OTTER RFID ANTENNA SYSTEM

Team 13
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Introduction

- Recent increase of otter population
- Fish hatchery owners concerned
- Track and study otter movement

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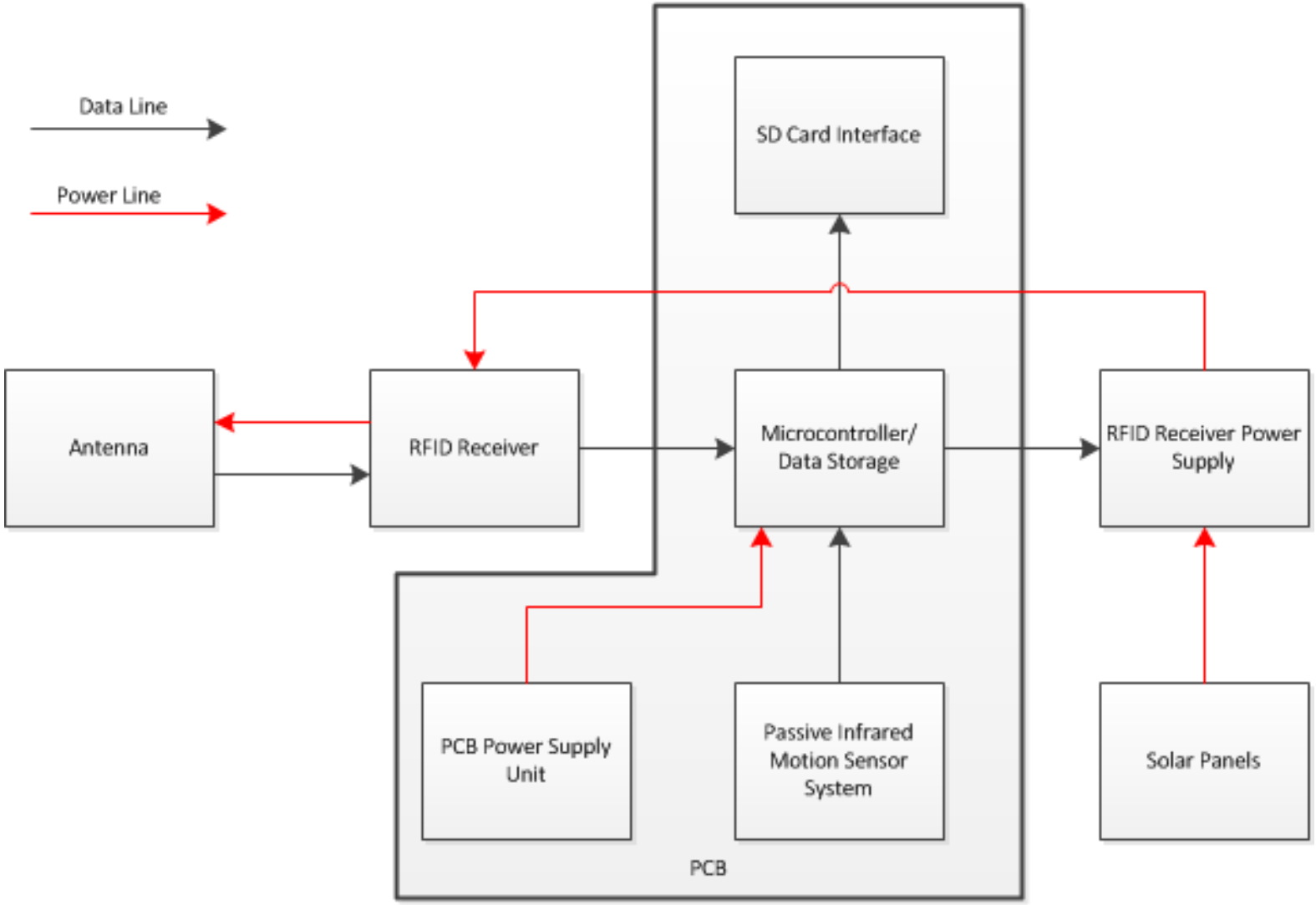
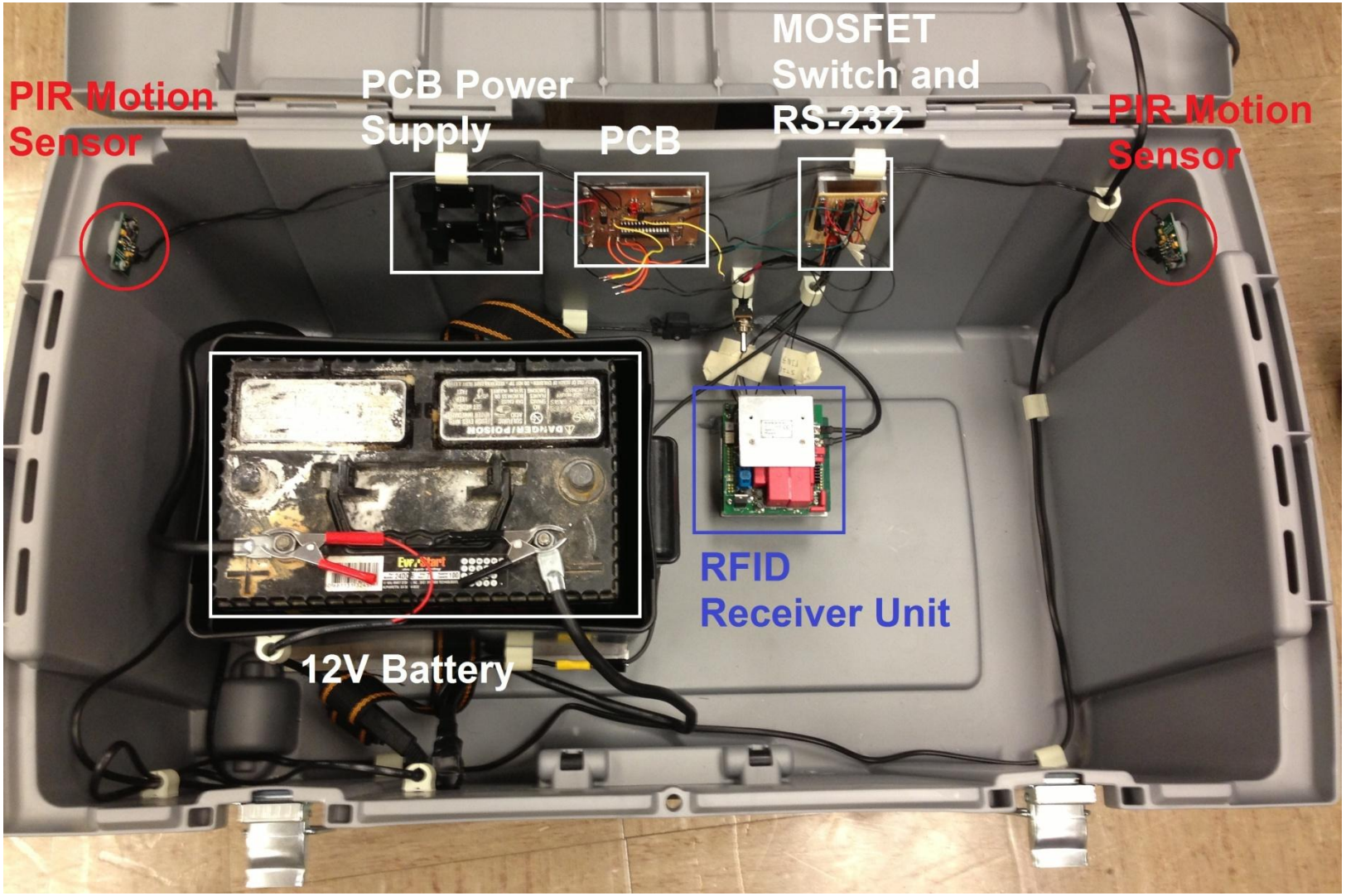
Objectives

- Identify and log otter movement
- Data easily accessible to researchers
- Develop a low cost, energy efficient system

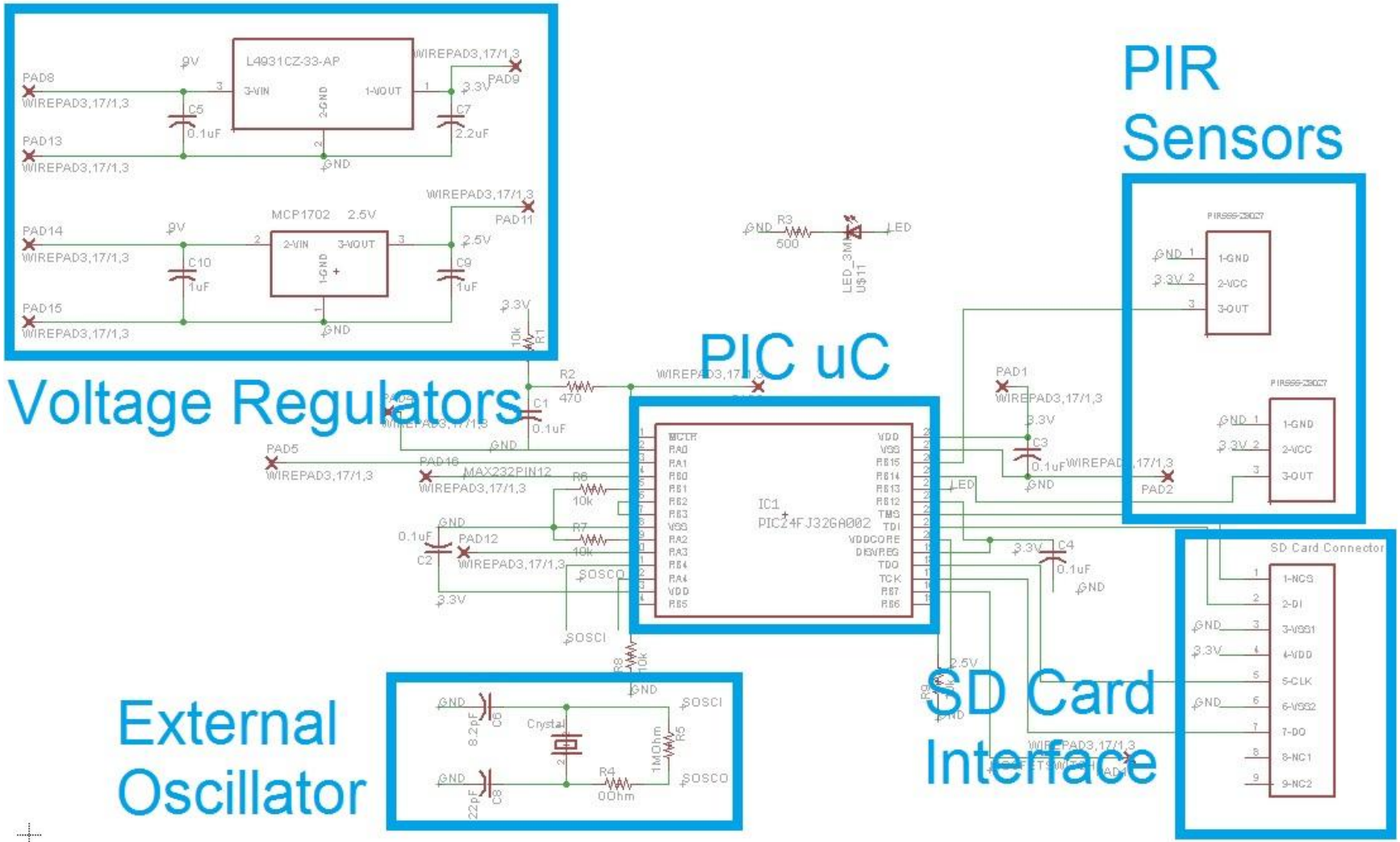
Design Overview



RFID Antenna System

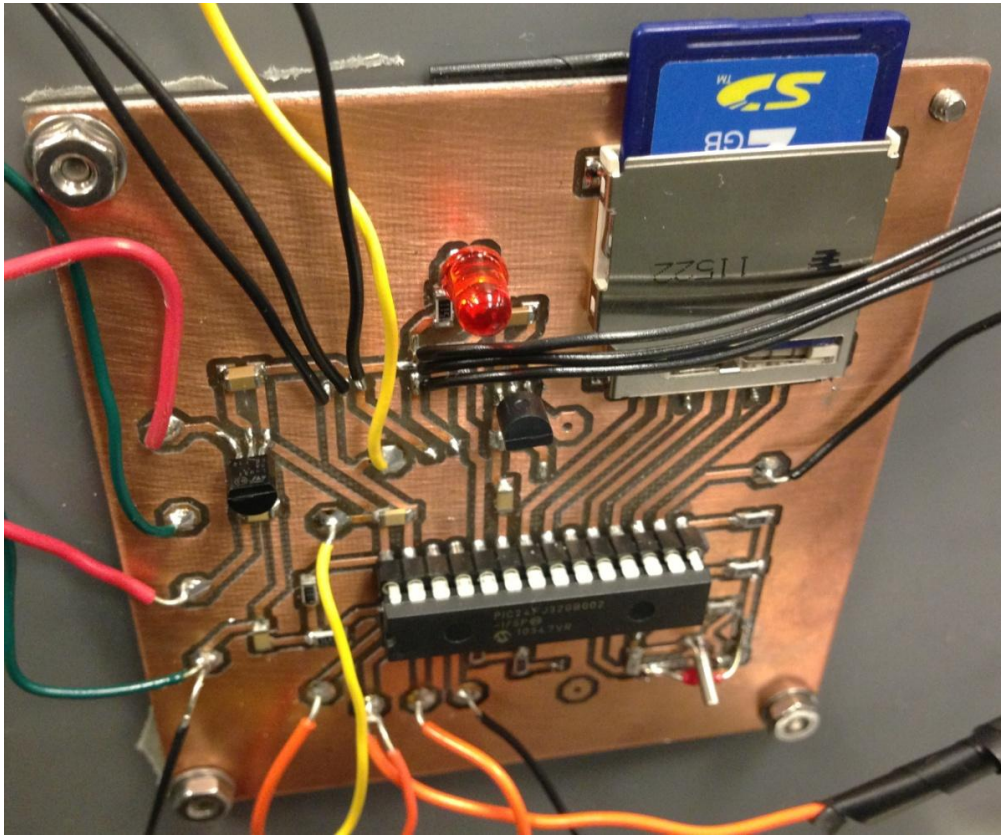


PCB Schematic

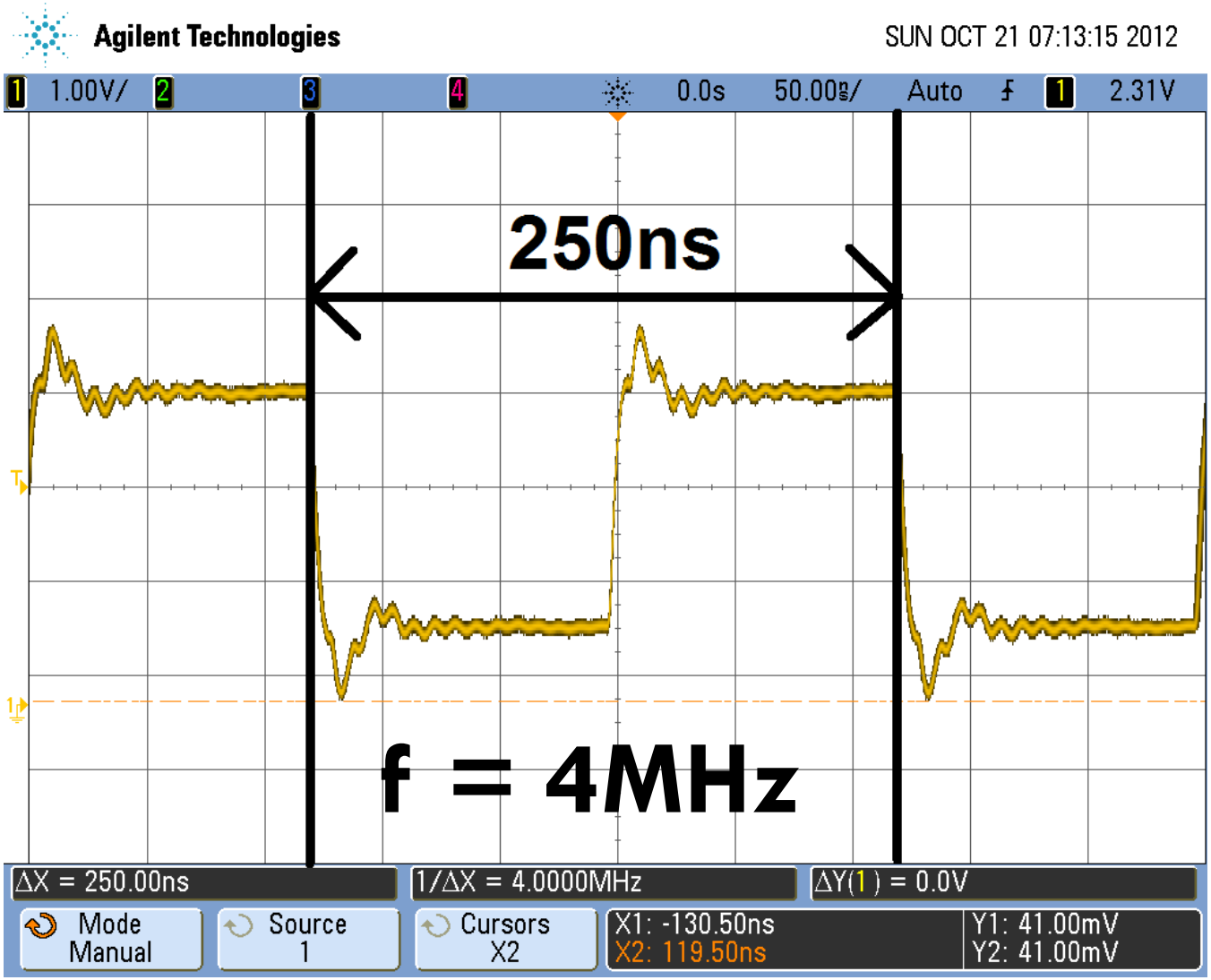


PCB

- 32 mil wire traces
- Test points
- PIC programmable interface

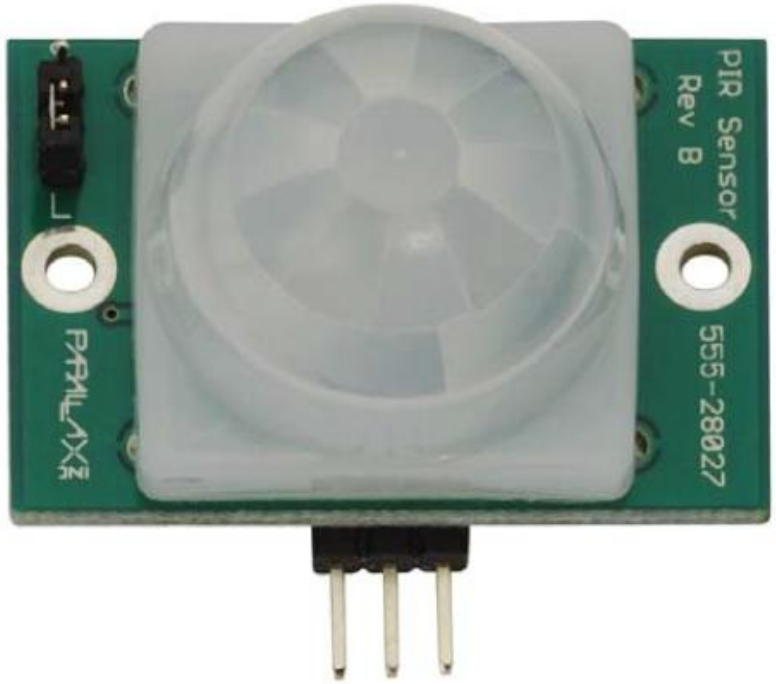


PIC Clock Speed Testing



PIR Motion Sensor

- Minimal power consumption
- Switches power with movement detection
- Provides information on movement direction



Motion Sensor Power Consumption

5V Supply

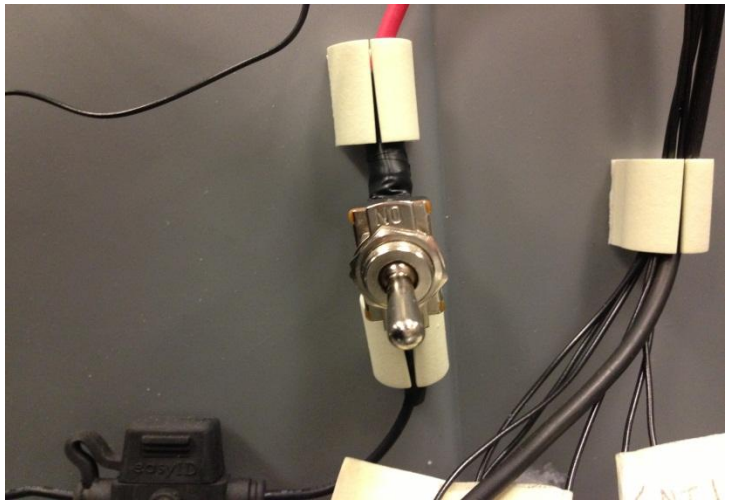
Sensor State	Current (mA)	Power (mW)
Inactive	0.120	0.6
Active	19.68	98.4

3.3V Supply

Sensor State	Current (mA)	Power (mW)
Inactive	0.119	0.3927
Active	2.563	8.4579

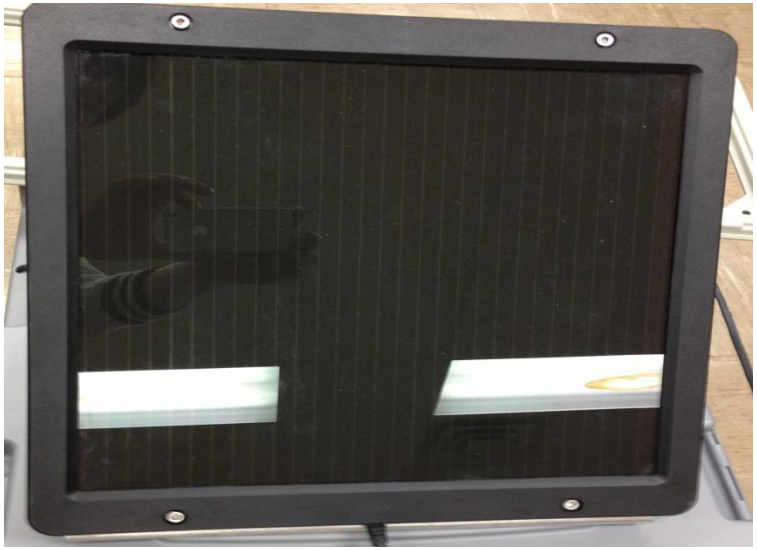
RFID Receiver Power Supply Unit

- 12V car battery
- Solar panel charges it
- A switch is used to manually switch power



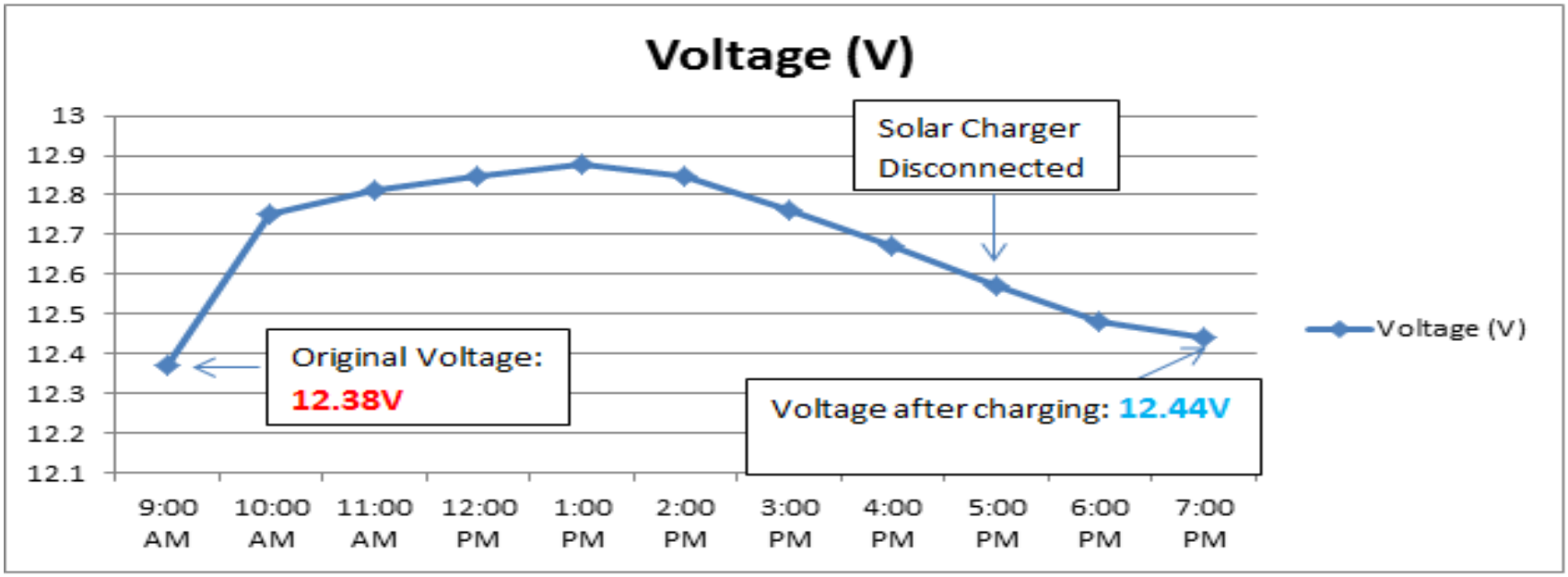
Solar Panel

- Charges and maintains the voltage of the battery
- Built-in overcharge protection and blocking diode
- Faces South, about 40° from the horizontal (latitude)



Solar Panel Efficiency

- $Solar\ panel\ Rating = 0.3A \times 4.2h \times 7days$
  $\approx 8.82Ah/week$ (4.2 hours of sunlight per day)
- $Receiver\ Unit\ battery\ usage$
  $= 310mA \times 0.58hours/week \approx 0.543Ah/week$

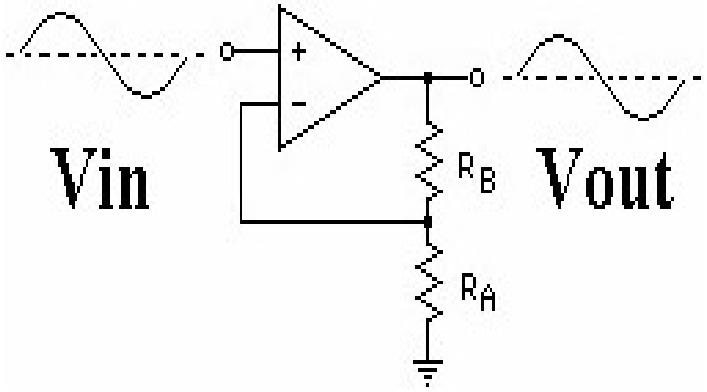


MOSFET and Op-AMP

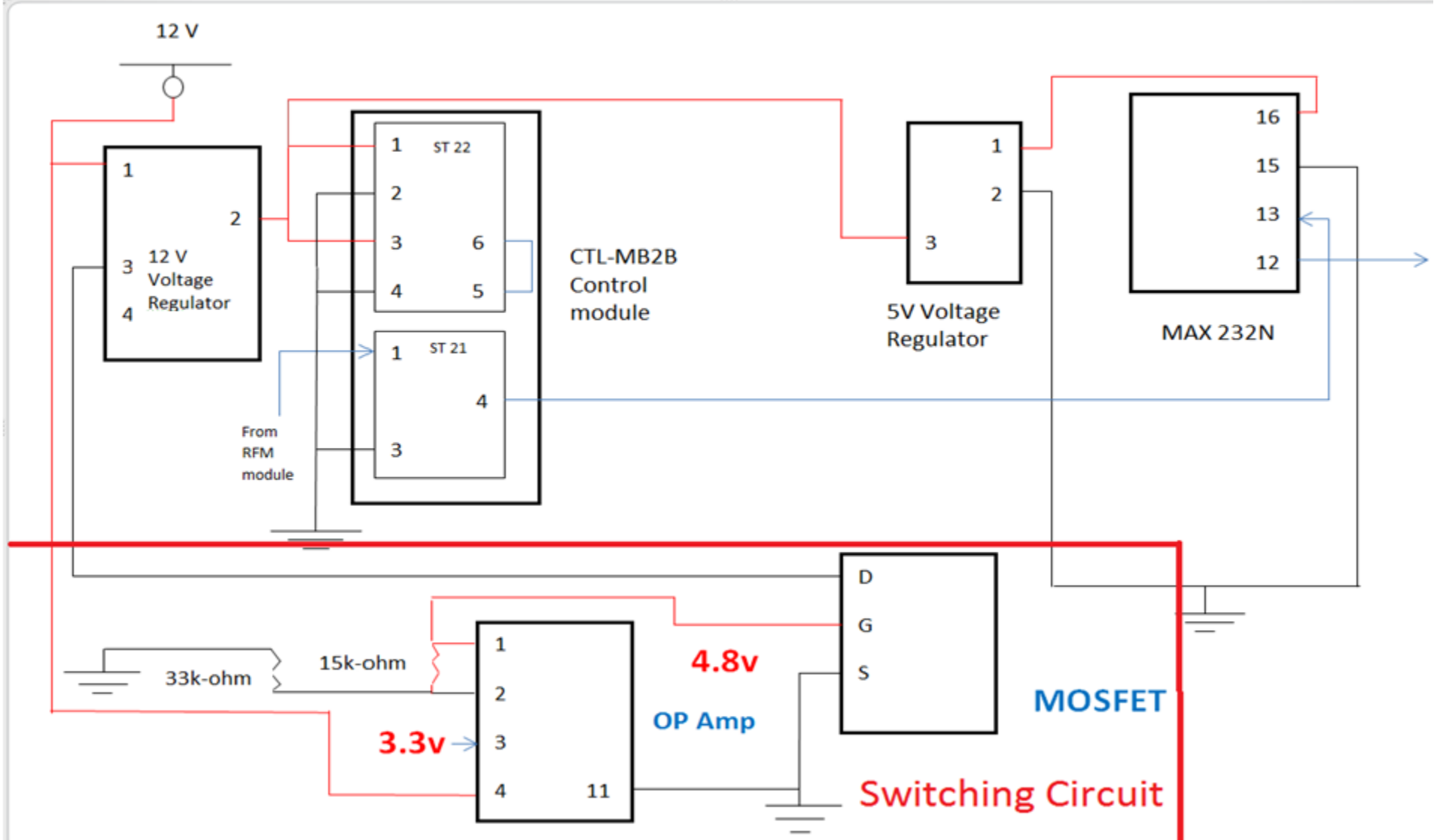
- MOSFET: Turns on the CTL module only when motion is detected
- Op-amp: Increases input voltage of the gate of the MOSFET

$$\frac{V_{out}-V_{in}}{V_{in}} = \frac{R_b}{R_a} = \frac{15k}{33k} = \frac{V_{out}-3.3}{3.3}$$

Vout=4.8V



Block Diagram of Switching Circuit



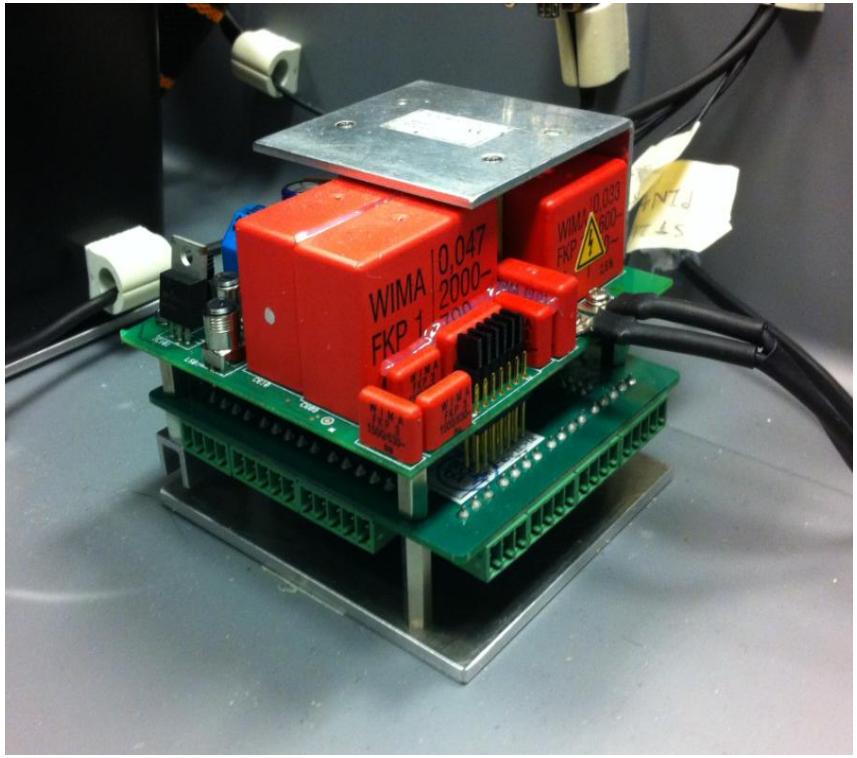
TI RFID LF 134.2 kHz Antenna

- Reads the Passive Integrated Transponder (PIT) tags
- Uses inductive coupling to provide power to the PIT tags
- The antenna sends the unique ID to the RFM/CTL module
- Has inductance of 27 µH at 134.2 kHz

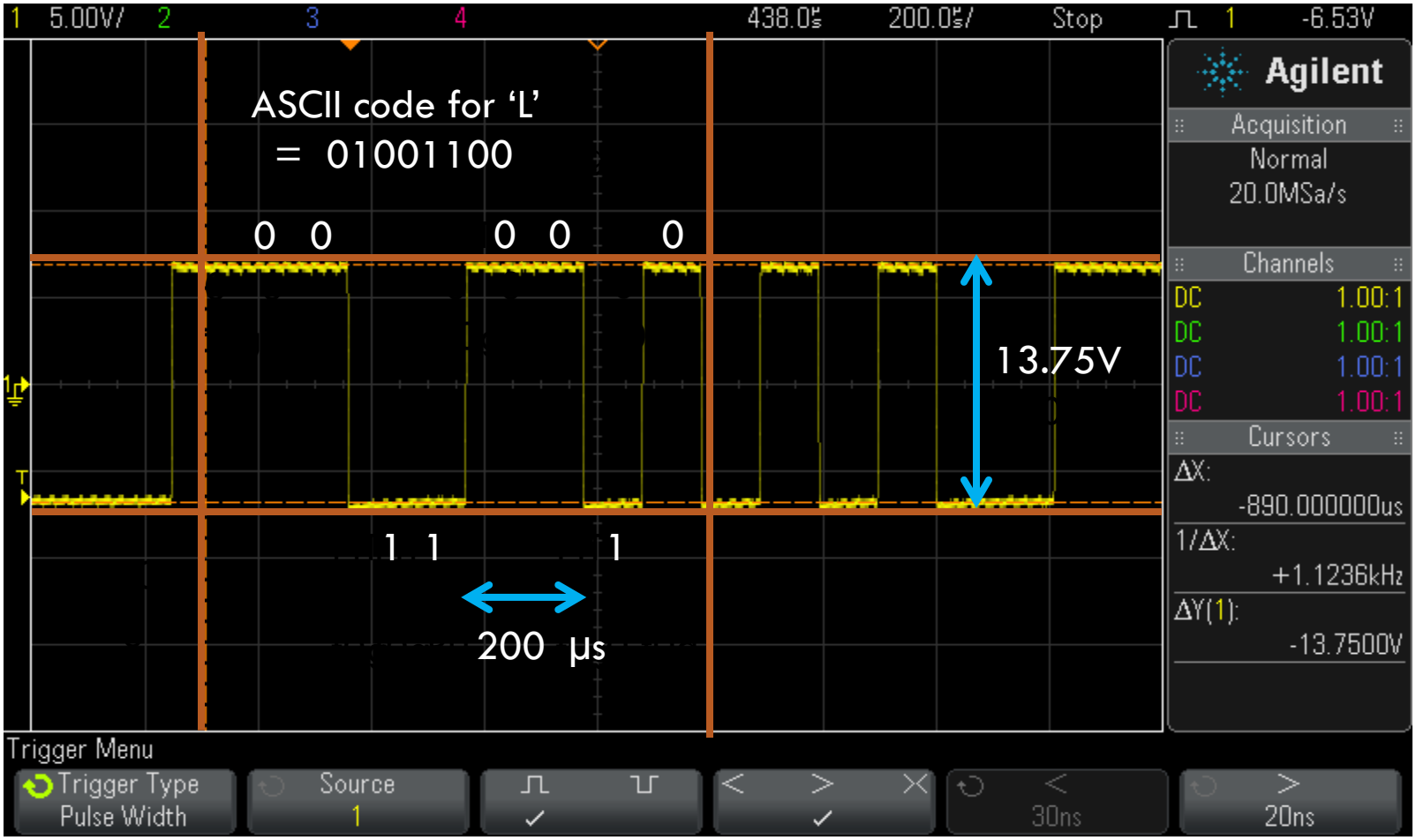
PIT Tags

RFM/CTL Module

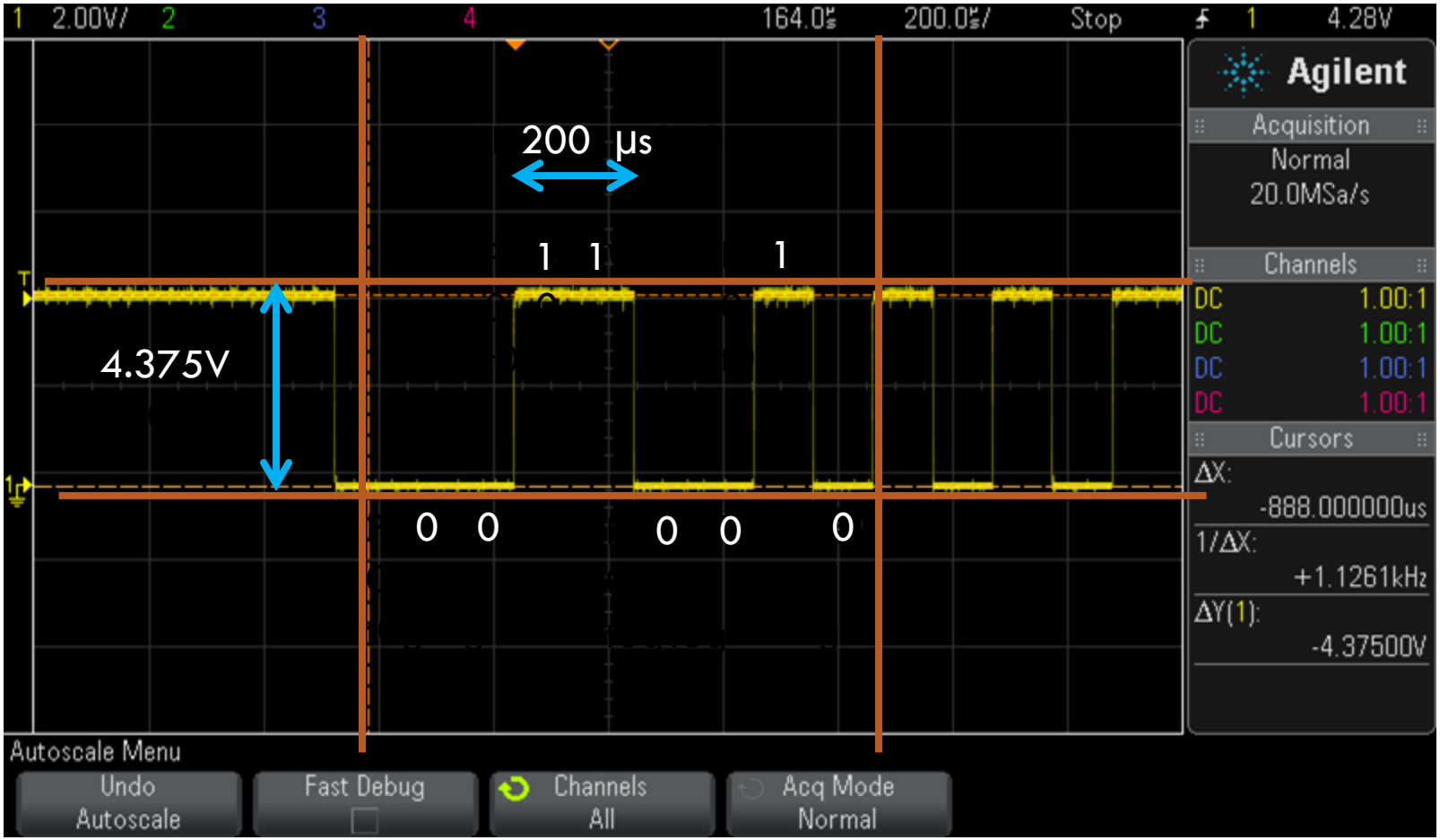
- Provides power to the antenna
- Radio frequency module that controls the antenna
- Demodulates and decodes signal from the antenna
- Outputs the decoded signal in RS-232 format



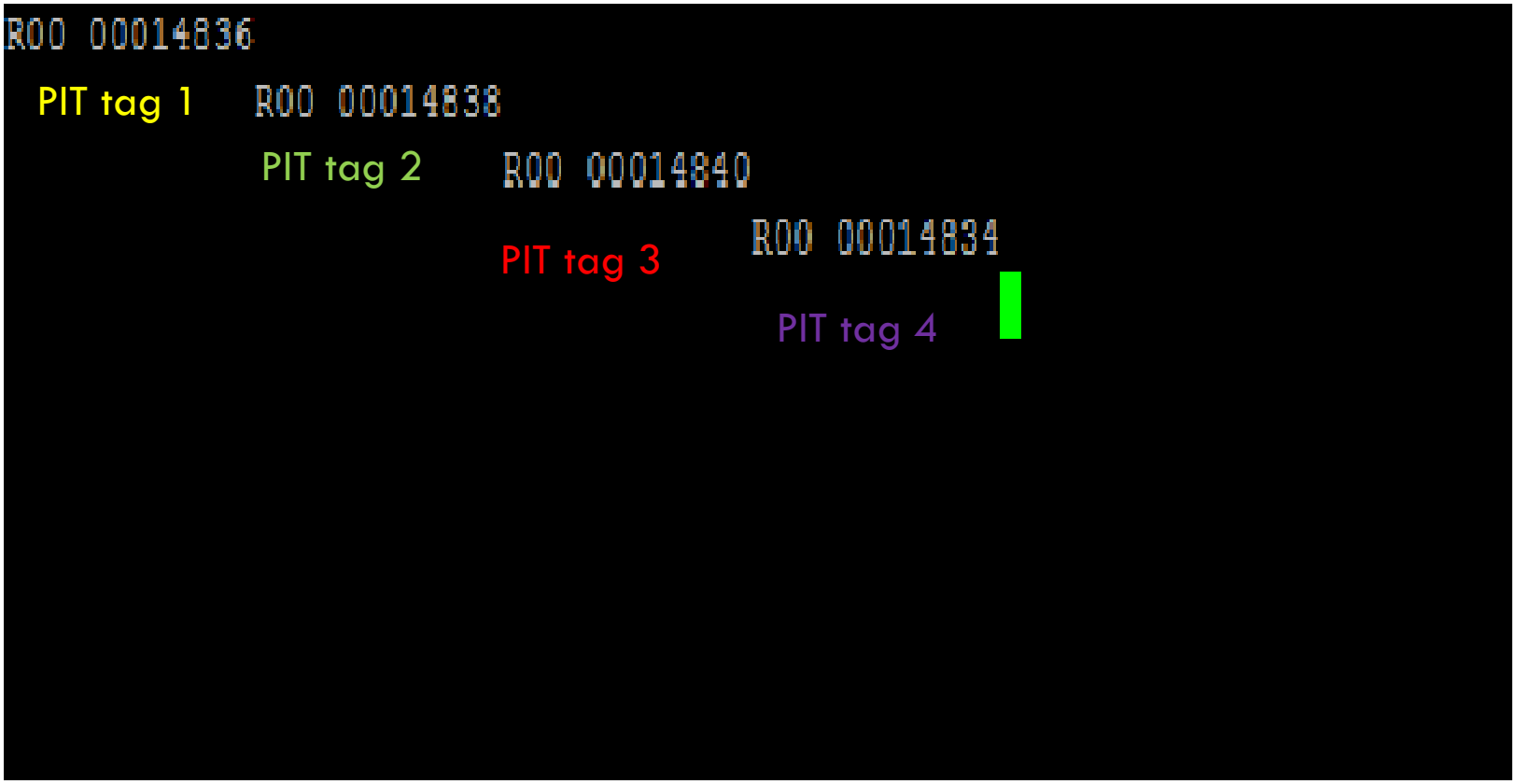
RS232 Output from the RFM/CTL Unit



MAX232 Output of the Signal

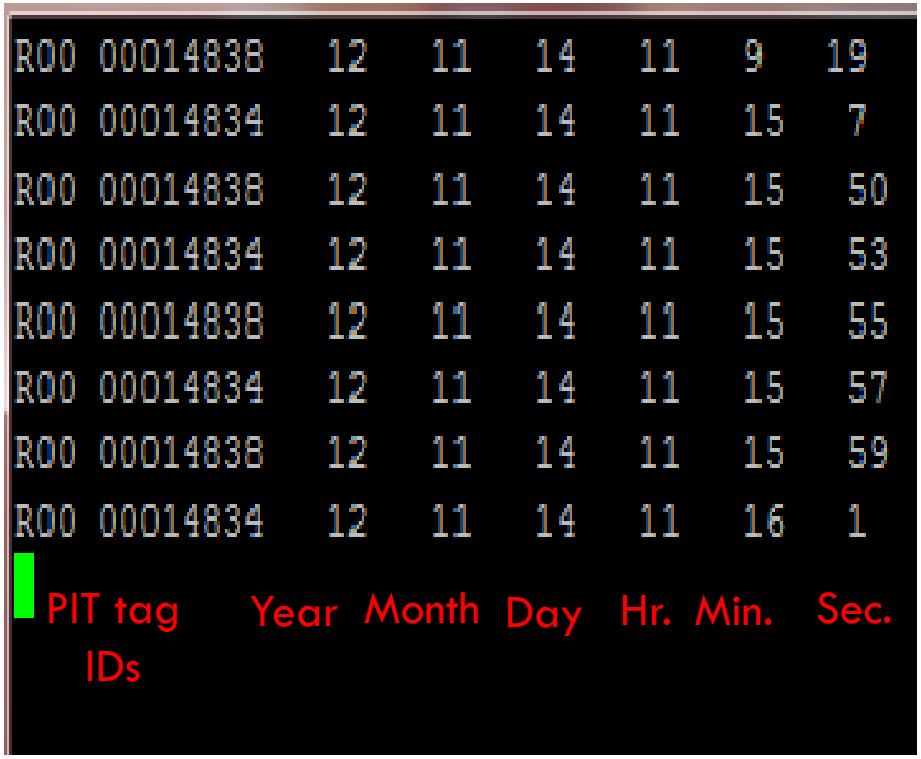


PIT Tag IDs


R00 00014836
PIT tag 1
R00 00014838
PIT tag 2
R00 00014840
PIT tag 3
R00 00014834
PIT tag 4

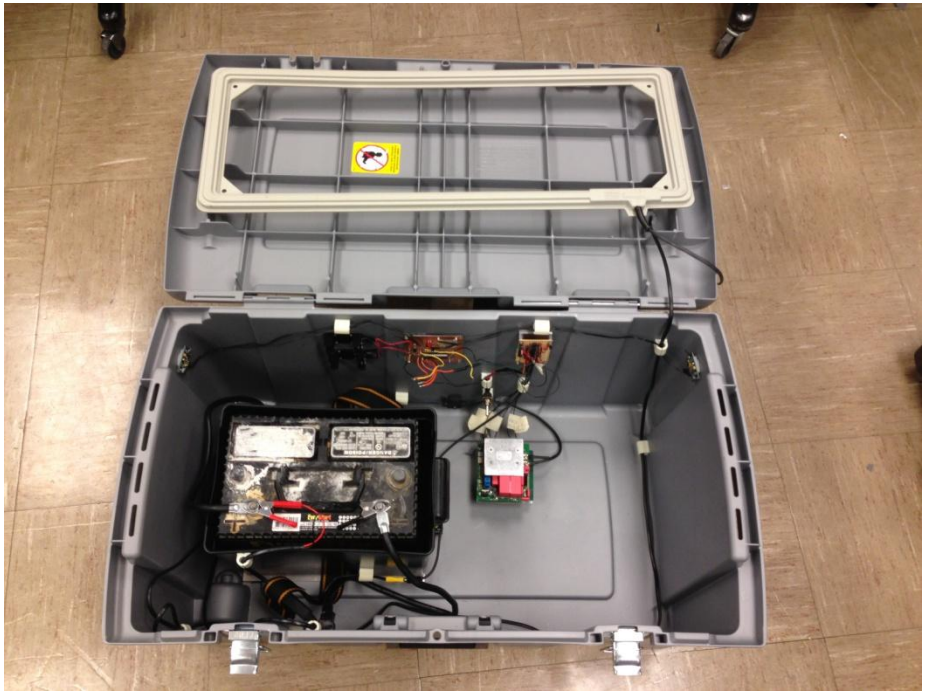
Real Time Clock

- Uses the inbuilt RTCC module in the PIC microcontroller
- Uses external 32.768 kHz clock crystal for stabilization
- Calibration Range: +/- 2.64 seconds error per month



Project Results

- Switching circuit successfully implemented
- PIT tags successfully read by the antenna
- Real time clock provides accurate timestamp



Further Work

- Develop code to write data directly to SD card
- Develop a program to read the data off the card
- Integrate individual code together

Questions?