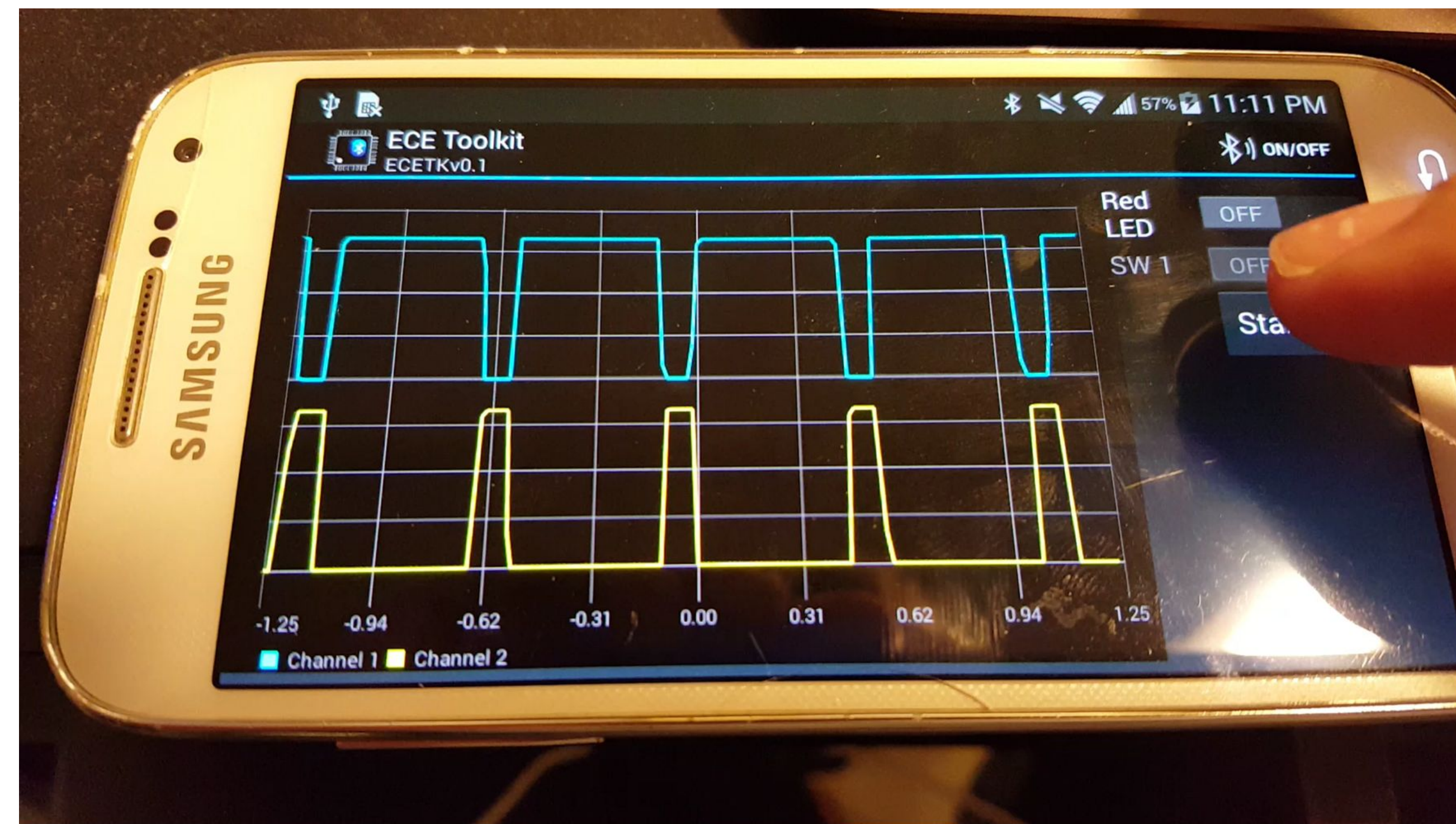
Advisor: Dr. Bruce Land

Cornell  
ECE

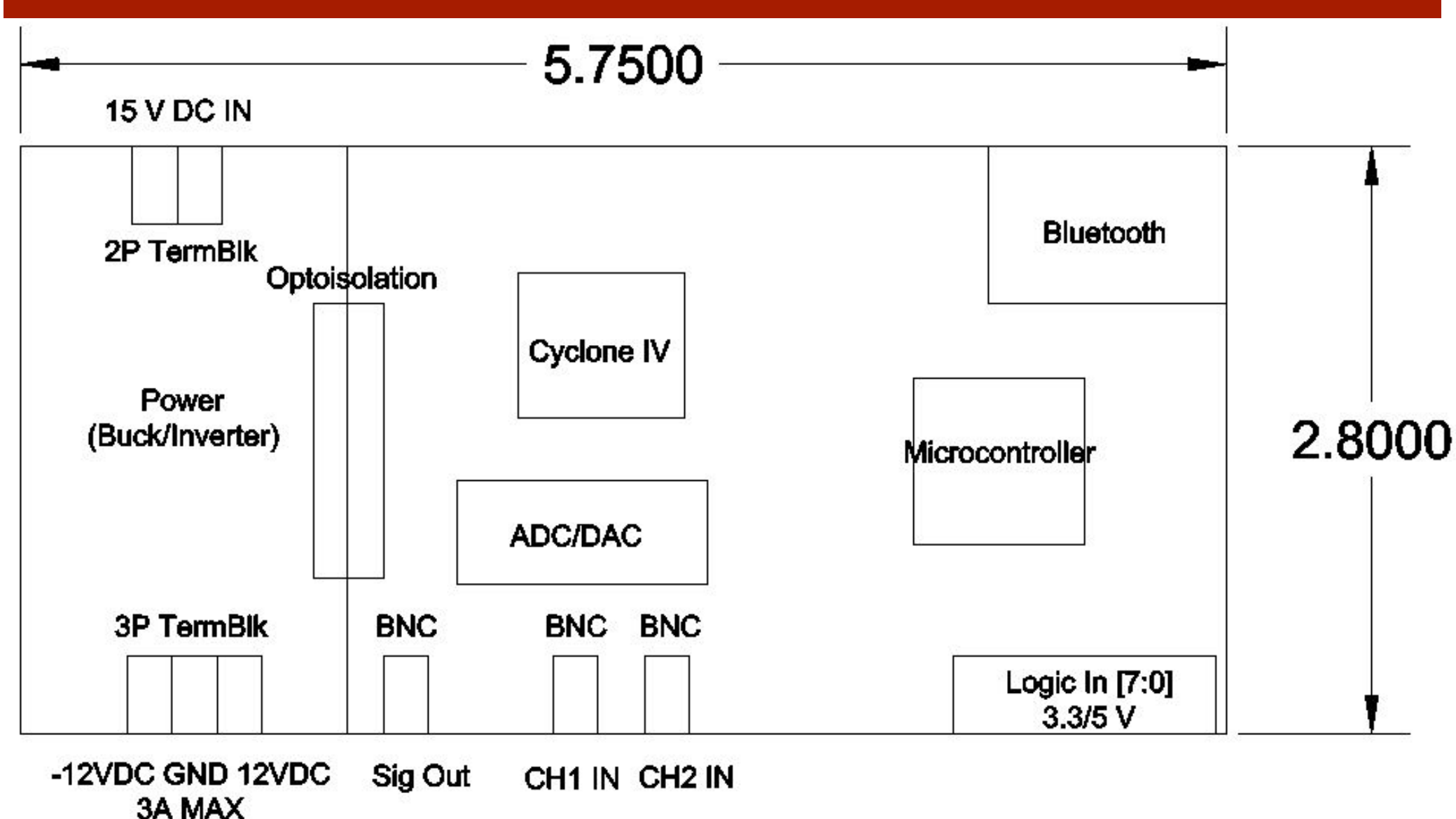
## Abstract

- ❖ All-in-one toolkit for Android
  - ◆ Oscilloscope
  - ◆ Signal Generator
  - ◆ Power Supply
  - ◆ Logic Analyzer
- ❖ Complete wireless solution with useful bandwidth
- ❖ Implemented dual-channel oscilloscope with triggering and online data evaluation at 24 FPS
- ❖ Future work includes custom hardware design and firmware drivers for other systems

## Rising-edge triggered scope data at 24 FPS on Samsung Galaxy S4 Mini

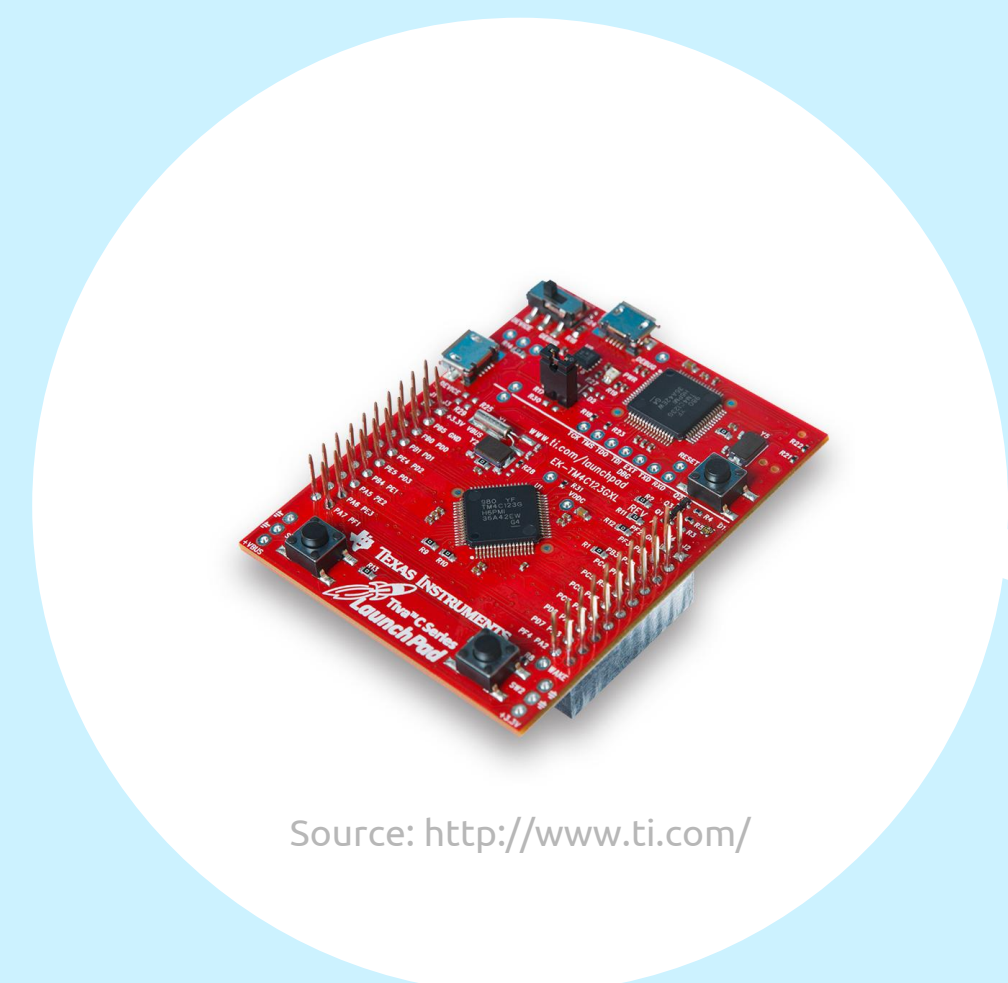


## Product Specification



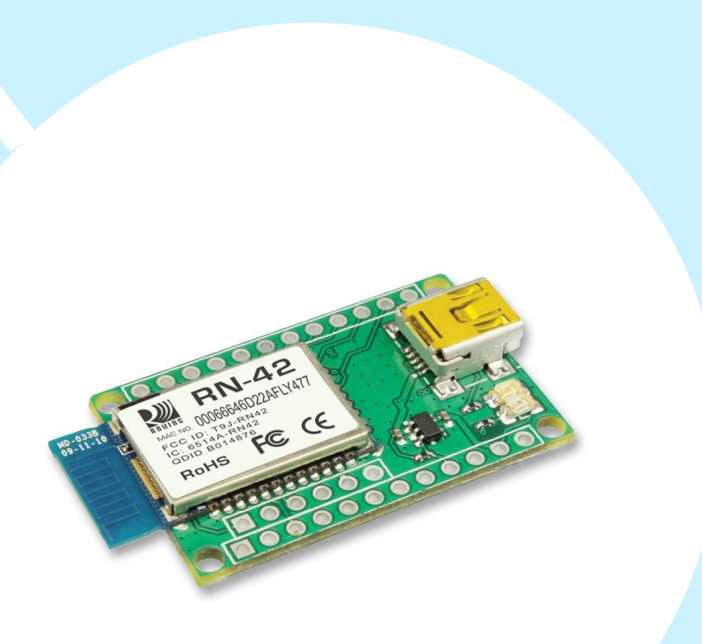
- ❖ Oscilloscope
  - ◆ 2 Channel, 10-bit res, 100 MSps
  - ◆ 141 VAC with 10x probe
- ❖ Power Supply
  - ◆ +/- 12V @ 3A
  - ◆ Voltage/Current Control, Current Limiting
- ❖ Signal Generator
  - ◆ Sine, square, triangle, saw-tooth, noise
  - ◆ 10 Vpp, 100 kHz, DC Bias
- ❖ Logic Analyzer
  - ◆ 8-data bits, 100 MHz
  - ◆ 3.3/5V

ARM Core TivaC serves as bridge between Bluetooth and FPGA



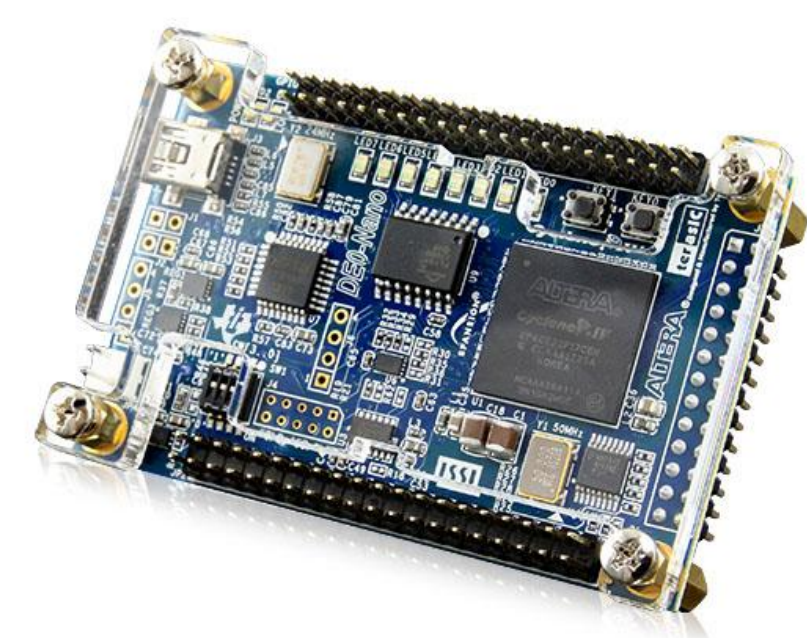
Source: <http://www.ti.com/>

Microchip RN-42 Bluetooth module uses Bluetooth 2.1 serial port profile (SPP) at 240 kbps



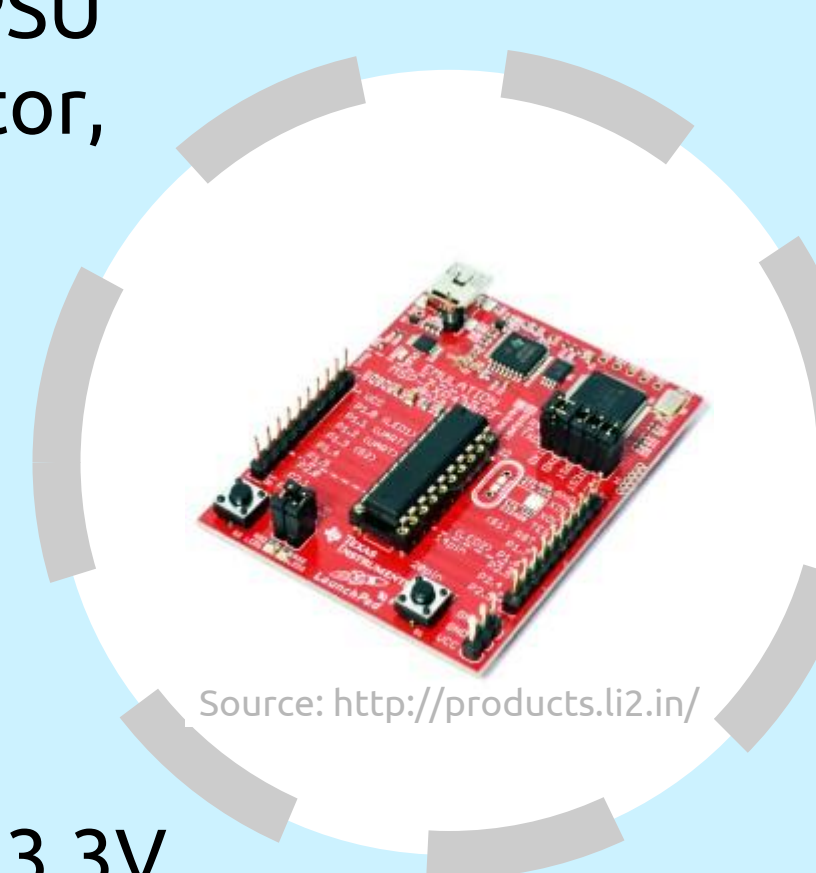
Source: <http://www.newark.com/>

Cyclone IV is "CPU" of the system: data acquisition, hardware triggering, PSU control, signal generator, logic analyzer



Source: <http://www.terasic.com/>

MSP430 generates 3.3V 2kHz 5-95% duty sweep test signal



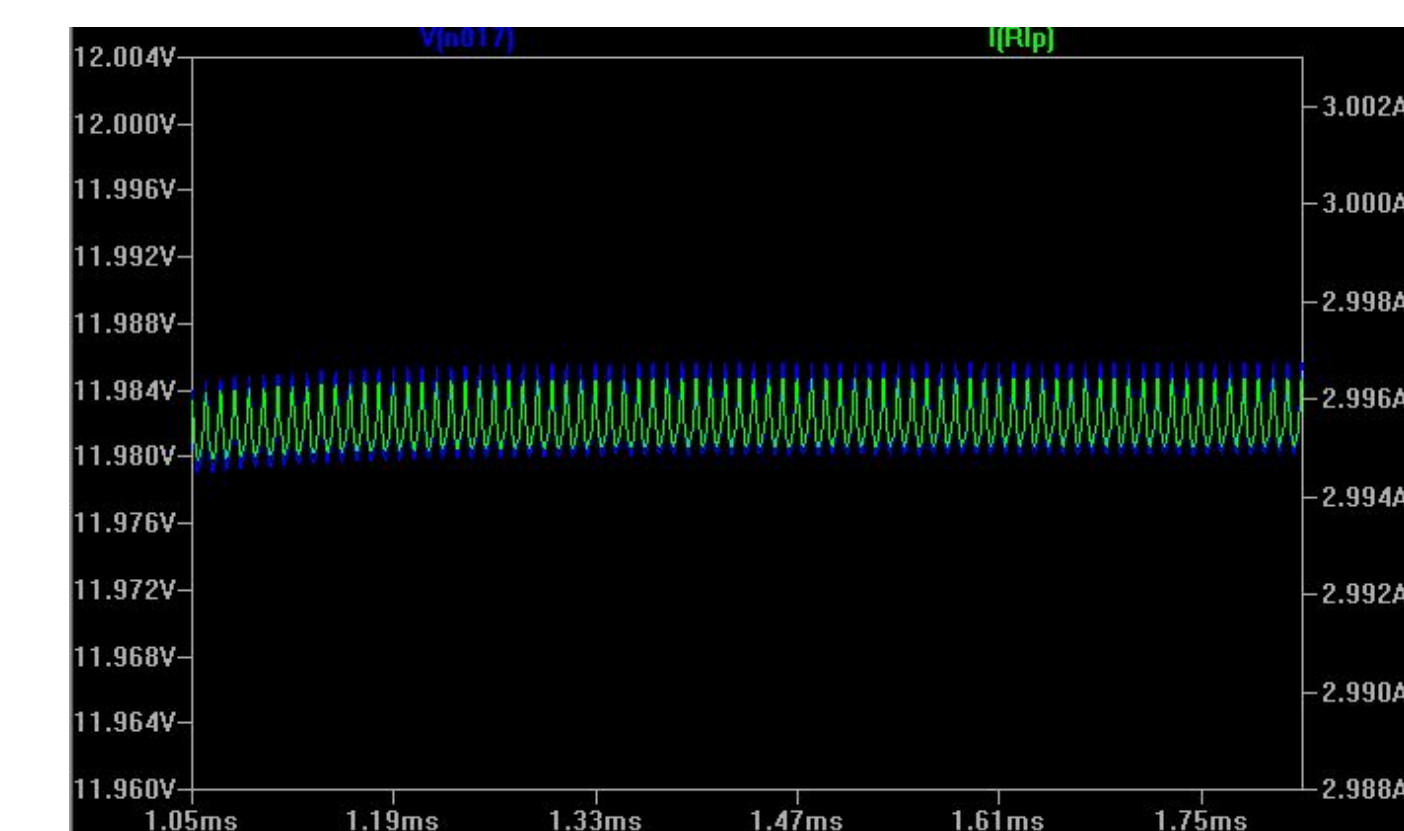
Source: <http://products.lti.in/>

## Results

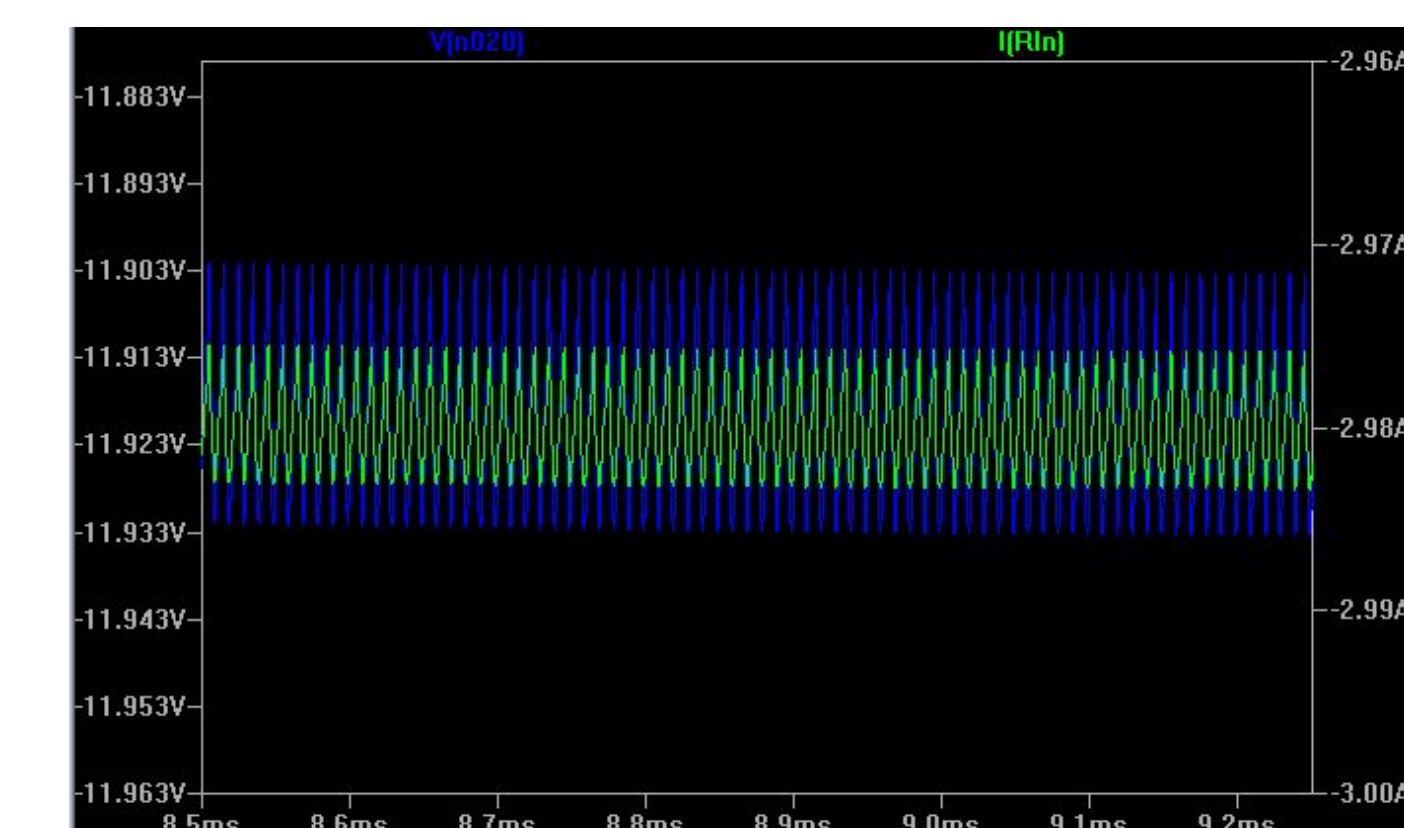
- ❖ Hardware enables a real-time system at 24 FPS
- ❖ Rising-edge triggered, 2-channel oscilloscope on Android smartphone

## Future Work

### Simulation of Power Supply at Full Load

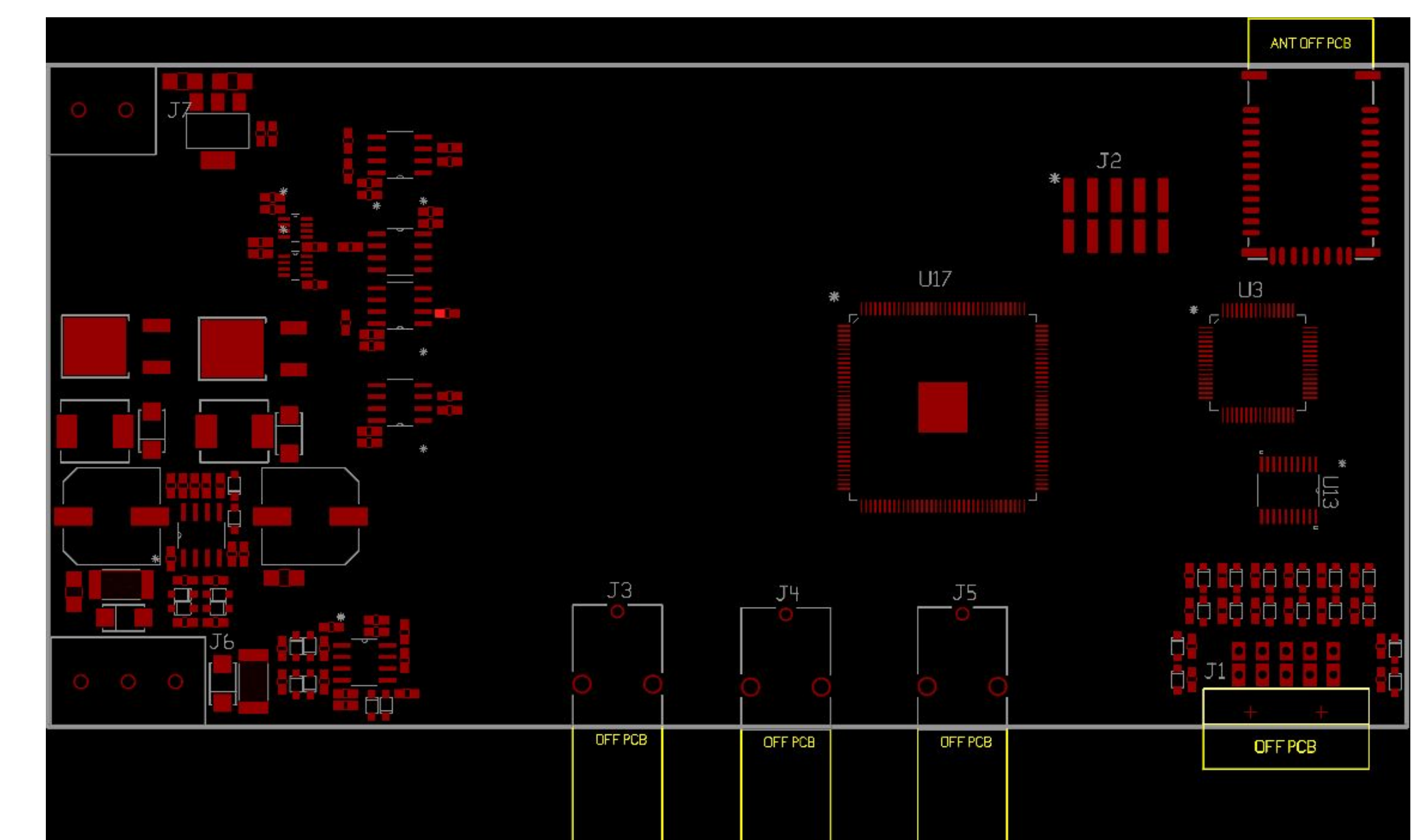


4 mV ripple on 12 V output



30 mV ripple on -12V output

### Custom PCB in progress according to specification



## Acknowledgements

Thanks to Dr. Bruce Land for advising this project. It was something I have wanted to work on for some time.