Instructor: Dr. Charles Kim
Webpage: www.mwftr.com/SD.html

Team UCC

Progress Presentation #2

Senior Design II

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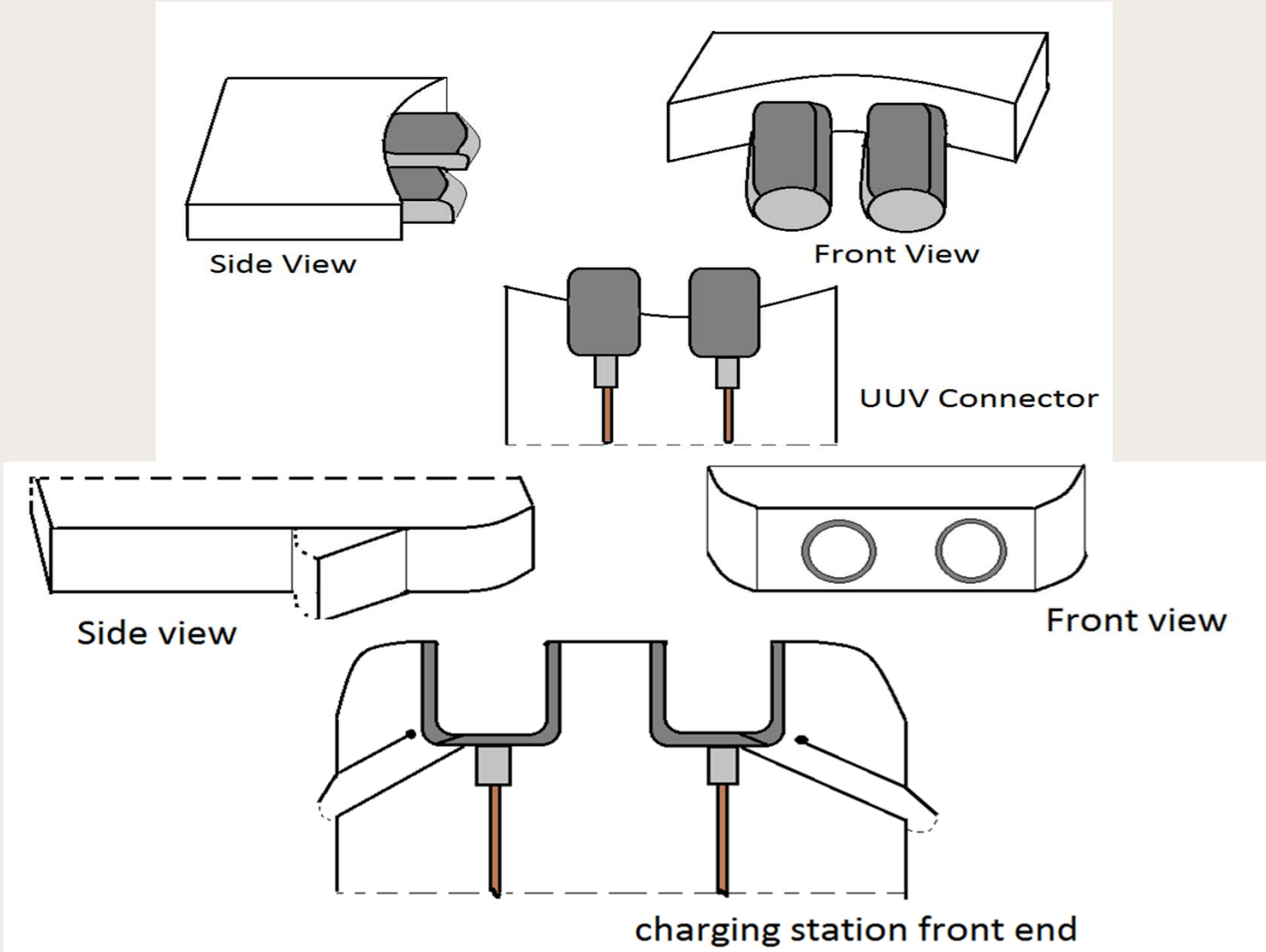
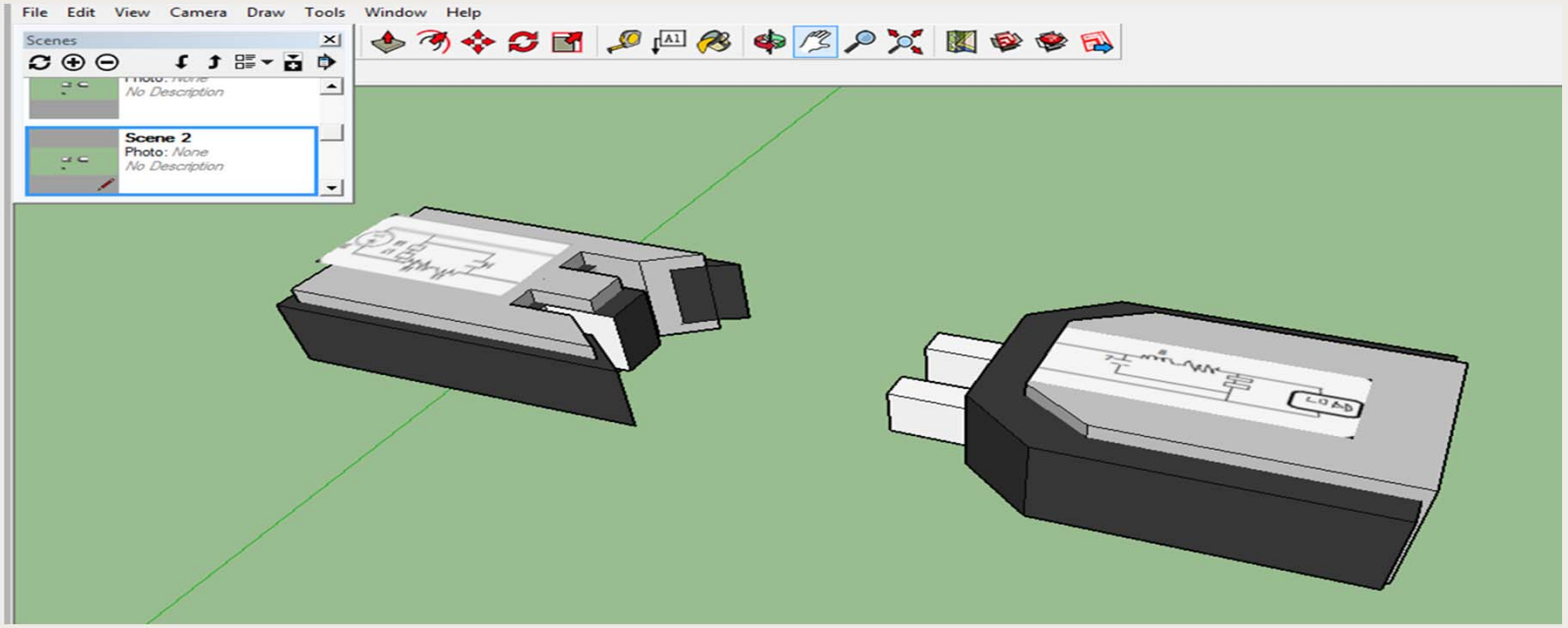
Date: Feb 18th, 2015

Final Solution Schematic Diagram

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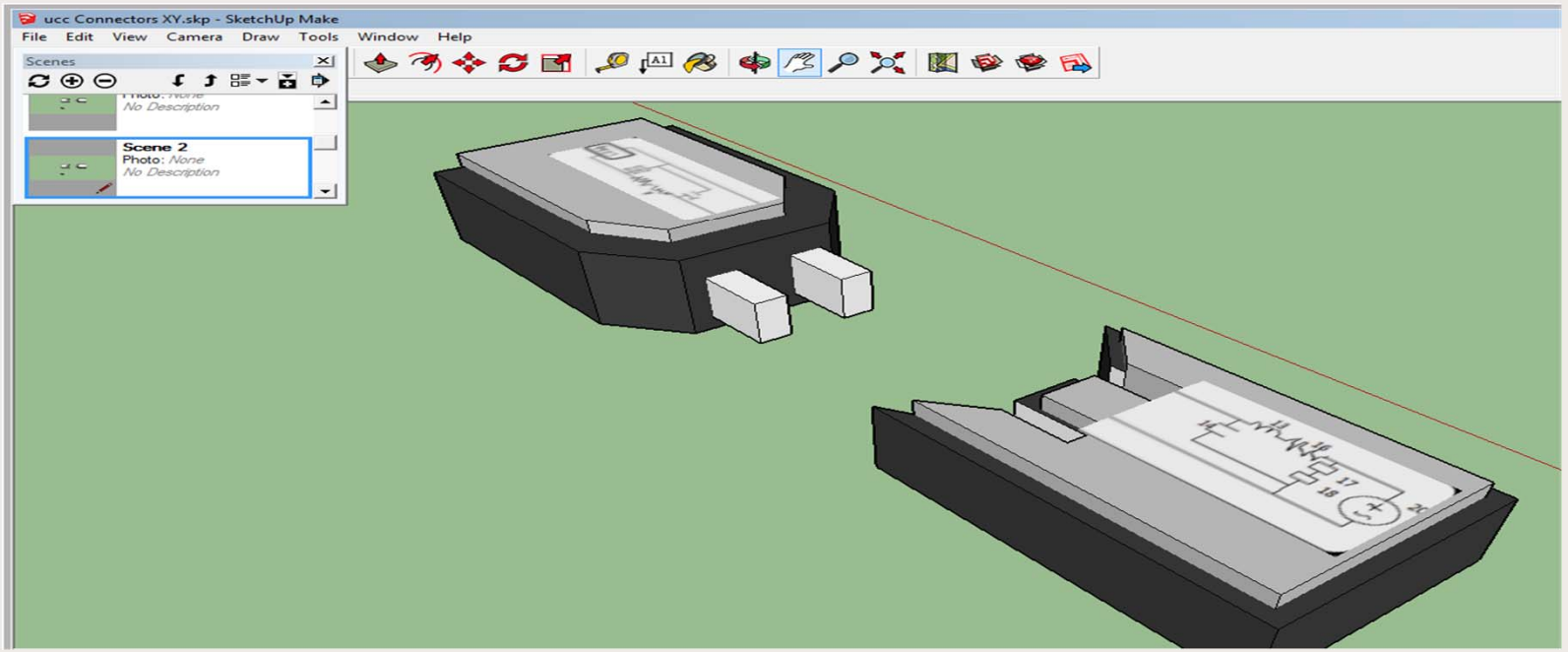
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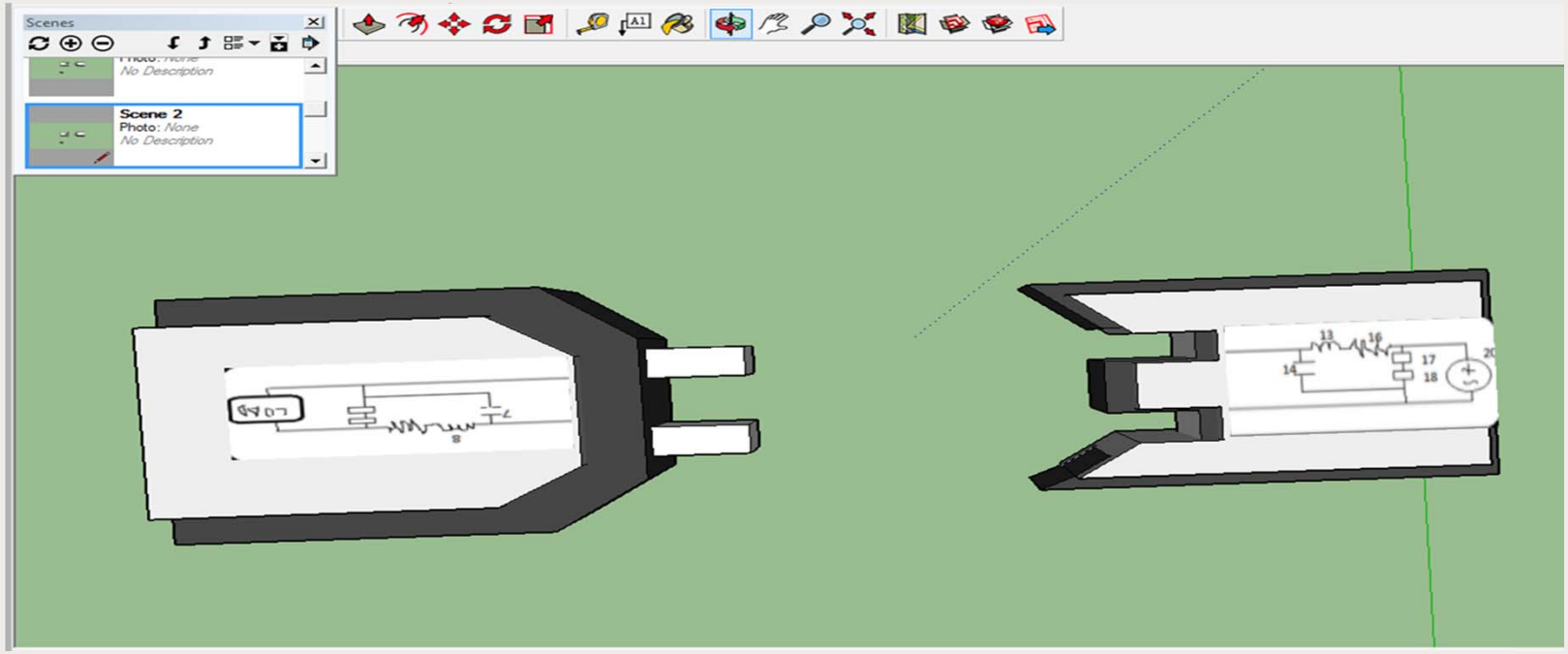
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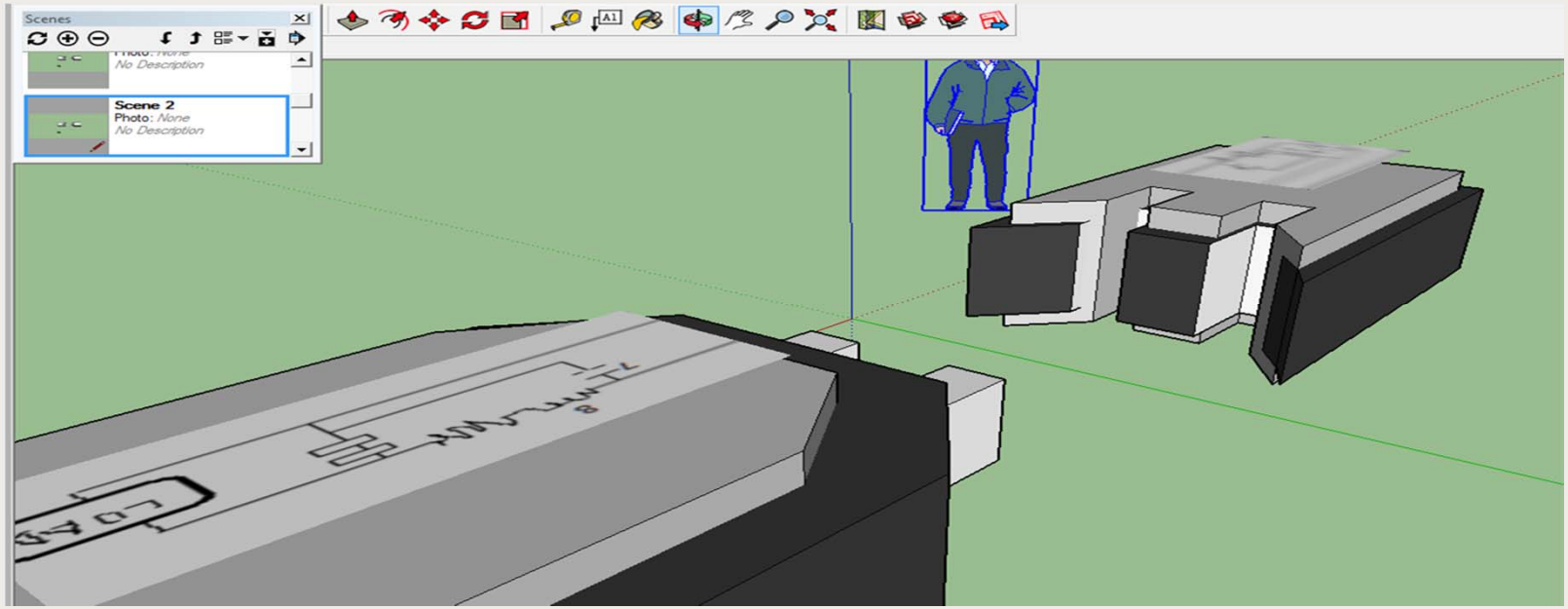
Scenes
No Description
Scene 2
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No Description

Design Requirements

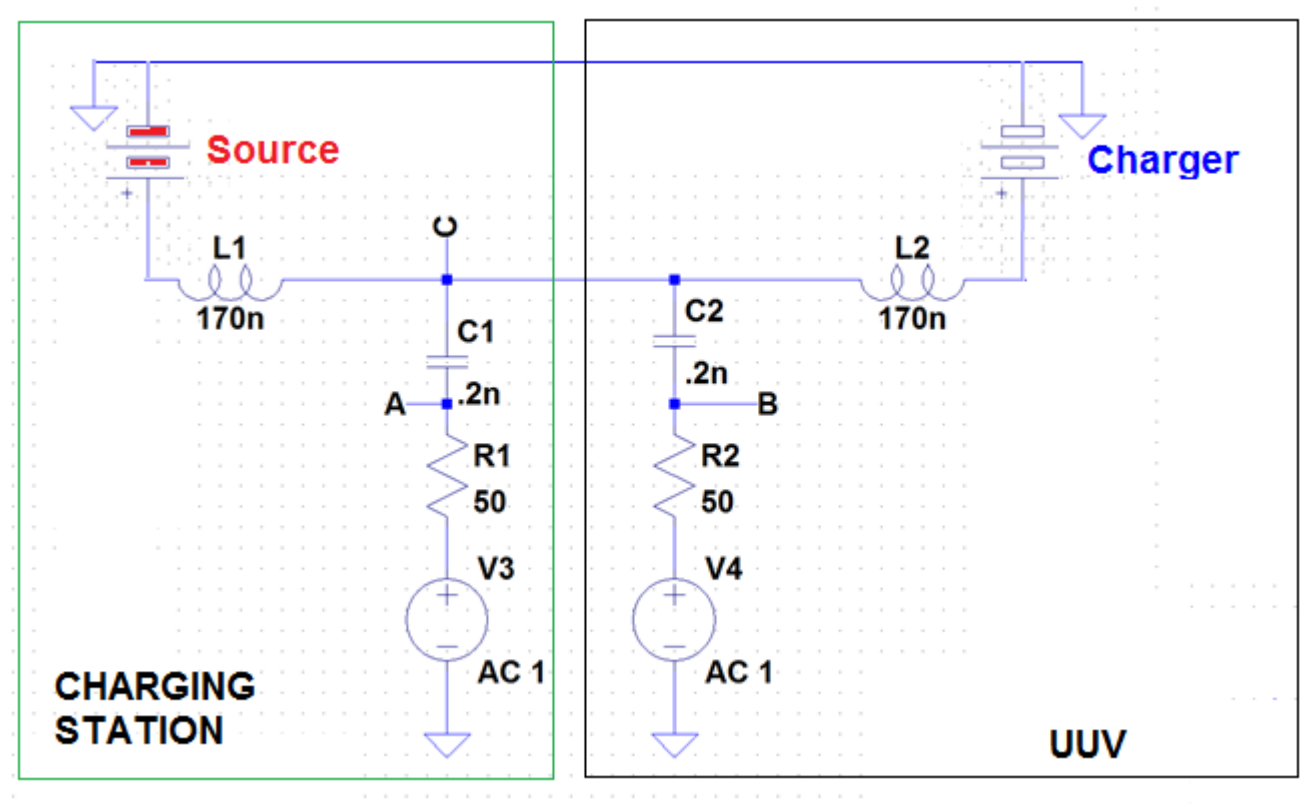
- Input Power: 48 V DC, 25 A
- Capable of functioning in seawater as well as fresh water (>= 100 meters deep)
- Capable of functioning in temperatures between -2℃ and 50℃
- Surviving in temperatures between -40℃ and 70℃
- Capable of spending 25 years submerged in seawater
- Capable of carrying a 2.4 or 5GHz 802.11 signal across the connector.

RF Signal TX / RX Testing

Circuit design created within the LTSpice program that is used to test and see if the circuit will be able to attenuate the 2.4 GHz signal.

Contains:

- 2 Inductors rated at 170 nH
- 2 Capacitors rated at .2 nF
- 2 Resistors rated at 50 Ohms
- Battery Source rated at 50 V

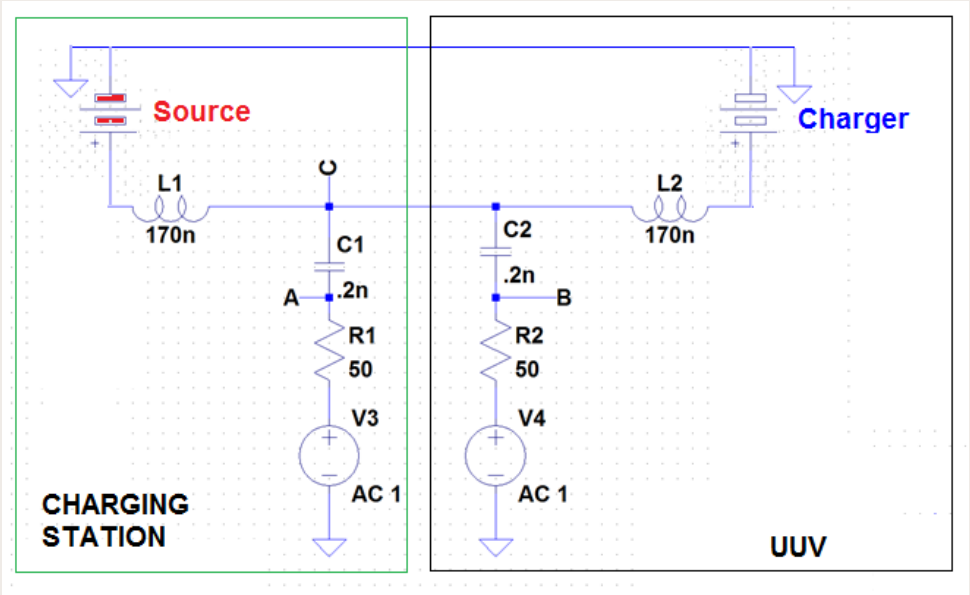


Nodes labelled and placed as A & B, are points placed so that we could see if the signal was generated at each point.

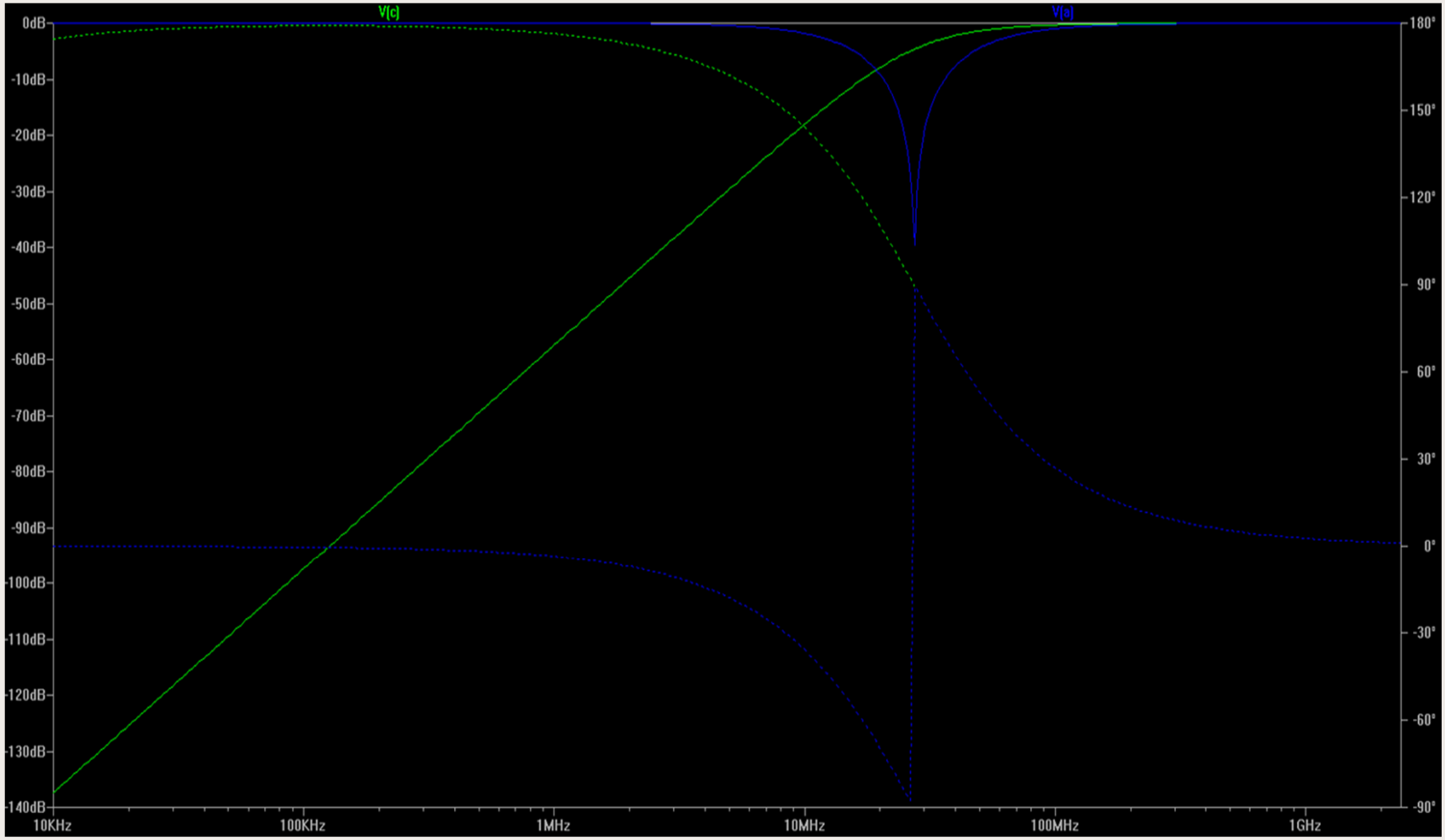
RF Signal Measurement using Analog Discovery Board

Based off the results it is shown that the voltage throughout the circuit stays the same.

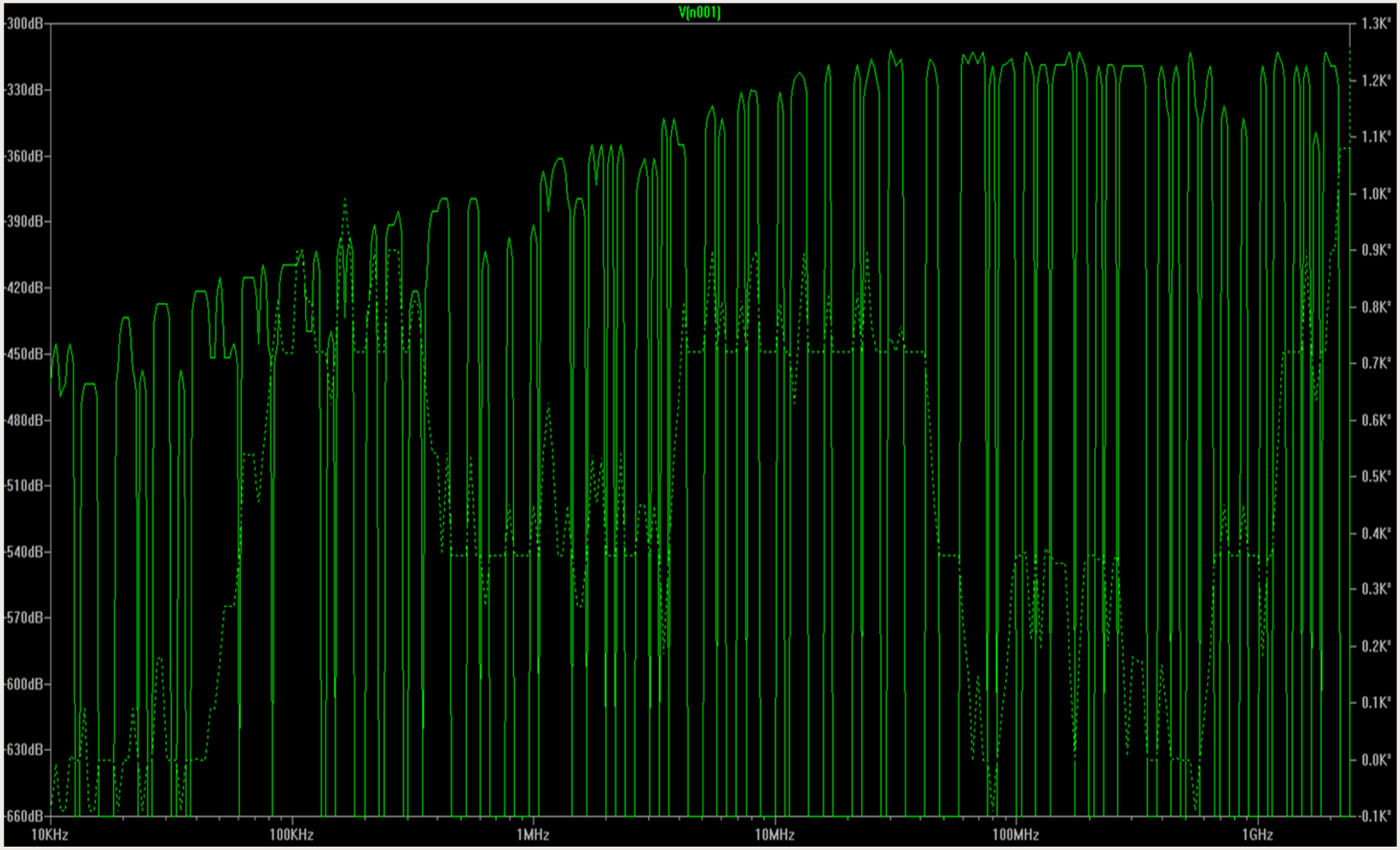
In addition, the signal attenuates the as it should through the circuit and not the battery source.



-- Operating Point --		
V(a):	5e-019	voltage
V(n004)	0	voltage
V(n002)	50	voltage
V(n001):	50	voltage
V(b):	5e-019	voltage
V(n005):	0	voltage
V(n003):	50	voltage
I(C2):	1e-020	device_current
I(C1):	1e-020	device_current
I(L2):	0	device_current
I(L1):	0	device_current
I(R2):	1e-020	device_current
I(R1):	1e-020	device_current
I(V4):	1e-020	device_current
I(V3):	1e-020	device_current
I(V2):	0	device_current
I(V1):	0	device_current



In the picture, the plot shows that signal is able to successfully pass through the capacitors within the circuit model.



In the picture, the plot shows that the signal is not being attenuated through the battery source.

Further Testing

Recently we tested a Bias tee at lower frequencies with an analog discovery device, to see if there are any substantial changes to the values and parameters.

With the results below, it is seen that for the following test highlighted; that if using any value greater than 100 mV for “W”, then the frequencies for C1 & C2 will increase greatly and substantially.

C1	C2	R1	W		CH1		CH2	
			Frequency	Voltage	Frequency	Voltage	Frequency	Voltage
100µF	100µF	51Ω	100Hz	50mV	?????	119.4mV	?????	1.4mV
100µF	100µF	51Ω	1kHz	100mV	1.00kHz	185.6mV	1.10kHz	6.8mV
100µF	100µF	51Ω	10kHz	500mV	10.00kHz	272.4mV	10.00kHz	50.8mV
100µF	100µF	51Ω	100kHz	100mV	99.85kHz	152.0mV	99.995kHz	17.6mV
100µF	100µF	51Ω	1MHz	50mV	1.00MHz	108.6mV	1.00MHz	18.2mV

If using any value greater than 100mV for "W", then the frequencies for CH1 & CH2 greatly increase

Current & Future Schedule

#	Task	Start	End	Duration
1	Converge on LC calculation	2/6/2015	2/20/2015	14
2	Buy Testing Equipment and Prototype Material	2/6/2015	2/20/2015	14
3	Design the Prototype Mechanical Housing Package	2/6/2015	2/27/2015	21
4	Establish RF Connection in Incremental Steps	2/6/2015	2/27/2015	21
5	Fabricate Niobium Connectors via HU ME MS	2/27/2015	3/6/2015	7
6	Mechanical and Electrical Sub-System Component Integration	2/27/2015	3/13/2015	14
7	Integration Testing	3/6/2015	3/6/2015	21
8	Prepare Report Material for Critical Design Review	3/6/2015	4/3/2015	28
9	System Demonstration	4/9/2015		1

Purchase List for RF Signal Testing

Qty	Item #	Description	Job	Unit Price	Line Total
6.00	PE34116LF-12	SMA Male to RP SMA Male	Comm Module	$ 42.55	$ 255.30
2.00	PE7005-30	30 dB Fixed Attenuator	Comm Module	$ 49.94	$ 99.88
3.00	PE9070	SMA Female to SMA Female Adapter	Comm Module	$ 15.75	$ 47.25
Pasternak					
6.00	602-1180-ND	XBEE-SMA RP Chip	Comm Moduel	$ 37.54	$ 225.24
Digikey					
				Subtotal	$ 627.67
				Sales Tax	
				Total	**$ 627.67**

Highlights of the Period

- Successfully created a circuit within LTSpice program that was able to attenuate and produce a 2.4 GHz signal throughout the circuit.
- Purchased components to begin winding of the inductor for communication with the arduino boards.
- Created an initial rough design for the 3D printing, which will be inspected and recreate for a more accurate rendition of the connectors.

Lowlights of the Period

- Delivery of material from Northrop Grumman for the assembly of the prototype.
- Acquiring new knowledge on how to use the machine shop to carve the niobium piece
- The assembly of the housing for the design of the connectors will be needed for the prototype for full implementation.
- Weight and dimension calculations still need to be fully completed and implemented to help create an accurate final design.
- Niobium rods for the connectors need to be purchased to begin testing for production and machinery.

Risk Mitigation Measures

Risk	***Probability***	***Impact***	***Risk Control & Management***
Not receiving the necessary part for the assembly of the prototype	30%	Slow the project completion	Tracking package from sender to delivery
Not having enough knowledge on how to use the machine shop on the Niobium metal	65%	Not having the ideal shape desired for the niobium pieces	Not having the desired shape of Niobium decided for the final prototype design Gathering knowledge on how to apply the machine shop on niobium metal
Not having enough time to spend on prototype testing	45%	Uncertainty on the full operation of the prototype	Speeding the assembly process and save time on building the prototype. Using LTspice to find the right value of the capacitor and inductor required for the operation of the prototype

Focus of Next Period Activities

Low Point	*How The Low Points Are To Be Resolved*	*New Approach*	*Next Major Milestone*
Weight/ Dimension Calculation and Sizing	• Continue studying to help with better understanding of determining weight & dimensions.	• Research the methods and procedures needed to properly calculate the weight/dimensions • Acquire knowledge & help from mechanical engineer students and colleagues	• Begin the calculation to find the right dimensions for the connectors
Niobium Rods Being Purchased	• Determine what niobium rod size and type will be appropriate	• Figure out what size Niobium rods will be able to transfer the energy properly	• Purchase Niobium rods to begin sculpting and carving the rods for the connectors
Assembly of The Housing	• Construct and assemble the housing	• Determine the size the housing needs to be to be able to fit the arduino boards and the circuit	• Create an initial design for the housing