

# E.E. 3333-001: P01

# Remote Event Sensing

4/24/08

Kyle Romero

Will Gray

Aaron Adcock

Ronjan Mathur

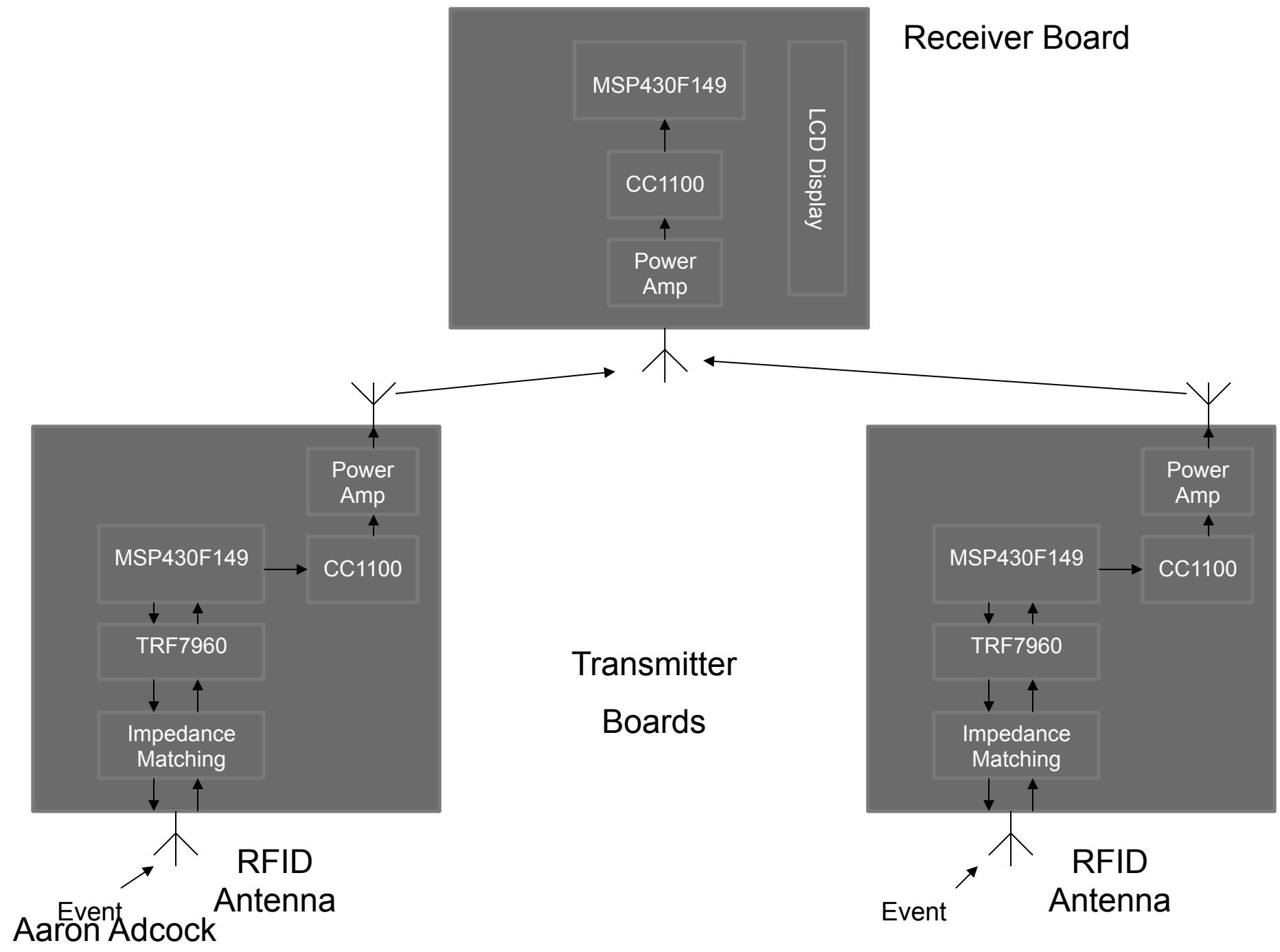
Adviser: Dr. Mitra

# The Project

- The system should have two remote transmitters and one central receiver.
- An event occurs at transmitter 1.
- Within 15 minutes a corresponding event occurs at transmitter 2.
- The time between the two events is to be measured and must be accurate in seconds.
- A power amplifier should be used to maximize transmission distance

# Project Breakdown

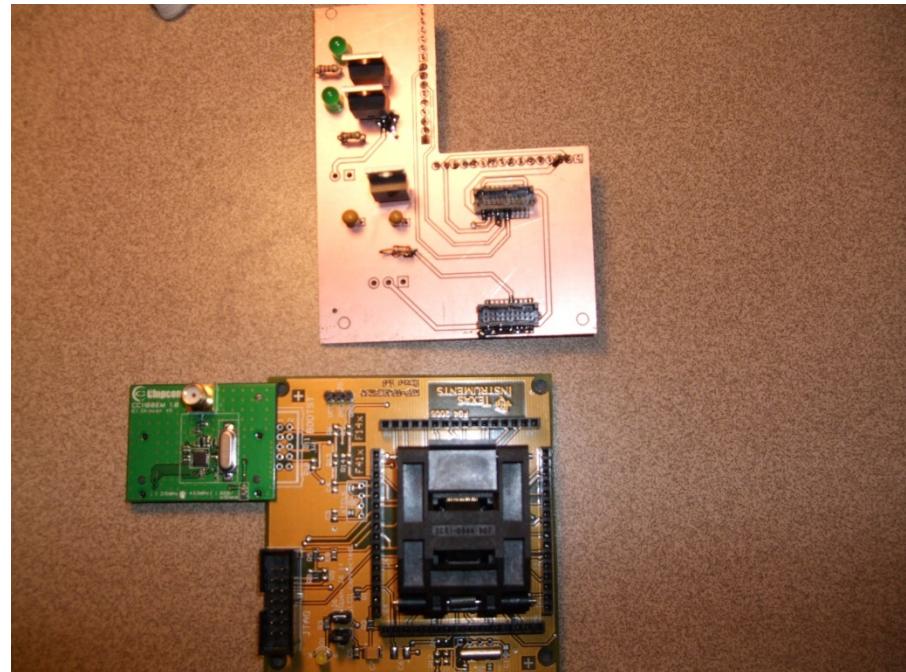
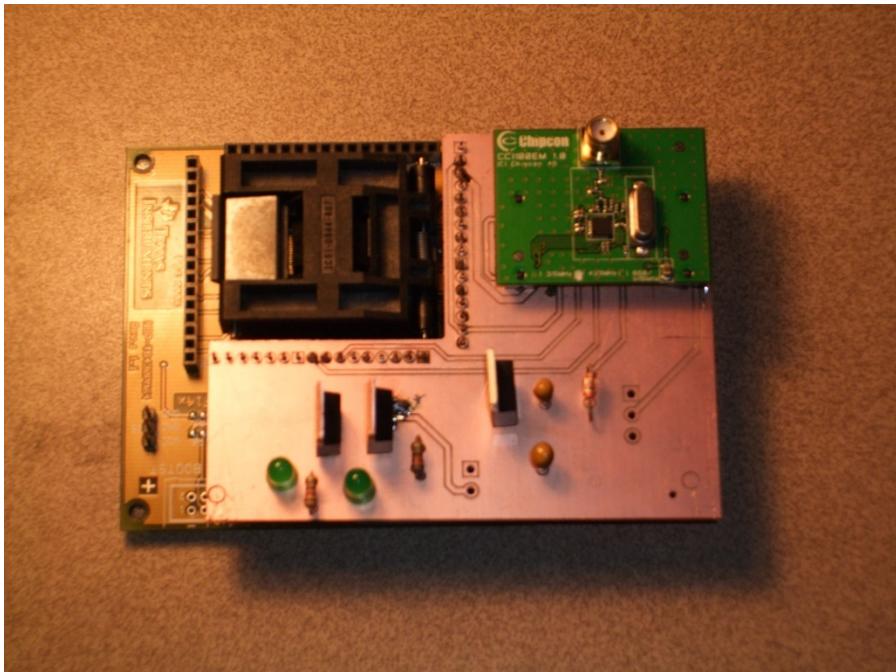
- Will Gray
  - CC1100/MSP430 Board
  - Receiver Board
- Aaron Adcock
  - Transmitter Board
  - RFID
- Kyle Romero
  - Software
- Ronjan Mathur
  - Power Amplifier



# CC1100/MSP430 Board

# CC1100-MSP430 Board

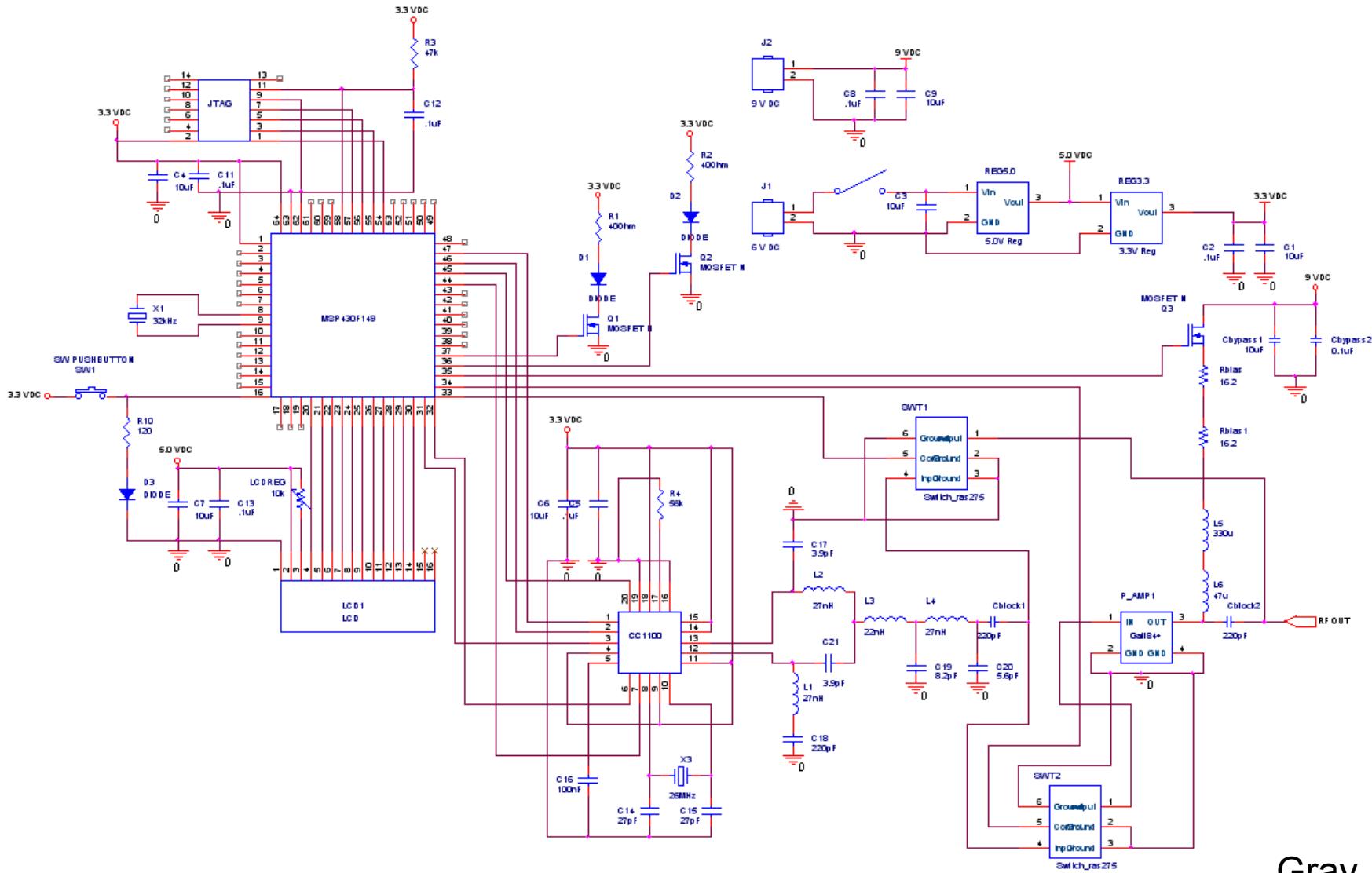
- For Communication Between MSP430 Clamshell and CC1100 Daughterboard.



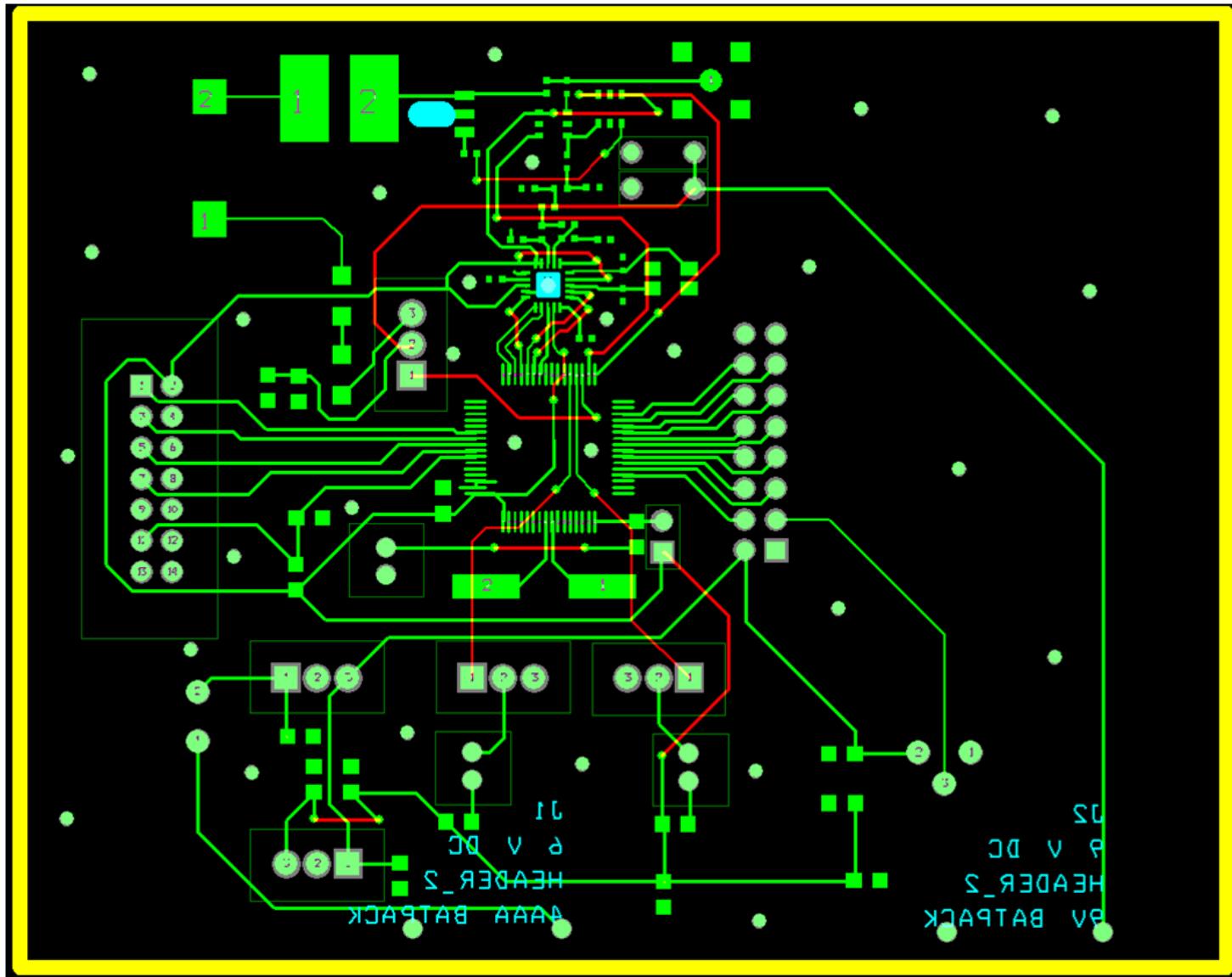
Gray

# Receiver Board

# Receiver Board

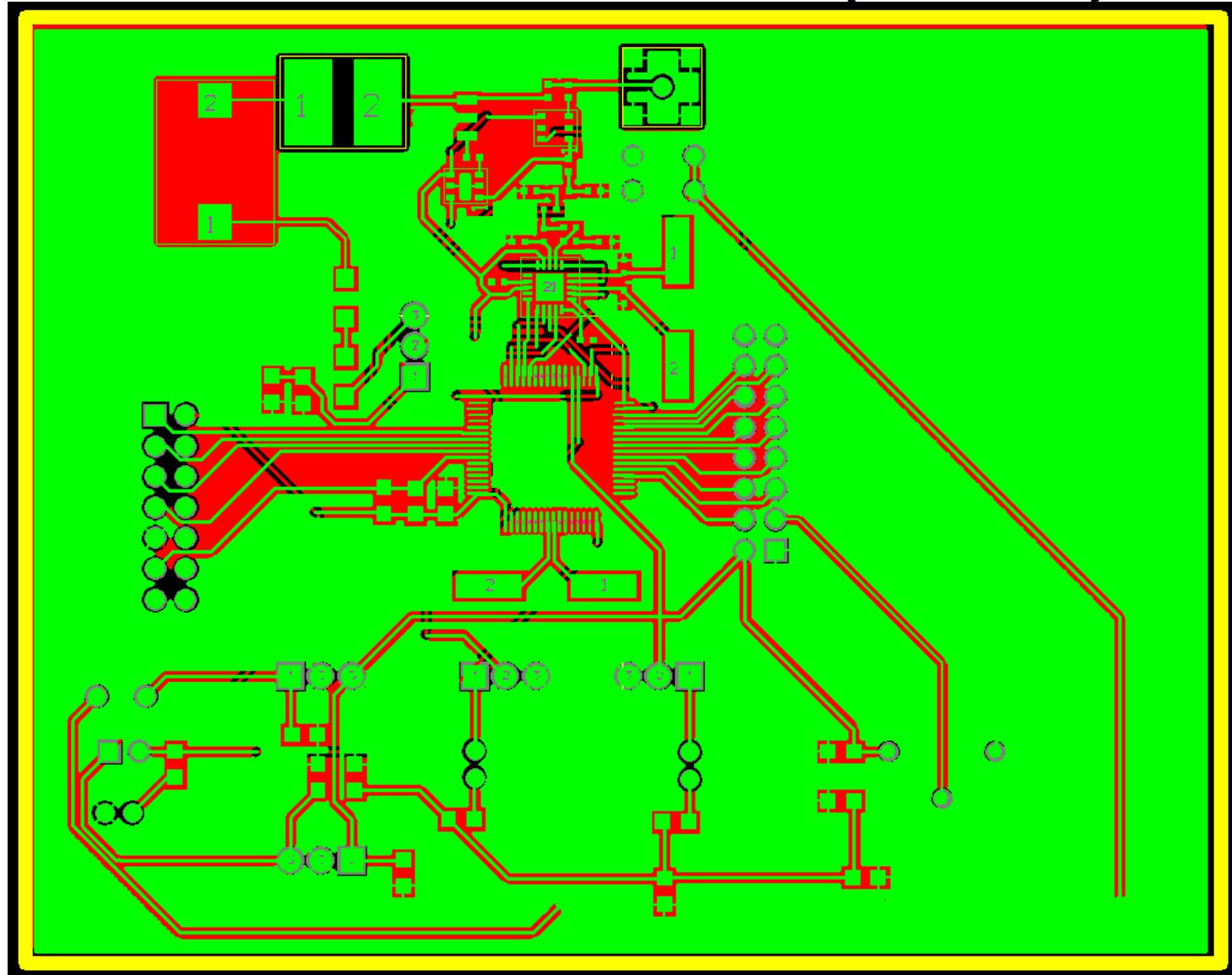


# Receiver Board (cont.)

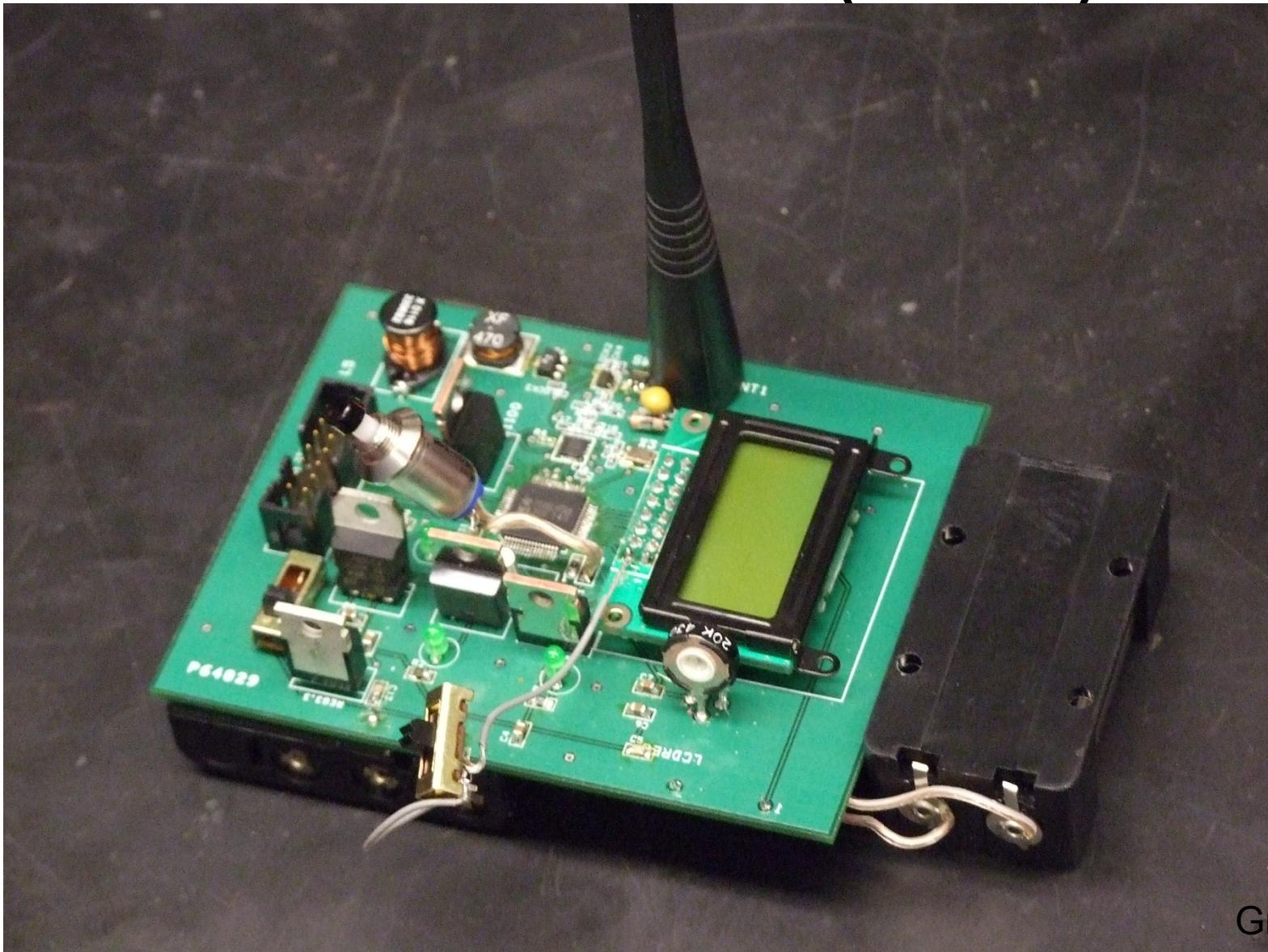


Gray

# Receiver Board (cont.)



# Receiver Board (cont.)



Gray

# General Board Parts

General Board Parts Purchases			
Item	Qty.	CPU(Cost/Unit)	Total
MSP430F149	3	\$10.10	\$30.30
4 'AAA' Battery Mount	5	\$0.99	\$4.95
9V Batteries	5	\$3.10	\$15.50
9V Battery Mount	5	\$1.10	\$5.50
3.3V Linear Regulator	5	\$0.33	\$1.65
5.0V Linear Regulator	5	\$0.45	\$2.25
CC1100	5	\$4.61	\$23.05
100nF 0402	5	\$0.11	\$0.55
27pF 0402	10	\$0.05	\$0.50
3.9pF 0402	10	\$0.05	\$0.50
8.2pF 0402	5	\$0.05	\$0.25
5.6pF 0402	5	\$0.05	\$0.25
220pF 0402	15	\$0.10	\$1.50
27nH 0402	15	\$0.09	\$1.35
22nH 0402	5	\$0.07	\$0.35

Gray

# General Board Parts (cont.)

General Board Parts Purchases			
Item	Qty.	CPU(Cost/Unit)	Total
56k ohm 0402	5	\$0.02	\$0.10
16.2 ohm 0402	5	\$0.10	\$0.50
120 ohm 0805	5	\$0.05	\$0.25
40 ohm 0805	5	\$0.05	\$0.25
16.2 ohm 0805	5	\$0.10	\$0.50
120 ohm 0805	5	\$0.05	\$0.25
26 MHz XTAL	5	\$1.65	\$8.25
RF Switch	10	\$0.11	\$1.10
Power Amplifier	3	\$1.10	\$3.30
IRL540N MOSFET	10	\$0.12	\$1.20
330uH 0805	5	\$0.05	\$0.25
47uH 0805	5	\$0.06	\$0.30
0.1uF 0805	15	\$0.05	\$0.75
10uF 0805	15	\$0.07	\$1.05
Coaxial Antenna Jack	4	\$5.43	\$21.72
32 kHz XTAL	5	\$0.12	\$0.60
	Total		\$128.82

Gray

# General Board Parts (cont.)

Receiver Board_0 Parts Purchases			
Item	Qty.	CPU(Cost/Unit)	Total
LEDs	8	\$0.12	\$0.96
JTAG Header	3	\$1.41	\$4.23
Pushbutton	2	\$4.45	\$8.90
AAA Batteries	9	\$0.99	\$8.91
	Total		\$23.00

Gray

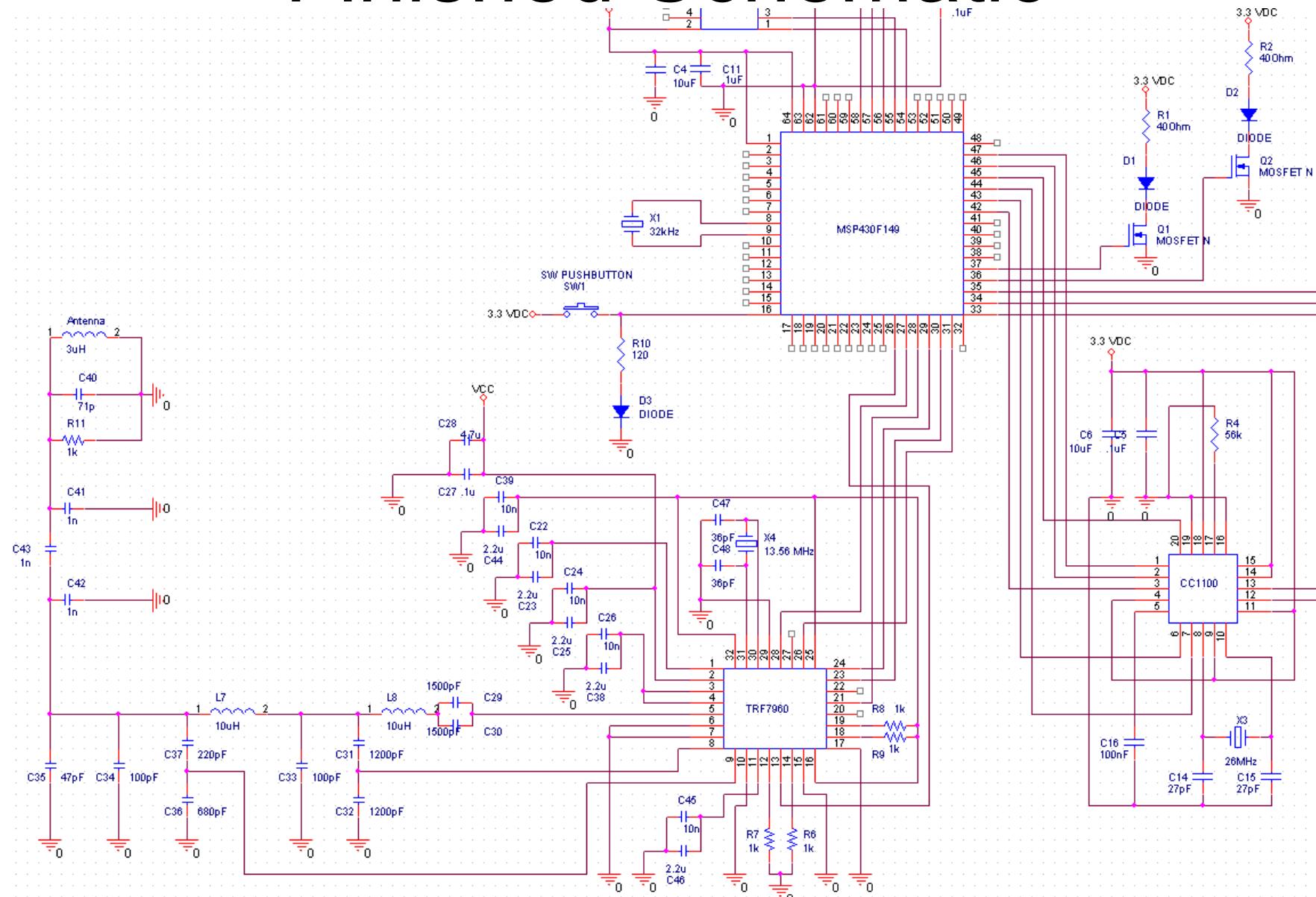
# Receiver Board Specific Parts

Receiver Board Parts Purchases			
Item	Qty.	CPU(Cost/Unit)	Total
0.1uF 0805	3	\$0.05	\$0.15
10uF 0805	3	\$0.07	\$0.21
10k Pot.	2	\$0.12	\$0.24
LCD Screen	1	\$22.19	\$22.19
	Total		\$22.79

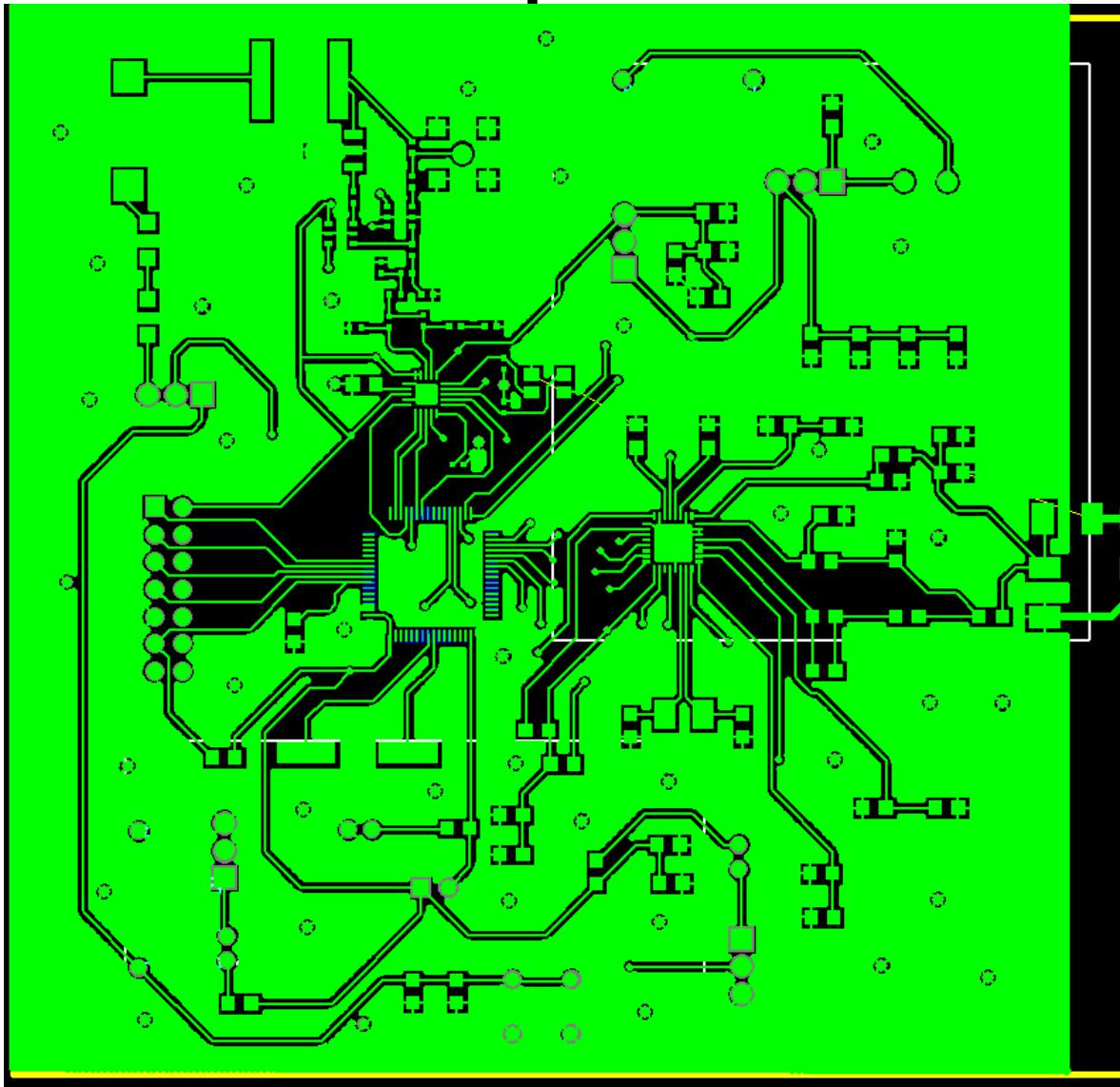
Gray

# Transmitter Board

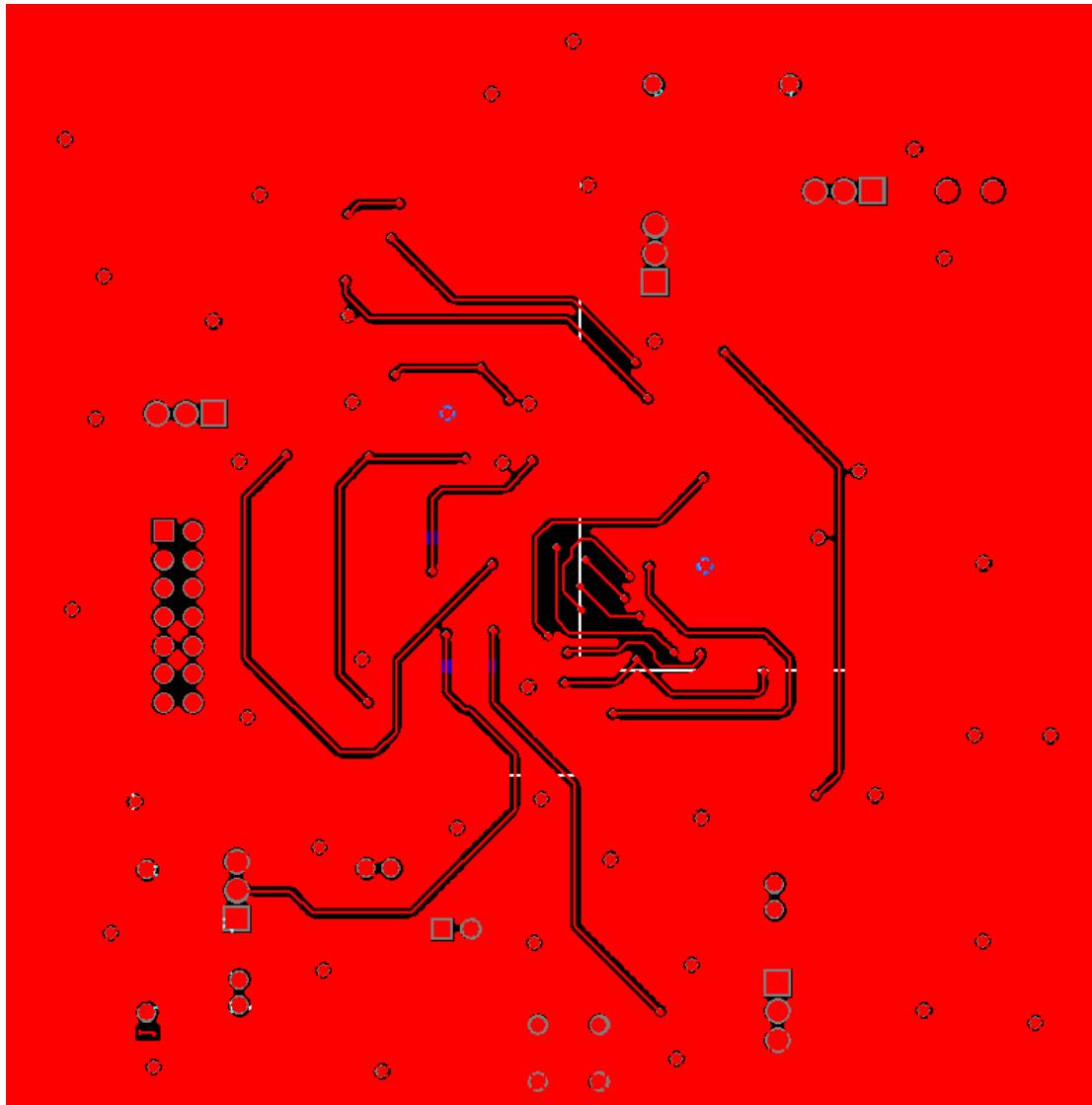
# Finished Schematic



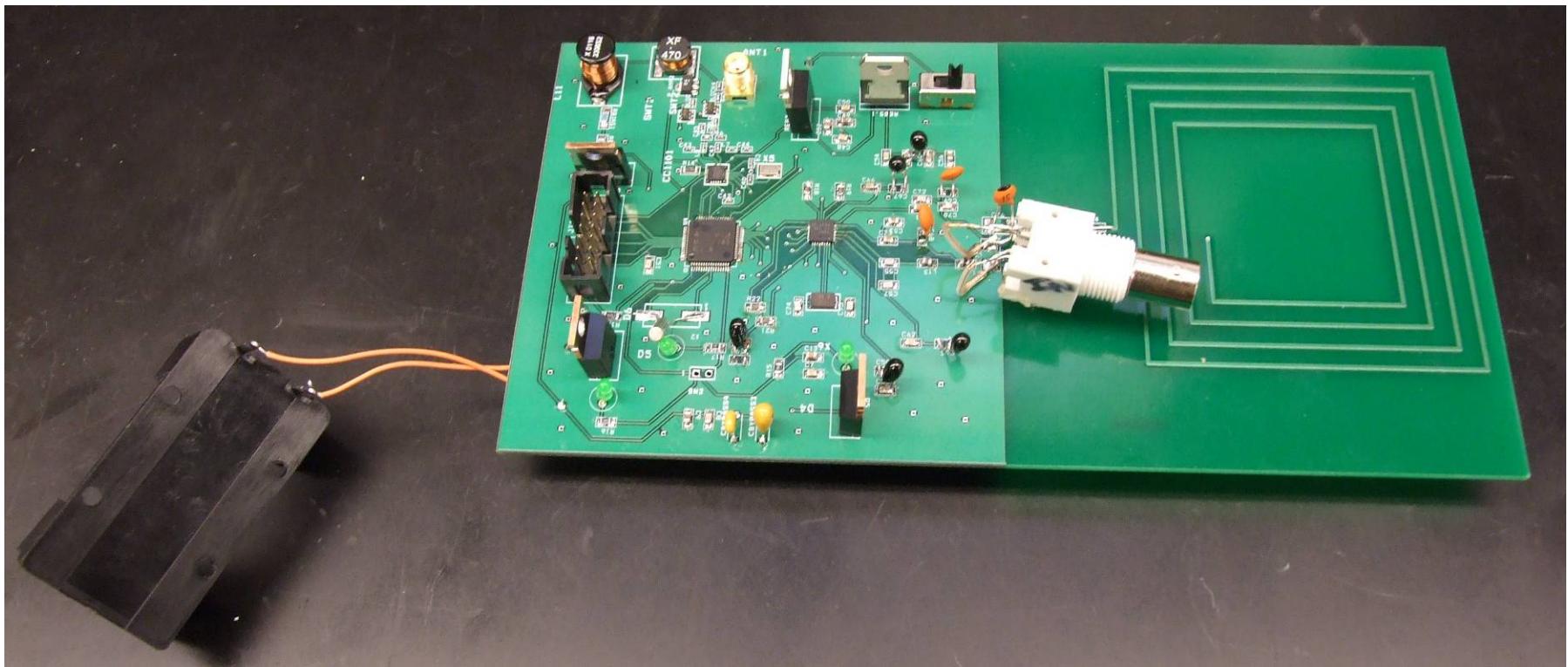
# Top Side



# Bottom Side



# Populated Board



# RFID

# TRF7960

- 13.56 MHz
- Output power: 100, 200 mW (@5V)
- Flexible (various modulations/encoding options)
- Multiple protocols
- Made for use with TI MCU's
- Obtained for free

# RFID Antenna

## Square Spiral Inductor Formula

$$L = 9.375 * \mu * n^2 * (d_{avg})^2 / (11 * d_{out} - 7 * d_{avg})$$

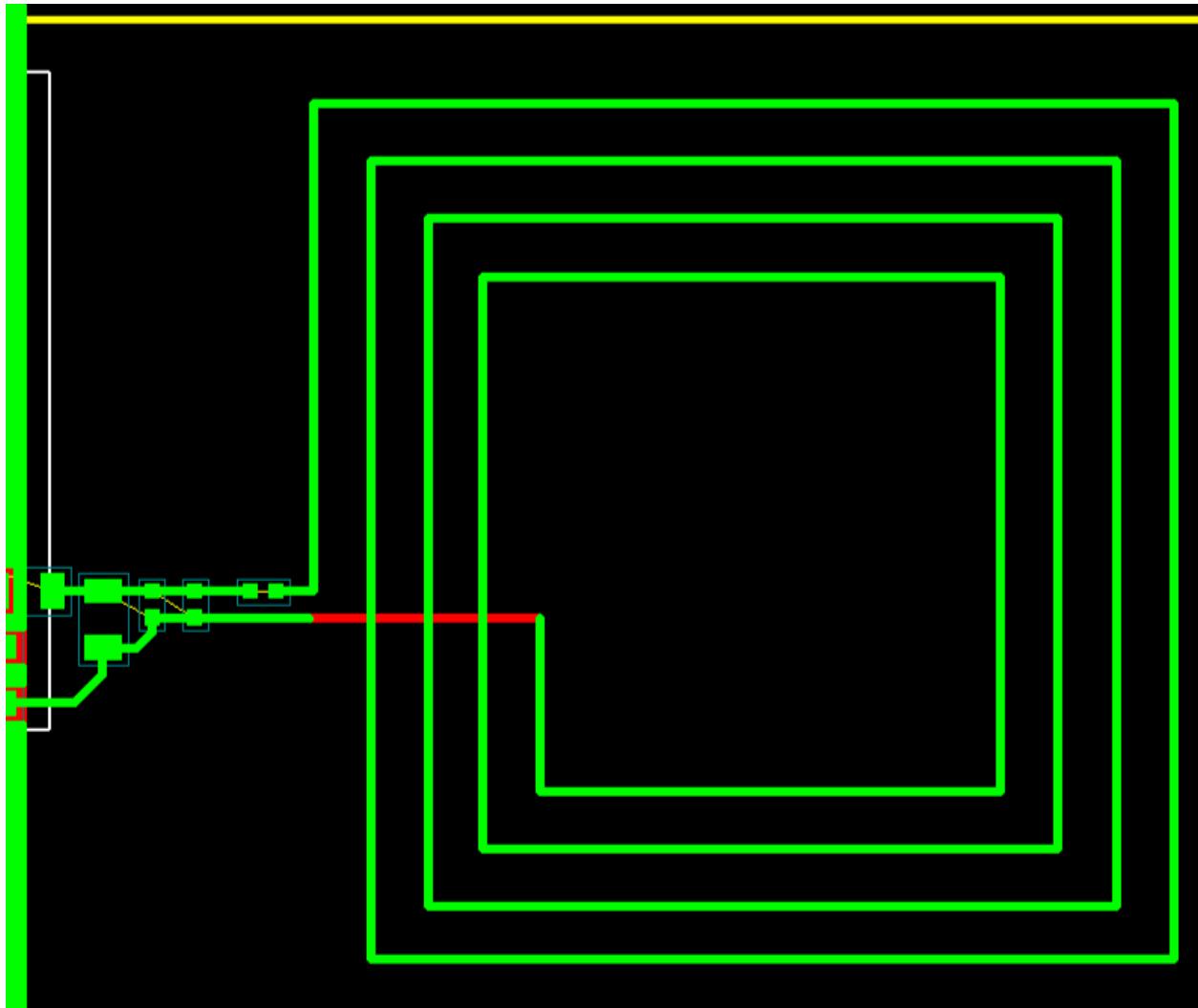
Specifically for Integrated Circuits

$$L = 1.94 \text{ } \mu\text{H}$$

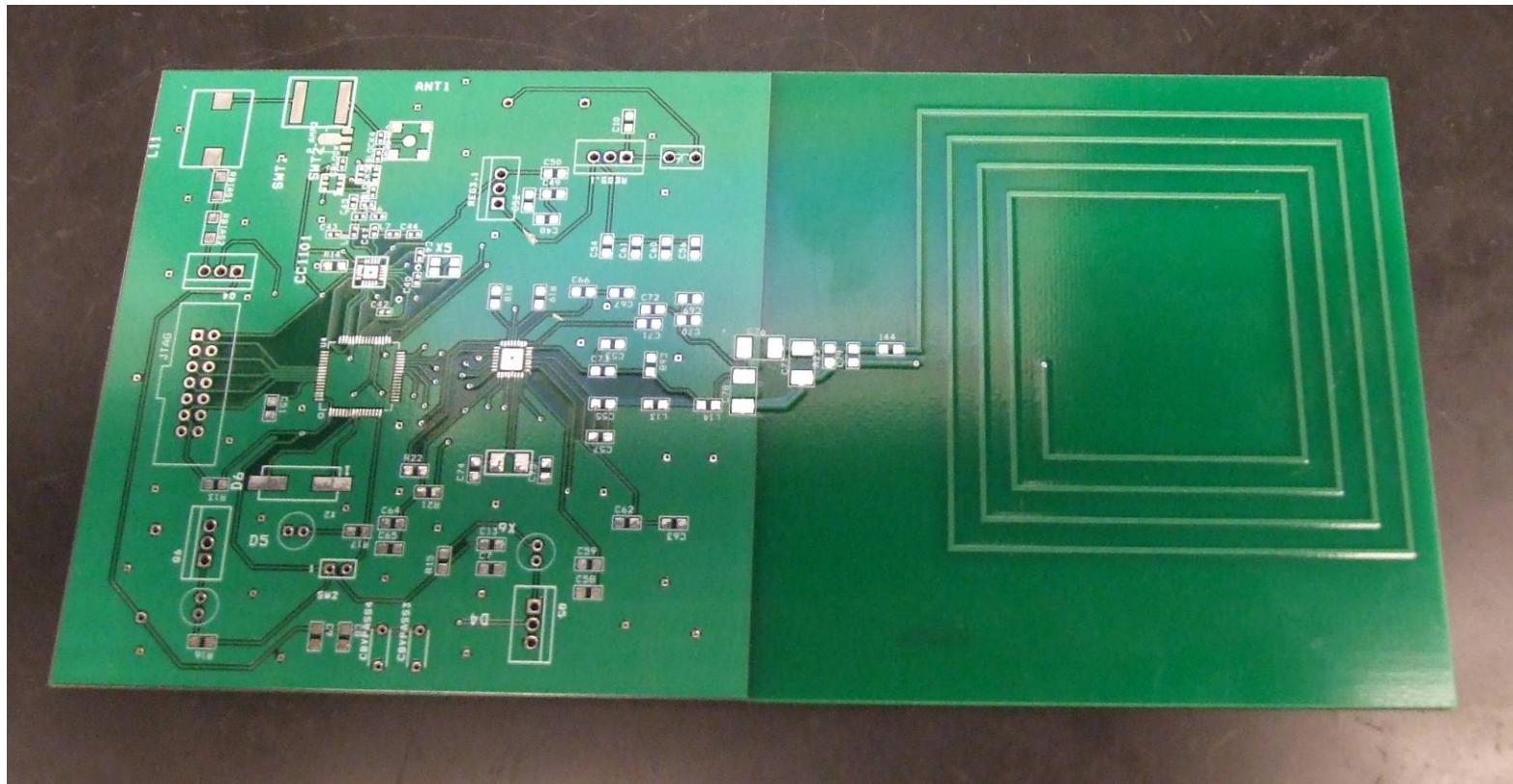
$$C = 71 \text{ } \text{pF}$$

Dr. Saed

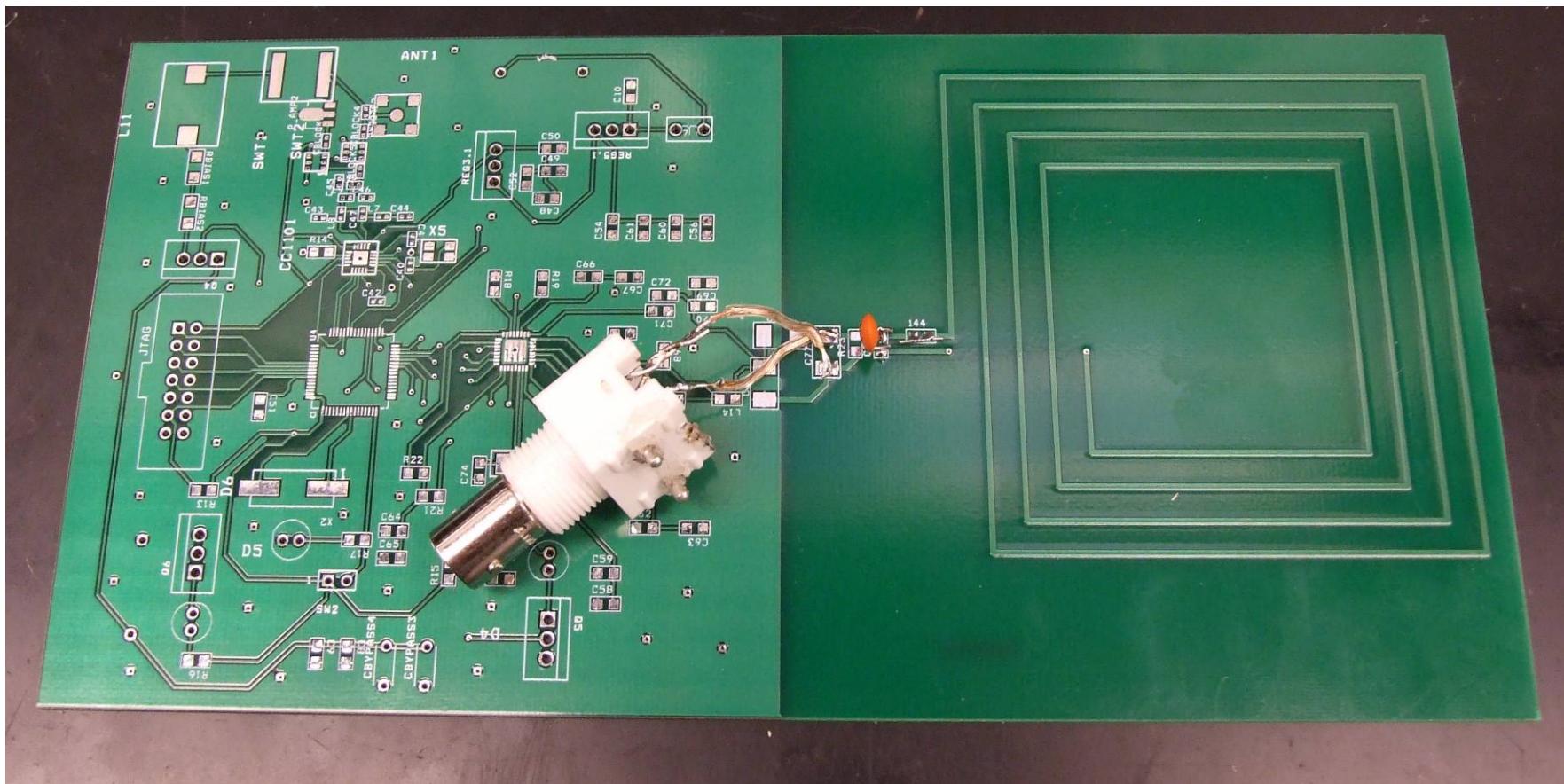
# Antenna



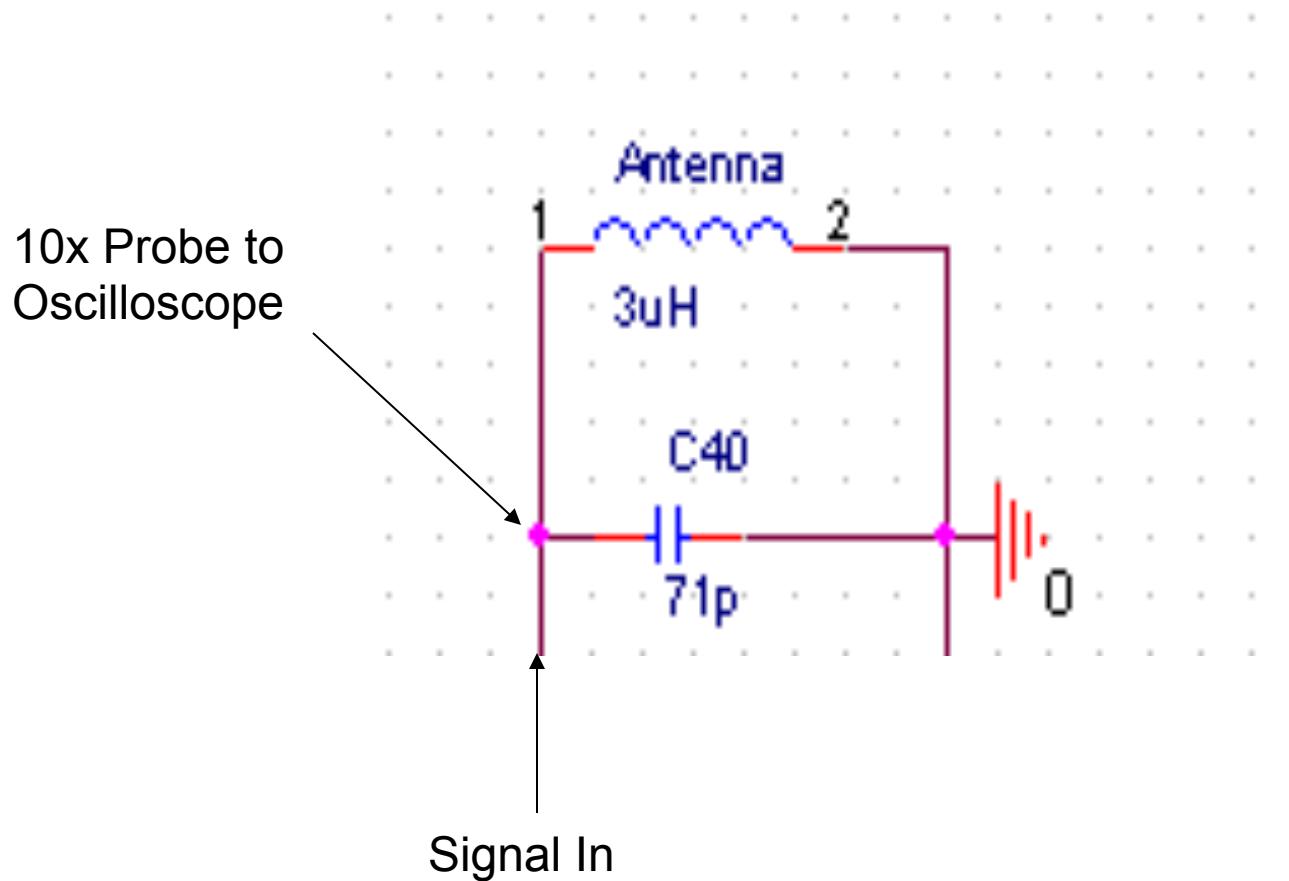
# PCB



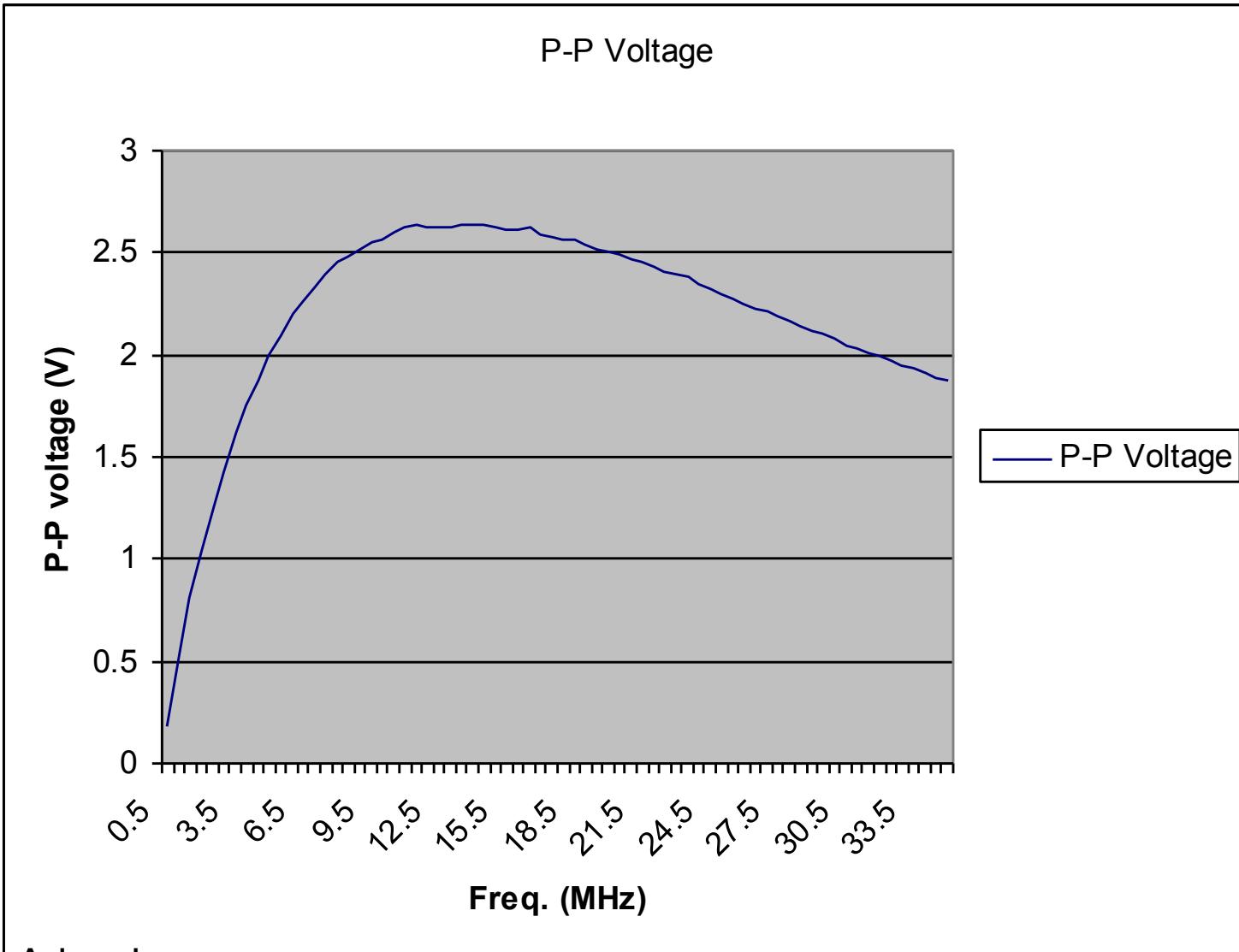
# Antenna Testing



# Test Circuit



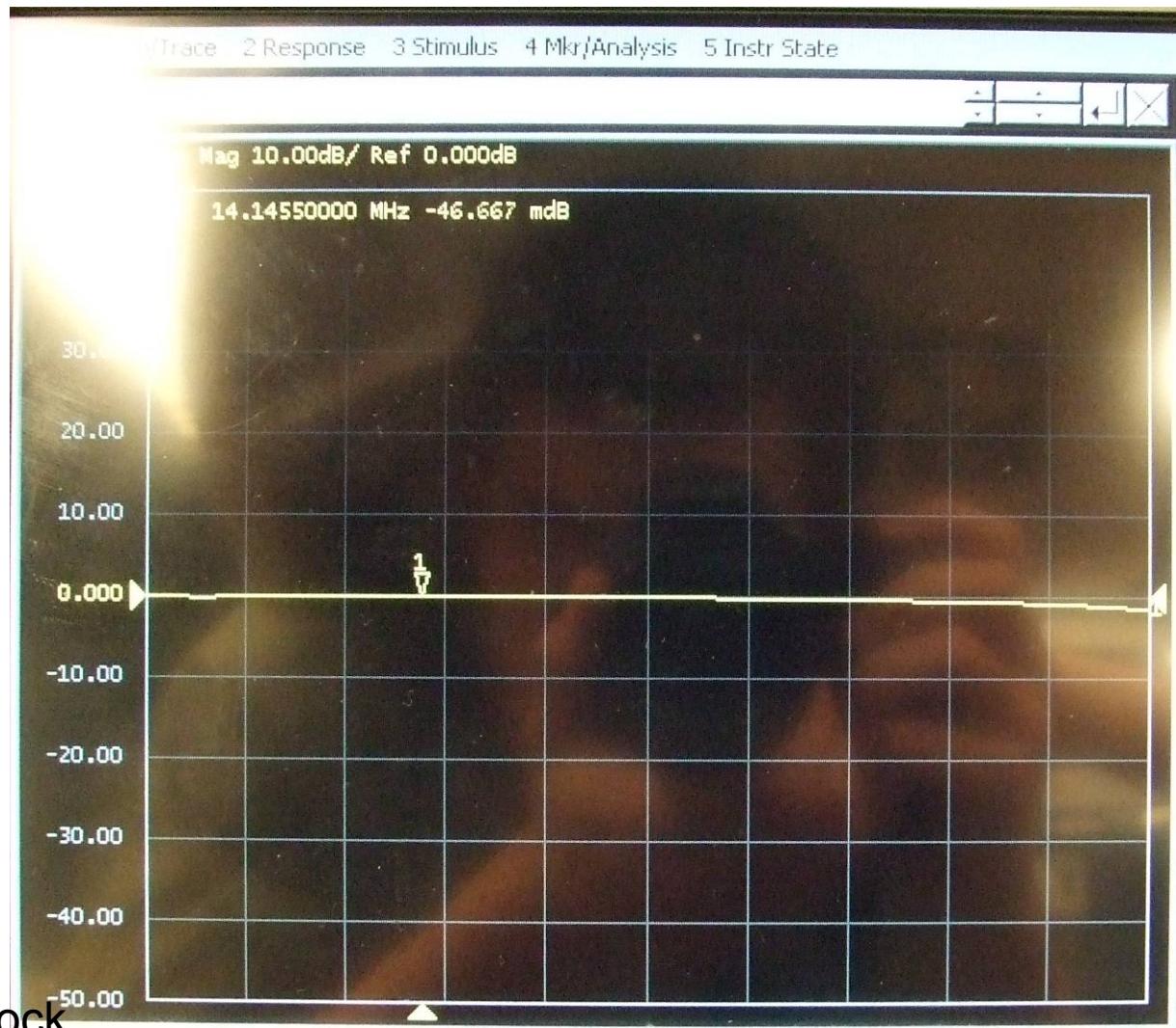
# Resonance Data



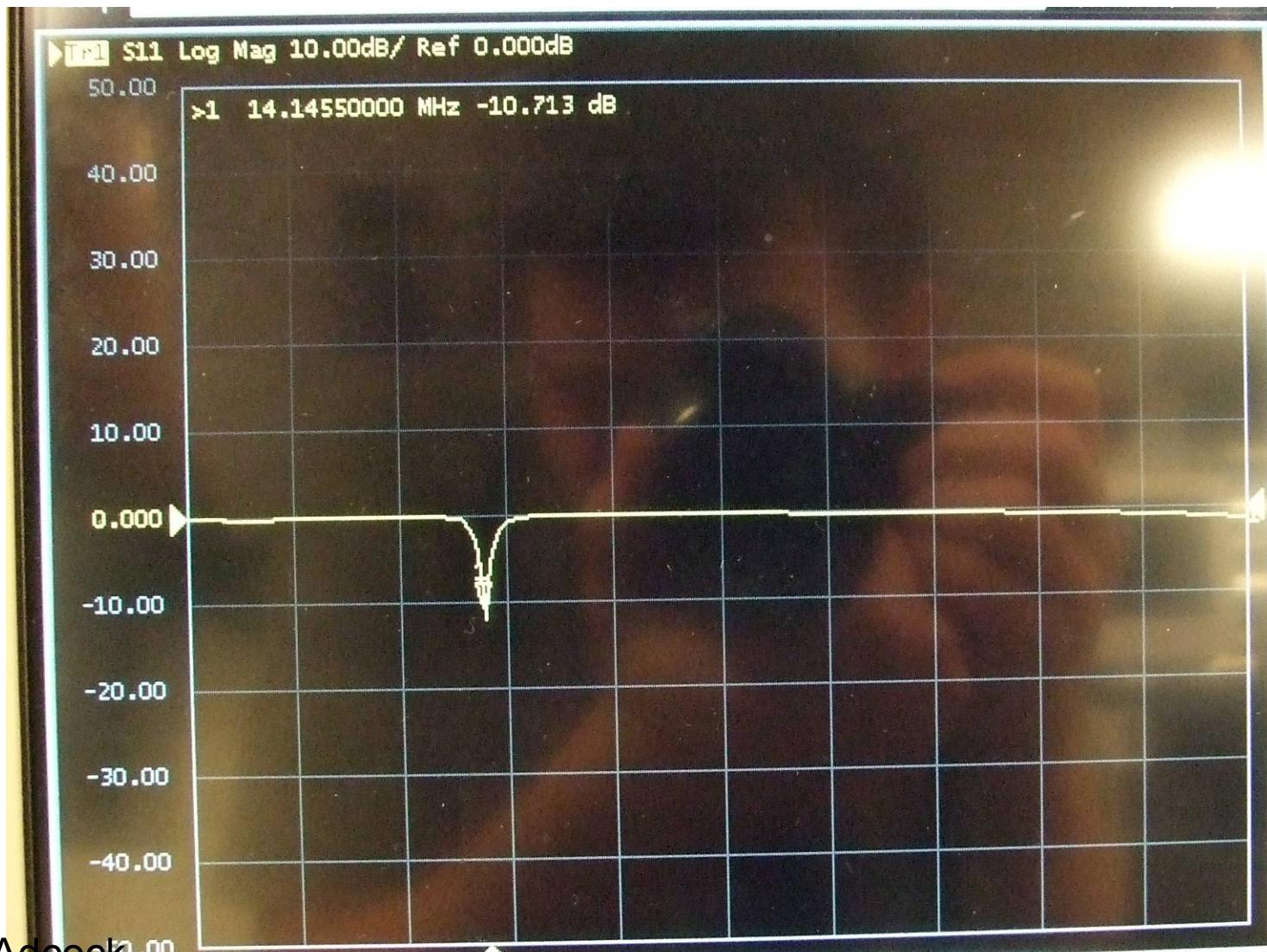
# Testing Odd's & Ends

- Using above data: 3-dB points at 4.5 MHz and 35 MHz
- $Q = \omega/BW = .648$
- Used Network Analyzer as well
- Attempted to create an impedance matching network

# Network Analyzer



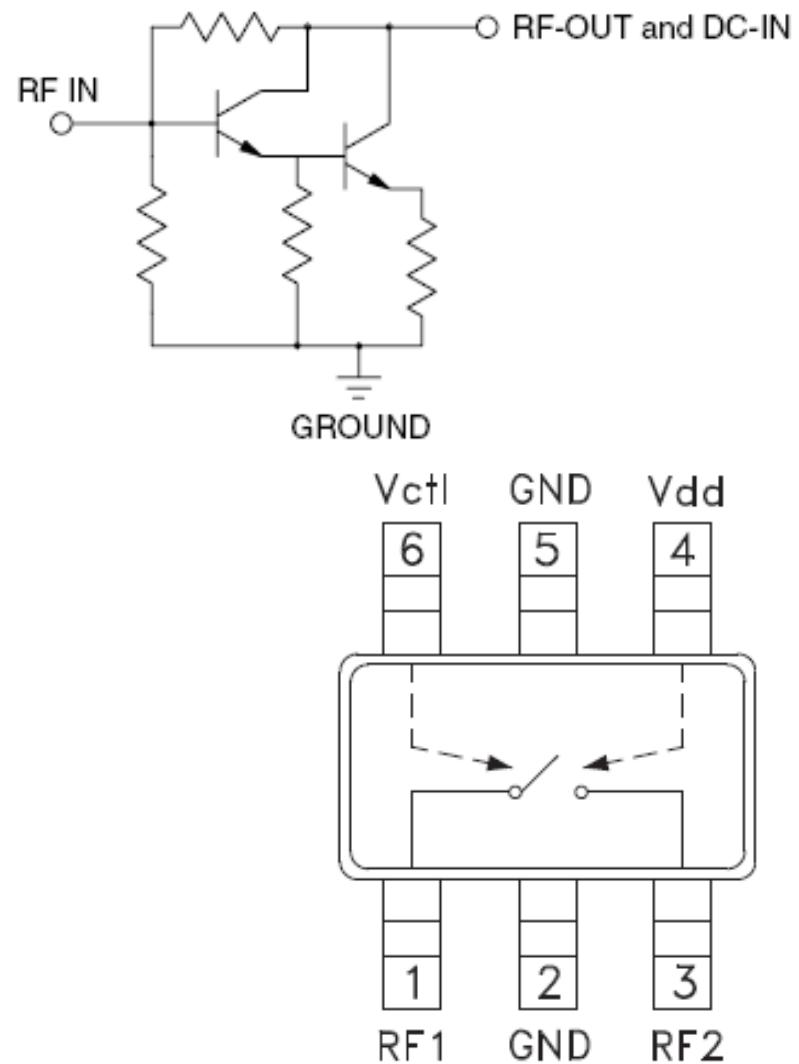
# RFID Tag

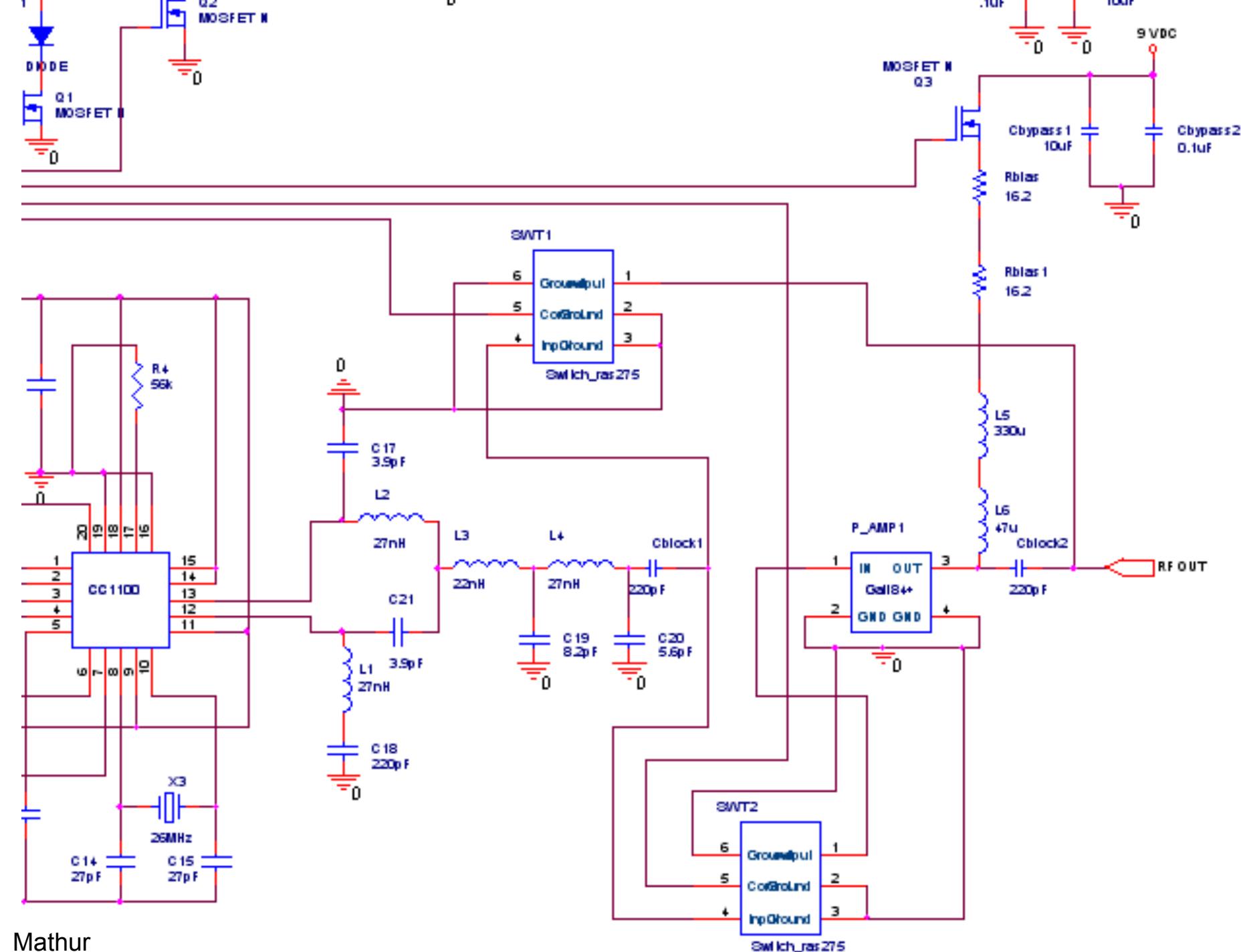


# Power Amplifier

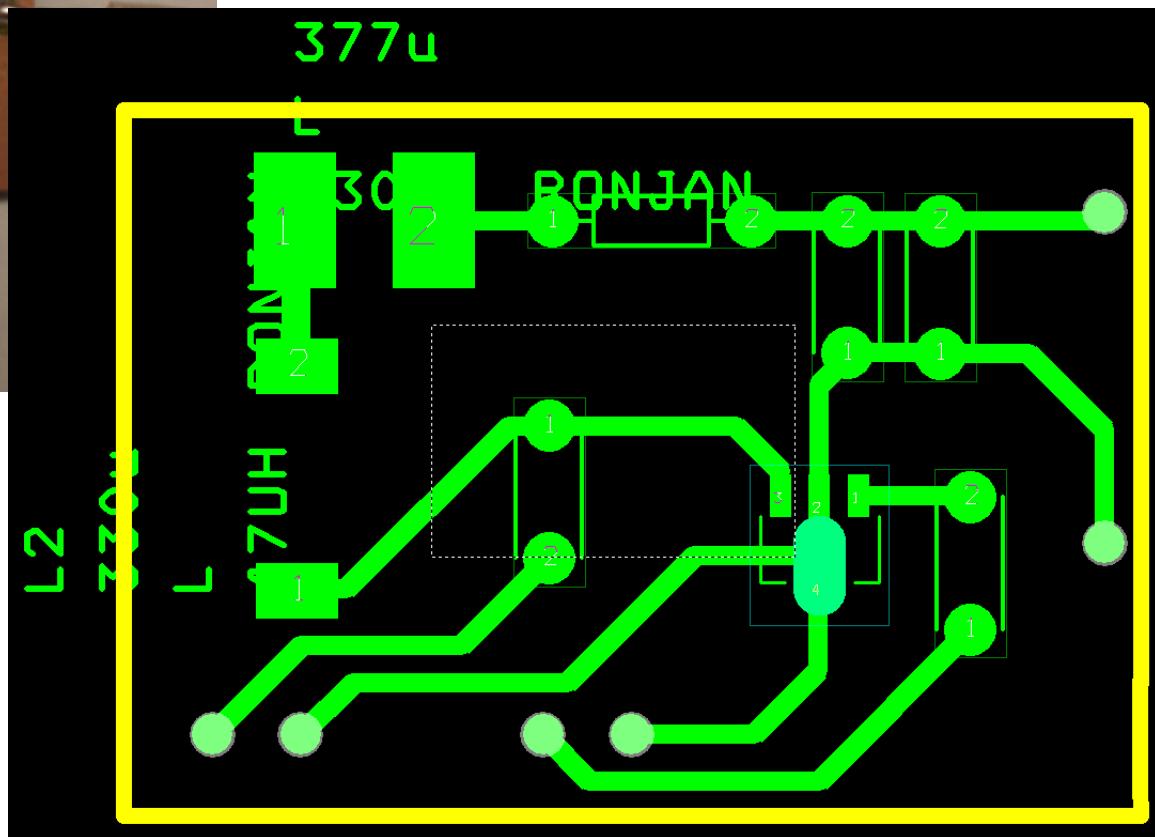
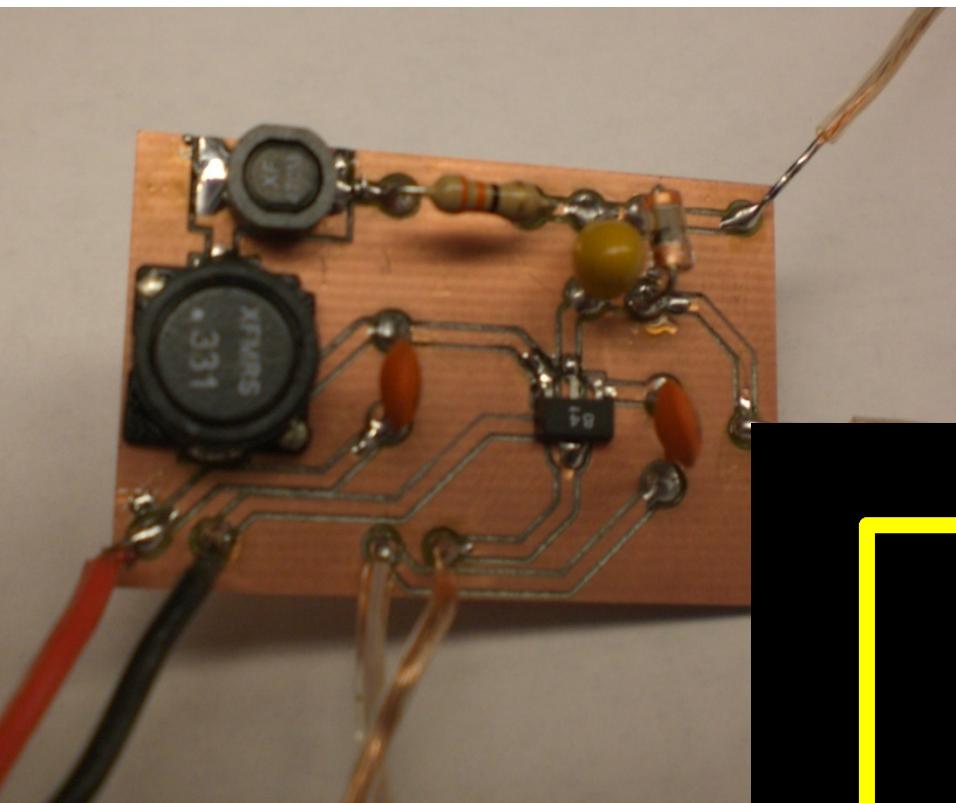
# Power Amplifier

- Gali 84+ from MiniCircuits
  - Max Output @ 1-dB compression: 21.7 dBm
  - Input Gain: 21 dB
- Required to increase effective range of system
- Removable from circuit using HMC550 digitally controlled switch from Hittite
  - Low power loss switch, ~1 dBm
  - Quick Switching time
  - 25 dBm no-damage power rating

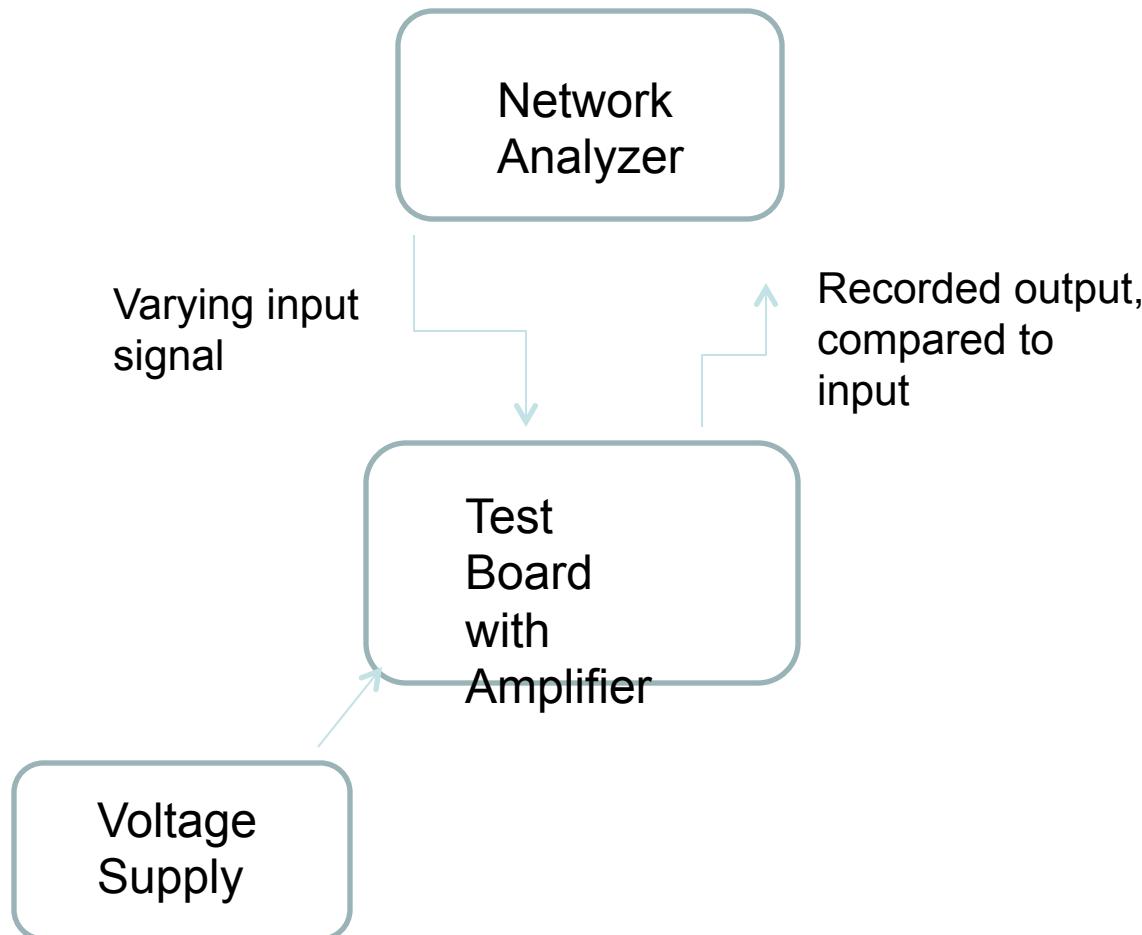




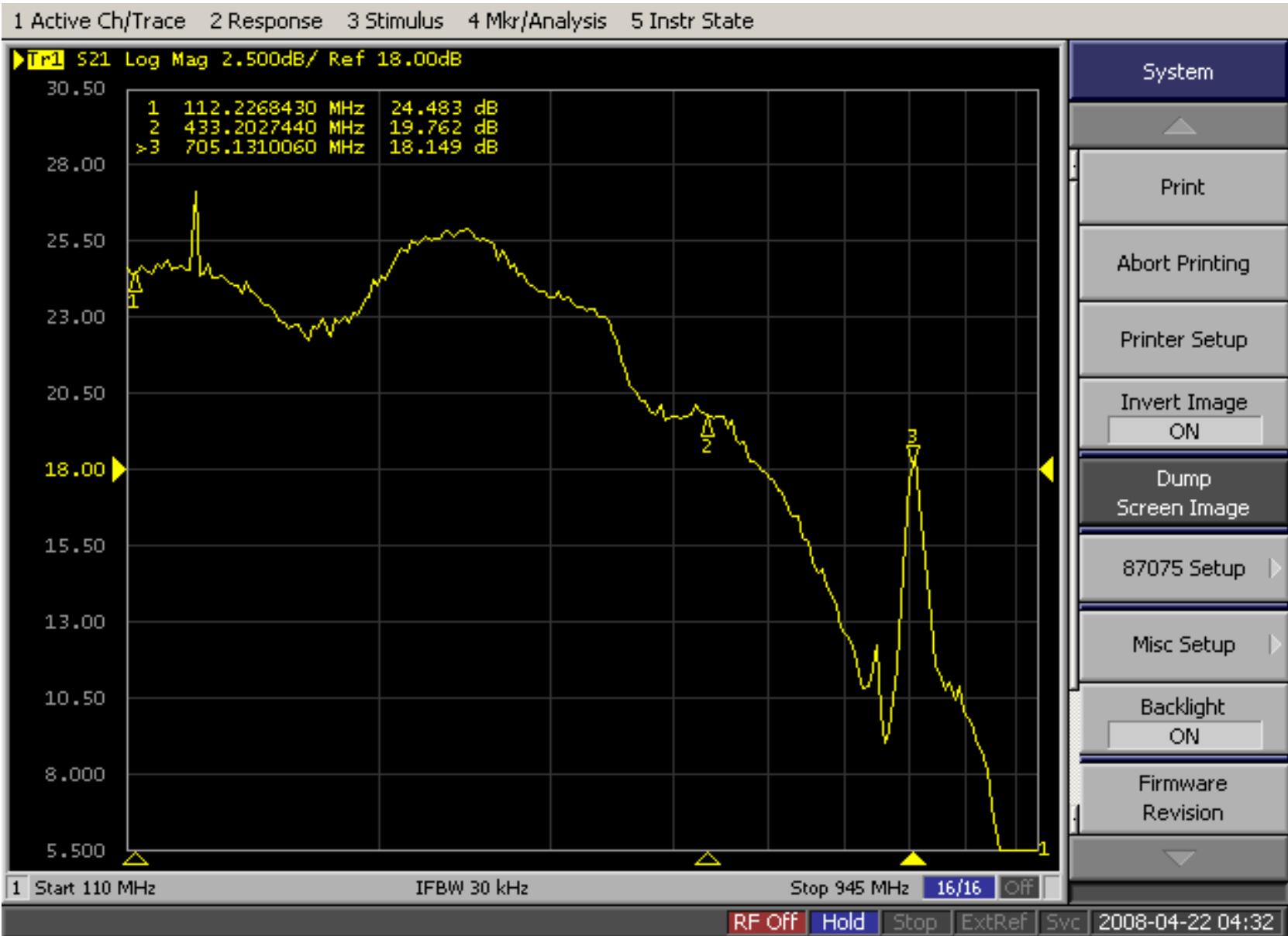
# Amplifier Test Board



# Amplifier Test



# Amplifier Test



# Components for RFID

## Board

<b>Part</b>	<b>Part #</b>	<b>Qty. (per board)</b>	<b>Cost per unit</b>
2.2 uF Capacitor	81-GRM21R60J225KC15L	5	\$0.33
10 uF Capacitor	81-GRM21BR70J106KE76	5	\$0.48
4.7 uF Capacitor	81-GRM40034R475K6L	1	\$0.40
0.1 uF Capacitor	81-GRM40X104KA01D	1	\$0.08
1.2 uF Capacitor	80-C0805C125K9P	2	\$0.45
100 pF Capacitor	81-GRM40C101J50D	2	\$0.08
220 pF Capacitor	80-C0805C125K9P	1	\$0.06
680 pF Capacitor	80-C0805C681KDR	1	\$0.24
47 pF Capacitor	80-C0805C470J5G	1	\$0.05
1.5 nF Capacitor	81-GCM2195C2A152JA6D	2	\$0.16
36 pF Capacitor	80-C08055C360J5G	2	\$0.12

# Parts List

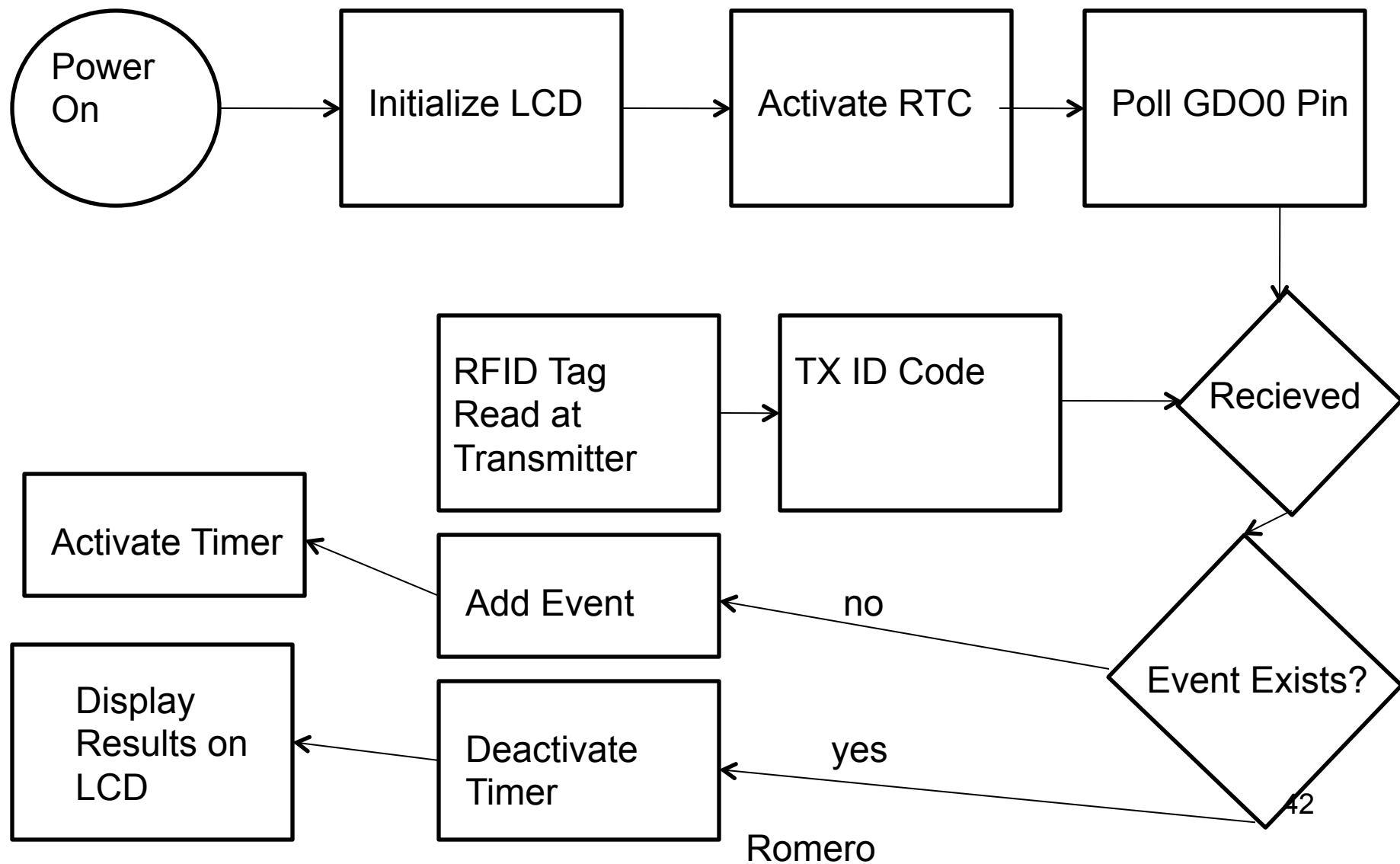
	part number	Amt. (per board)	Cost Per Unit (\$)
27 pF	GRM1555C1H270JZ01D	2	0.05
3.9 pF	GRM1555C1H3R9CZ01D	2	0.05
8.2 pF	GRM1555C1H8R2DZ01D	1	0.05
5.6 pF	GRM1555C1H5R6DZ01D	1	0.05
220 pF	140-CC505N221J	3	0.10
27 nH	LQG15HS27NJ02D	3	0.09
22 nH	MHI0402C22NJT-T	1	0.07
377uH	PE-53826S	1	1.31
16.2 Ω	RK73H2BLTD16R2F	2	0.10

# Software

# Overview

- Working:
  - LCD
  - Real Time Clock
- Coded but not tested
  - CC1100 interface
- Needs to be coded
  - RFID Interface

# Software Flow Chart



# Important Pins

P2.0	LCD	RS
P2.1	LCD	R/W
P2.2	LCD	R/W EN
P2.3	LCD	DB0
P2.4	LCD	DB1
P2.5	LCD	DB2
P2.6	LCD	DB3
P2.7	LCD	DB4
P3.0	LCD	DB5
P3.1	LCD	DB6
P3.2	LCD	DB7
P3.3	N/A	N/A
P3.4	N/A	N/A
P3.5	RFSW 1	P AMP ON/OFF
P3.6	RFSW 2	REG TX ON/OFF
P3.7	P AMP	Power ON/OFF
P4.0	POWER LED 1	LED 1 ON/OFF
P4.1	POWER LED 2	LED 2 ON/OFF
P4.2	N/A	N/A
P4.3	N/A	N/A
P4.4	N/A	N/A
P4.5	N/A	N/A
P4.6	CC1100	GDO2
P4.7	CC1100	GDO0
P5.0	CC1100	CSn
P5.1	CC1100	SI
P5.2	CC1100	SO/GDO1
P5.3	CC1100	SCLK

# LCD

- Used a 2 Line x 8 Character Display from CrystalFontz
- 11 Pins are used
  - Rs: Enable Instruction or Data
  - R/W: Read or Write Mode
  - REN: Enable Pin
    - Push High then drop low to read data pins
  - DB0->DB7: Data Pins

# Initialization

- Requires Predefined Commands to be sent at startup
- Care must be taken to avoid Delay errors or the display will not initialize correctly
- Once initialization is complete, the Cursor will appear at the top left corner of the LCD

upper 4 bits	0 <sub>a</sub> 0000 <sub>2</sub>	16 <sub>a</sub> 0001 <sub>2</sub>	32 <sub>a</sub> 0010 <sub>2</sub>	48 <sub>a</sub> 0011 <sub>2</sub>	64 <sub>a</sub> 0100 <sub>2</sub>	80 <sub>a</sub> 0101 <sub>2</sub>	96 <sub>a</sub> 0110 <sub>2</sub>	112 <sub>a</sub> 0111 <sub>2</sub>	128 <sub>a</sub> 1000 <sub>2</sub>	144 <sub>a</sub> 1001 <sub>2</sub>	160 <sub>a</sub> 1010 <sub>2</sub>	176 <sub>a</sub> 1011 <sub>2</sub>	192 <sub>a</sub> 1100 <sub>2</sub>	208 <sub>a</sub> 1101 <sub>2</sub>	224 <sub>a</sub> 1110 <sub>2</sub>	240 <sub>a</sub> 1111 <sub>2</sub>
0 <sub>a</sub> 0000 <sub>2</sub>	CGROM [0]	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	
1 <sub>a</sub> 0001 <sub>2</sub>	CGROM [1]	! 1A Qaa	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	
2 <sub>a</sub> 0010 <sub>2</sub>	CGROM [2]	" 2B Rbr	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	
3 <sub>a</sub> 0011 <sub>2</sub>	CGROM [3]	# 3C Sos	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	
4 <sub>a</sub> 0100 <sub>2</sub>	CGROM [4]	\$ 4D Tdt	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	
5 <sub>a</sub> 0101 <sub>2</sub>	CGROM [5]	% 5E Ueu	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	
6 <sub>a</sub> 0110 <sub>2</sub>	CGROM [6]	& 6F Ufv	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	
7 <sub>a</sub> 0111 <sub>2</sub>	CGROM [7]	* 7G Wgw	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	
8 <sub>a</sub> 1000 <sub>2</sub>	CGROM [8]	( 8H Xhx	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	
9 <sub>a</sub> 1001 <sub>2</sub>	CGROM [9]	) 9I Y19	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	
10 <sub>a</sub> 1010 <sub>2</sub>	CGROM [10]	*: JZjz	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	
11 <sub>a</sub> 1011 <sub>2</sub>	CGROM [11]	+; KOkk	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	
12 <sub>a</sub> 1100 <sub>2</sub>	CGROM [12]	, < L ¥11	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	
13 <sub>a</sub> 1101 <sub>2</sub>	CGROM [13]	- = M ]m }	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	
14 <sub>a</sub> 1110 <sub>2</sub>	CGROM [14]	. > N ^n →	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	
015 <sub>a</sub> 1111 <sub>2</sub>	CGROM [15]	< ? O _o t	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■	

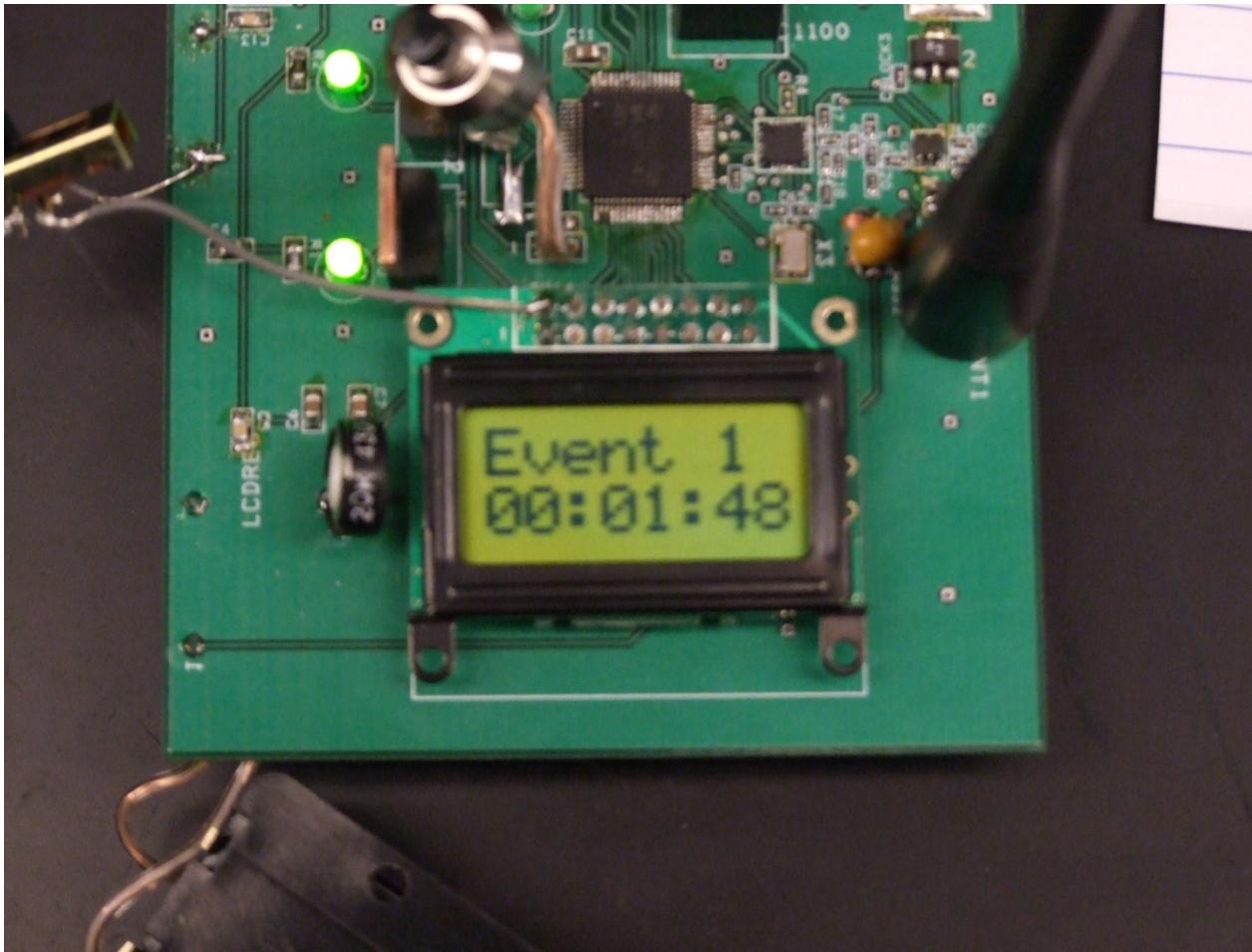
# Character Map

Figure 8. Character Generator ROM (CGROM)  
Romero

# Sending Commands

```
void LcdWriteChar(unsigned char dval)
{
    P2OUT = LCD_RWEN+LCD_RS; // RS E
    P2OUT |= dval <<3;
    P3OUT = dval>>5;
    P3OUT+= POWERAMP;
    P2OUT ^= LCD_RWEN; //
    Delay(100); //waitUntilDone();
} // LcdWriteChar()
```

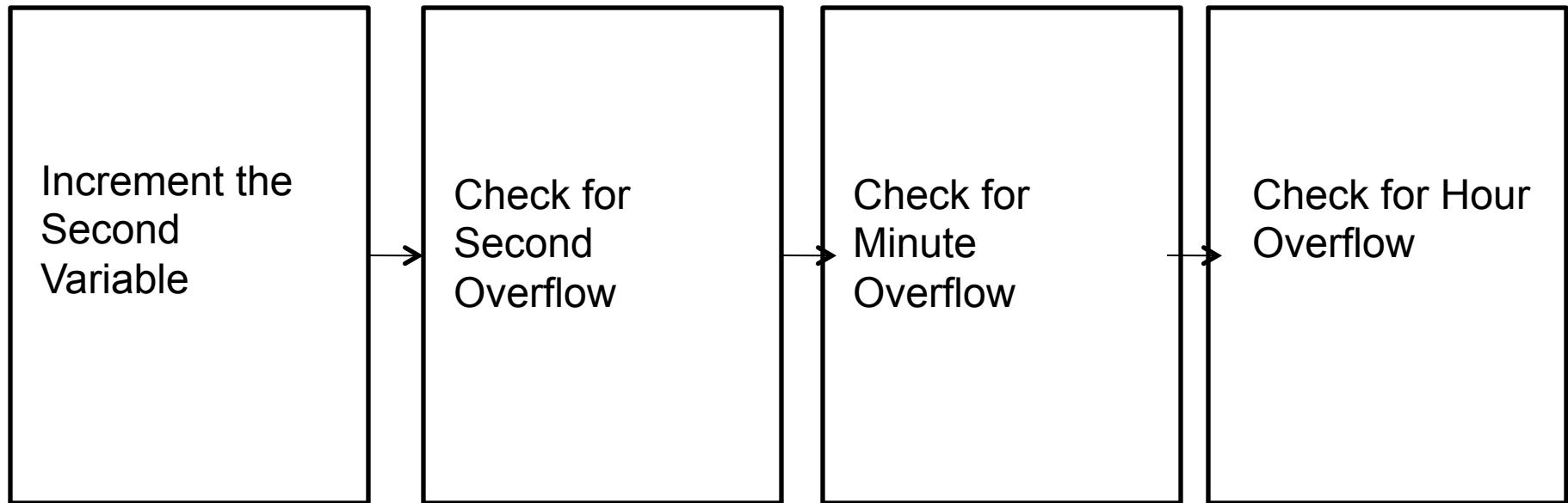
# The LCD Working



# The Timer

- Based off of a Timer A Interrupt
- Connected to the 32kHz Crystal
- Interrupt triggered on timer overflow
  - Set to overflow at 32000
    - This causes the interrupt to occur every 1s
- Upon interrupt enable, tick the real time clock and output current time onto LCD

# Tick Command



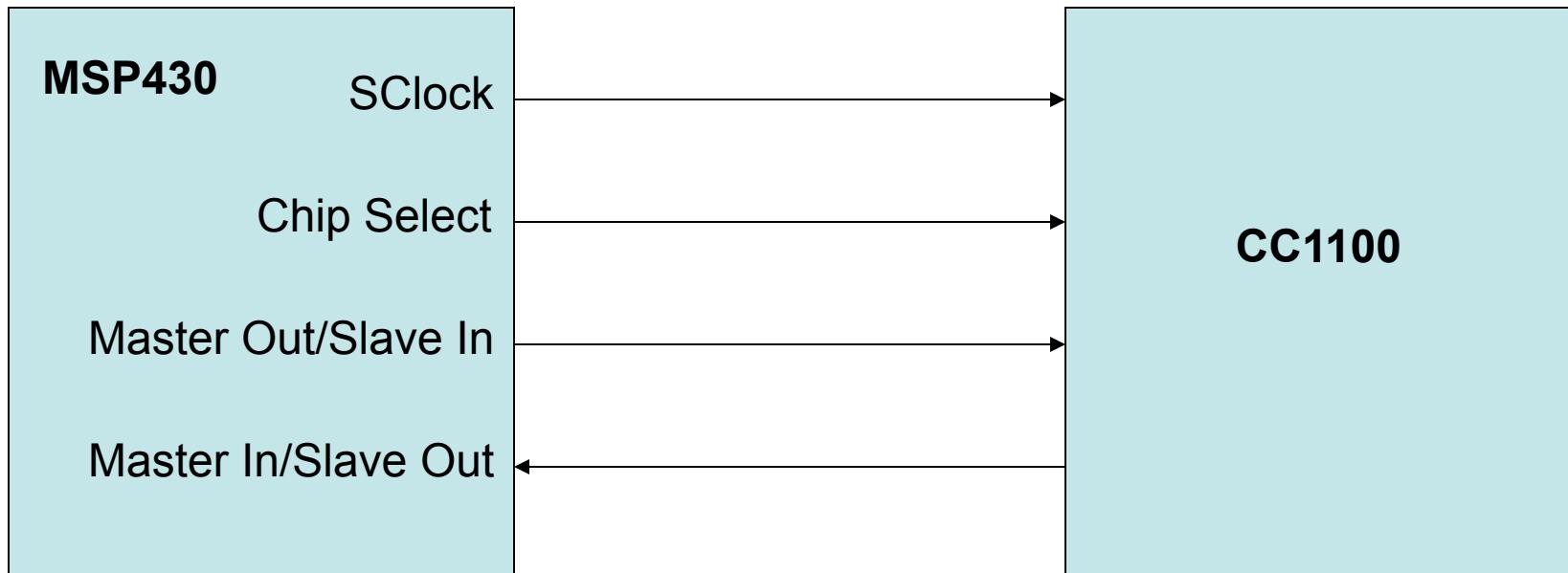
# The CC1100

- GDO0 pin Connected to Port 4
- No interrupt pin on Port 4
  - Requires software polling to detect RX on GDO0 pin
- While Loop at end of main function that checks for signal and then retrieves the data from the transmission.

# CC1100, continued

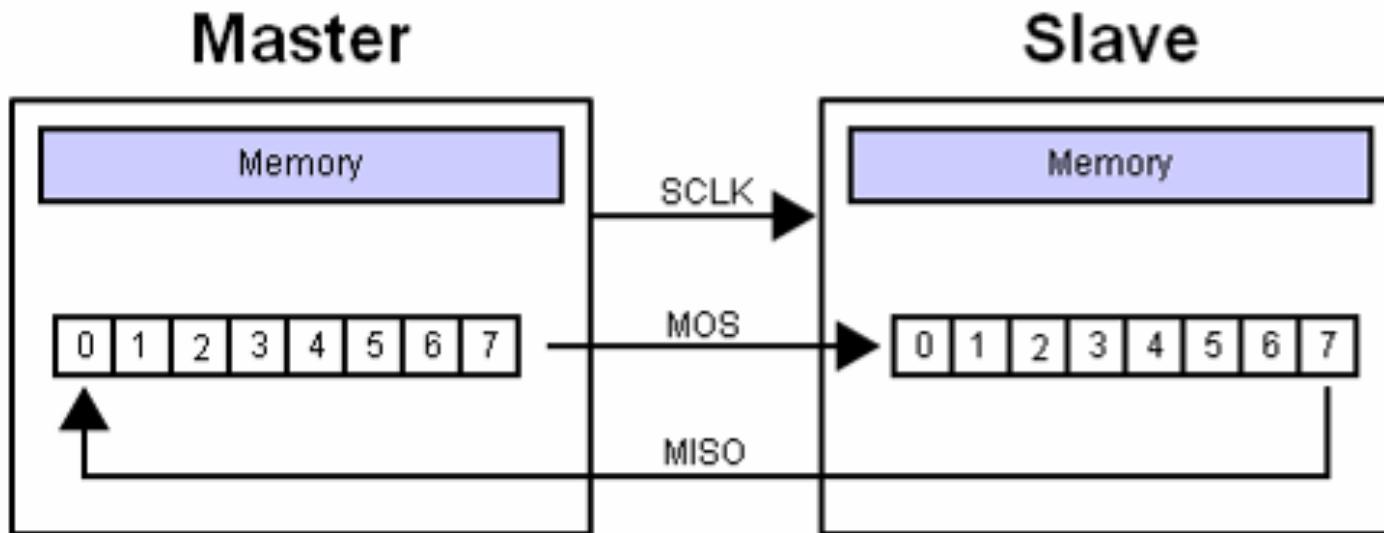
- Code still in progress
- Migrated Code from Eval Board Code
- Once completed, the transmitter board will transmit the ID read from an RFID tag and transmit it
- This will be the event ID and will be used to start and stop the appropriate event.

# SPI Interface



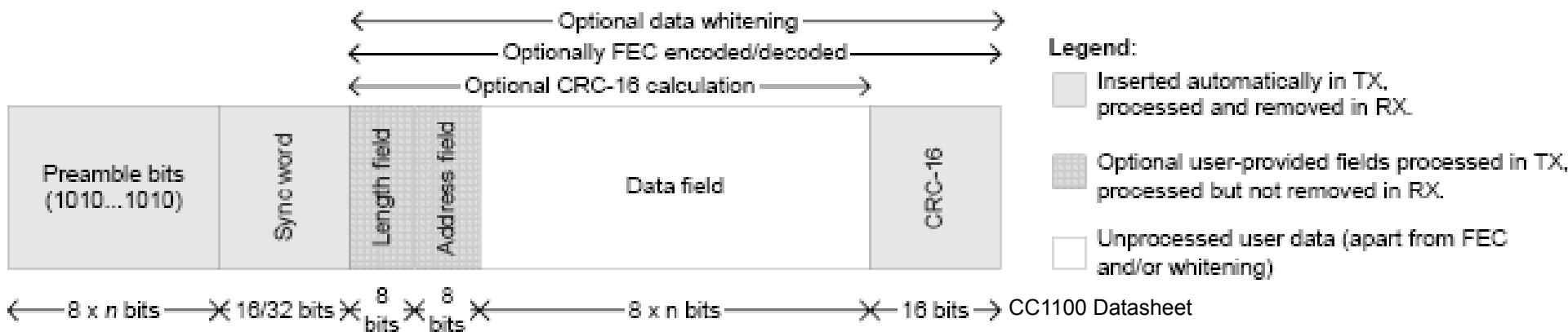
# SPI Operation

- For the CC1100
  - Lower Chip Select pin
  - Begin Transferring when CC1100 is ready
  - After transfer raise CS pin



# Packets

- Blocks of digital information



**Figure 11: Packet Format**

# Project Status

## Accomplishments

- Successful Transmission/Timing using Development Board
- Developed/Populated Receiver/Transmitter Boards
- Successful Programming of Both Boards
- Created/Tested Power Amplifier Circuit
- LCD Code works on new board
- Timing Code works on new board
- Created and tested a power amplifier circuit
- Designed/Built RFID Antenna

# Project Status

To Be Completed:

- Communication between boards using CC1100
- Communication with RFID chip
- Successful detection/reading of RFID tag
- Successful transmission using power amplifier

# Budget and Gantt Chart

# Budget - Projected

Estimated Budget		(1/18/2008)		
<b>Labor Costs</b>				
Name	Hourly Pay Rate	Hours Worked	Total Pay	
Ronjan Mathur	\$15.00	210	\$3,150.00	
Aaron Adcock	\$15.00	210	\$3,150.00	
Will Gray	\$15.00	210	\$3,150.00	
Kyle Romero	\$15.00	210	\$3,150.00	
		<b>Total Labor Cost</b>	\$12,600.00	
		<b>75% Overhead</b>	\$9,450.00	
		<b>Total Labor and Overhead</b>	\$22,050.00	
<b>Parts Costs</b>				
Part Name	Cost	Quantity	Total Cost	
Misc. Parts	\$50.00	NA	\$0.00	
		<b>Total Parts Cost</b>	\$0.00	
<b>Equipment Rental Costs</b>				
Equipment Name	Purchase Cost	Day Rental Rate	Days Rented	Total Cost
CC1100 x 3	\$300.00	\$0.60	60	\$36.00
Development Board	?		60	
Experimenters Board	\$100.00	\$0.20	60	\$12.00
Oscope	\$8,000.00	\$16.00	60	\$960.00
		<b>Total Rental Costs</b>		\$1,008.00
<b>Total Estimated Budget</b>		\$23,058.00		

# Budget: Week 15

Weekly Budget		(4/24/2008)		
Labor Costs				
Name	Hourly Pay Rate	Hours Worked	Total Pay	
Ronjan Mathur	\$15.00	150	\$2,250.00	
Aaron Adcock	\$15.00	150	\$2,250.00	
Will Gray	\$15.00	150	\$2,250.00	
Kyle Romero	\$15.00	150	\$2,250.00	
		<b>Total Labor Cost</b>	\$9,000.00	
		<b>75% Overhead</b>	\$6,750.00	
		<b>Total Labor and Overhead</b>	\$15,750.00	
Part Name		Cost	Quantity	Total Cost
Board Printing	\$33.00		3	\$99.00
Transmitter Board	\$15.77		2	\$31.54
Receiver Board	\$22.79		1	\$22.79
General Board Parts	\$151.82		1	\$151.82
		<b>Total Parts Cost</b>		\$305.15
Equipment Rental Costs				
Equipment Name	Purchase Cost	Day Rental Rate	Days Rented	Total Cost
CC1100 x 3	\$300.00	\$0.60	98	\$58.80
Experimenters Board	\$100.00	\$0.20	98	\$19.60
Oscope	\$8,000.00	\$16.00	98	\$1,568.00
			<b>Total Rental Costs</b>	\$1,646.40
<b>Budget Total</b>	<b>\$17,701.55</b>			

# Gantt Chart

ID		Task Name	Start	Finish	Duration	% Complete	Resource Names
1	✓	Week 1	01/10/08	01/16/08	5d?	100	
2	✓	Gain understanding of the CC1100	01/10/08	01/16/08	5d?	100	Mathur
3	✓	Research into Packet/Modulation Techniques	01/10/08	01/16/08	5d?	100	Adcock
4	✓	Look into the Programming Suite (SmartRF)	01/10/08	01/16/08	5d?	100	Romero
5	✓	Began work with the Experimenter Board	01/10/08	01/16/08	5d?	100	Gray
6	✓	Researched FCC Bands	01/10/08	01/10/08	1d?	100	Gray
7		Week 2	01/17/08	01/23/08	5d?	0	
8		Attempt SmartRF communication with Experime...	01/17/08	01/23/08	5d?	0	Romero
9		Research Packet Creation	01/17/08	01/23/08	5d?	0	Adcock
10		Work on Transmitter Board	01/17/08	01/23/08	5d?	0	Gray
11		Review Sensor Setups	01/17/08	01/23/08	5d?	0	Mathur
12		Week 3	01/24/08	01/30/08	5d?	0	
13		Look into CC1100 Registers / MSP430	01/24/08	01/30/08	5d?	0	Romero
14		Begin Creating Custom Packets	01/24/08	01/30/08	5d?	0	Adcock
15		Begin Transmitting with Transmitter Board	01/24/08	01/30/08	5d?	0	Gray
16		Order Sensors	01/24/08	01/30/08	5d?	0	Mathur
17		Week 4	01/31/08	02/06/08	5d?	0	
18		Begin Timing Algorithm	01/31/08	02/06/08	5d?	0	Romero
19		Continue Working with Packets	01/31/08	02/06/08	5d?	0	Adcock
20		Begin working with MSP/Sensor Interface	01/31/08	02/06/08	5d?	0	Gray
21		Testing of Sensors	01/31/08	02/06/08	5d?	0	Mathur

# Gantt Chart

ID		Task Name	Start	Finish	Duration	% Complete	Resource Names
22		Week 5	<b>02/07/08</b>	<b>02/13/08</b>	<b>5d?</b>	<b>0</b>	
23		Research Sensor ID # Techniques	02/07/08	02/13/08	5d?	0	Romero
24		Testing Sensors with Transmission	02/07/08	02/13/08	5d?	0	Mathur
25		Transfer Sensor Data to packets	02/07/08	02/13/08	5d?	0	Gray
26		Finalize Packet Setup	02/07/08	02/13/08	5d?	0	Adcock
27		Week 6	<b>02/14/08</b>	<b>02/20/08</b>	<b>5d</b>	<b>0</b>	
28		Begin testing packet Data	02/14/08	02/20/08	5d	0	Adcock
29		Begin Building Sensor/Transmitter Package	02/14/08	02/20/08	5d	0	Mathur
30		Begin Interpreting Packet Data	02/14/08	02/20/08	5d	0	Romero
31		Begin Power algorithm	02/14/08	02/20/08	5d	0	Gray
32		Week 7	<b>02/21/08</b>	<b>02/27/08</b>	<b>5d</b>	<b>0</b>	
33		Begin Modulation Tests	02/21/08	02/27/08	5d	0	Adcock
34		Continue Building Sensor/Transmitter Package	02/21/08	02/27/08	5d	0	Mathur
35		Continue interpreting packet data	02/21/08	02/27/08	5d	0	Romero
36		Continue Power Algorithm	02/21/08	02/27/08	5d	0	Gray
37		Week 8	<b>02/28/08</b>	<b>03/05/08</b>	<b>5d</b>	<b>0</b>	
38		Decide Modulation method	02/28/08	03/05/08	5d	0	Adcock
39		Finish Sensor/Transmitter Package	02/28/08	03/05/08	5d	0	Mathur
40		Finish Timing Algorithm	02/28/08	03/05/08	5d	0	Romero
41		Finish Power Algorithm	02/28/08	03/05/08	5d	0	Gray

# Gantt Chart

42	☐ Week 9	03/06/08	03/12/08	5d	0
43	☒ Test Packet Transmission (Separate)	03/06/08	03/12/08	5d	0 Adcock
44	☒ Test Power Algorithm (Separate)	03/06/08	03/12/08	5d	0 Gray
45	☒ Test Timing Algorithm (Separate)	03/06/08	03/12/08	5d	0 Romero
46	☒ Design Full System Test	03/06/08	03/12/08	5d	0 Mathur
47	☐ Week 10	03/13/08	03/26/08	10d	0
48	☒ Test Packet Transmission (Full System)	03/20/08	03/26/08	5d	0 Adcock
49	☒ Test Power Algorithm (Full System)	03/20/08	03/26/08	5d	0 Gray
50	☒ Test Timing/Reciever Algorithms (Full System)	03/20/08	03/26/08	5d	0 Romero
51	☒ Test Sensors (Full System)	03/20/08	03/26/08	5d	0 Mathur
52	☐ Week 11	03/13/08	03/19/08	5d	0
53	☒ Spring Break!	03/13/08	03/19/08	5d	0 All
54	☐ Week 12	03/27/08	04/02/08	5d	0
55	☒ Fix Packet Problems	03/27/08	04/02/08	5d	0
56	☒ Fix Power Problems	03/27/08	04/02/08	5d	0
57	☒ Fix Reciever Problems	03/27/08	04/02/08	5d	0
58	☒ Fix Sensor Problems	03/27/08	04/02/08	5d	0

# Gantt Chart

59	☐ Week 13		04/03/08	04/09/08	5d	0	
60	☒ Continue System Testing		04/03/08	04/09/08	5d	0	Adcock
61	☒ Continue System Testing		04/03/08	04/09/08	5d	0	Gray
62	☒ Continue System Testing		04/03/08	04/09/08	5d	0	Romero
63	☒ Continue System Testing		04/03/08	04/09/08	5d	0	Mathur
64	☐ Week 14		04/10/08	04/16/08	5d	0	
65	☒ Prepare Demonstration		04/10/08	04/16/08	5d	0	Romero
66	☒ Make Poster For Demonstration		04/10/08	04/16/08	5d	0	Gray
67	☒ Work out transmission errors		04/10/08	04/16/08	5d	0	Adcock
68	☒ Work out Mechanical errors		04/10/08	04/16/08	5d	0	Mathur
69	☐ Week 15		04/17/08	04/23/08	5d	0	Mathur
70	☒ Demo Day!		04/17/08	04/23/08	5d	0	All
71	☐ Week 16		04/24/08	04/30/08	5d	0	
72	☒ Final Presentation/Report		04/24/08	04/30/08	5d	0	All

# Questions?

