KEYSIGHT TECHNOLOGIES

NATIONAL HIGH MAGNETIC FIELD LABORATORY

SeniorDesignII

T307

Team 307

Keysight Narrow Band “Oscilloscope” for High Power Tuning of NMR Probes

Presentation Outline

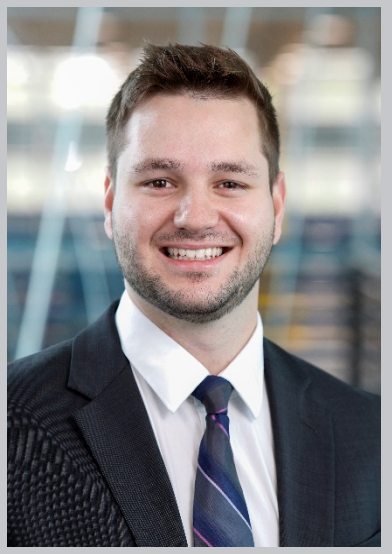
- Team Introduction
- Project Description
- Background
- Documentation
- Finished Prototype Demo
- Acknowledgements
- Summary

Introduction

Jonathan Burt	Gabriel De Leon	Emil Lobachev	Asher Rich	Kyle York
Programming Lead Document Lead	**Financial Advisor** Web Master	**Lead ECE** DGR	**Team Leader** Communications Lead	**Research Lead** Circuit & Hardware Assembly Lead



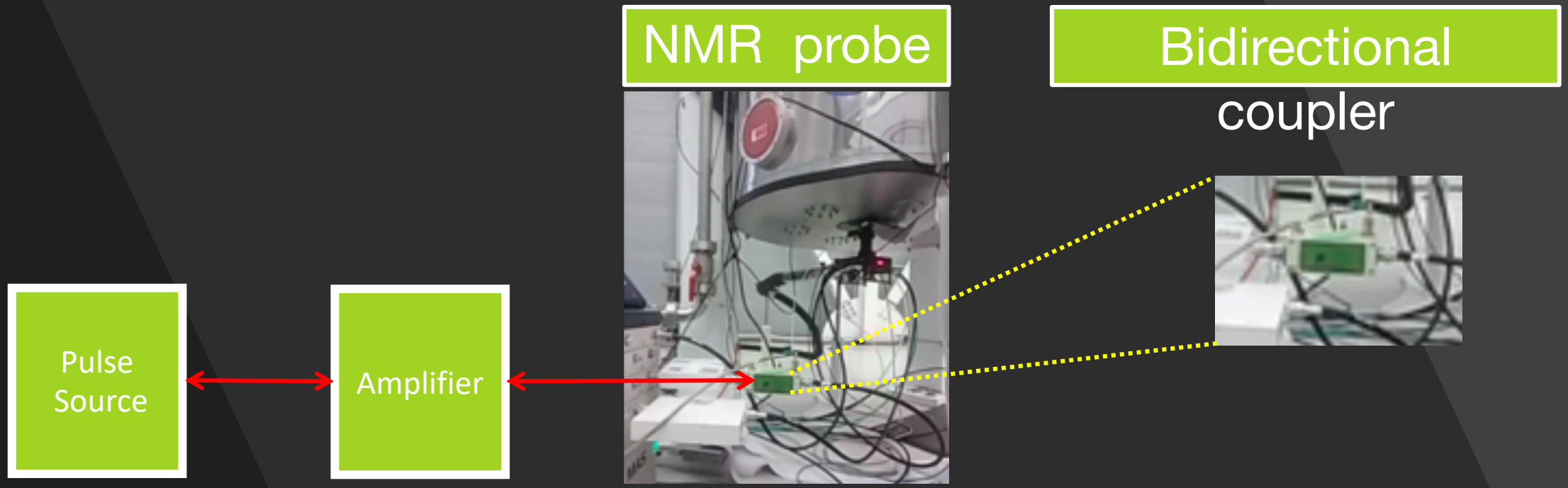




Project Description

- Proposal
- Abstract
- Requirements

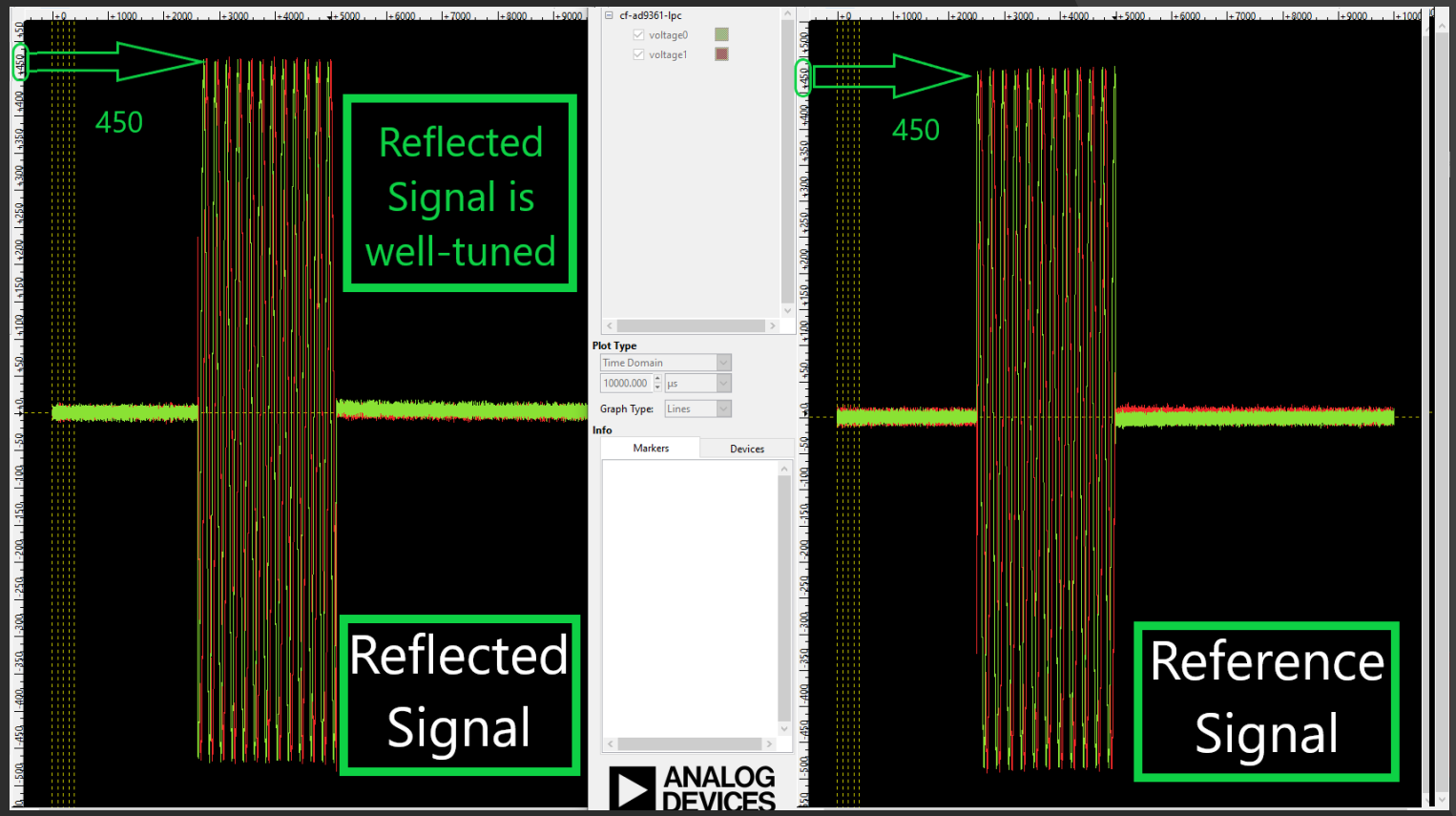
Proposal



Emil Lobachev

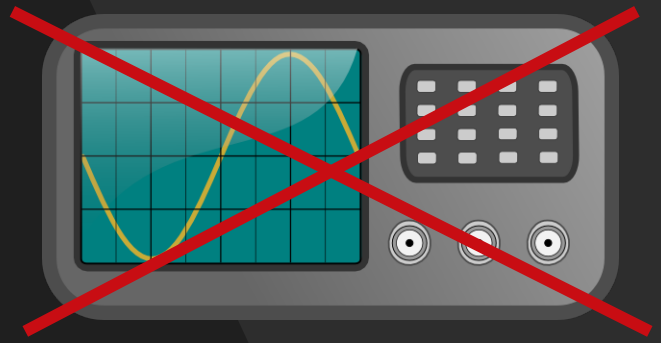
Proposal

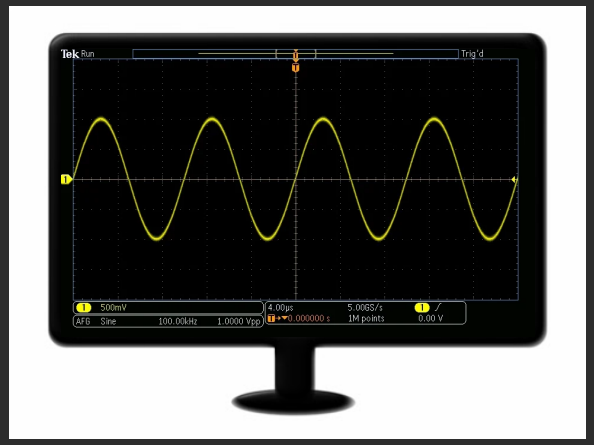
Software Defined Radio



Emil Lobachev

Project Description & Key Goals



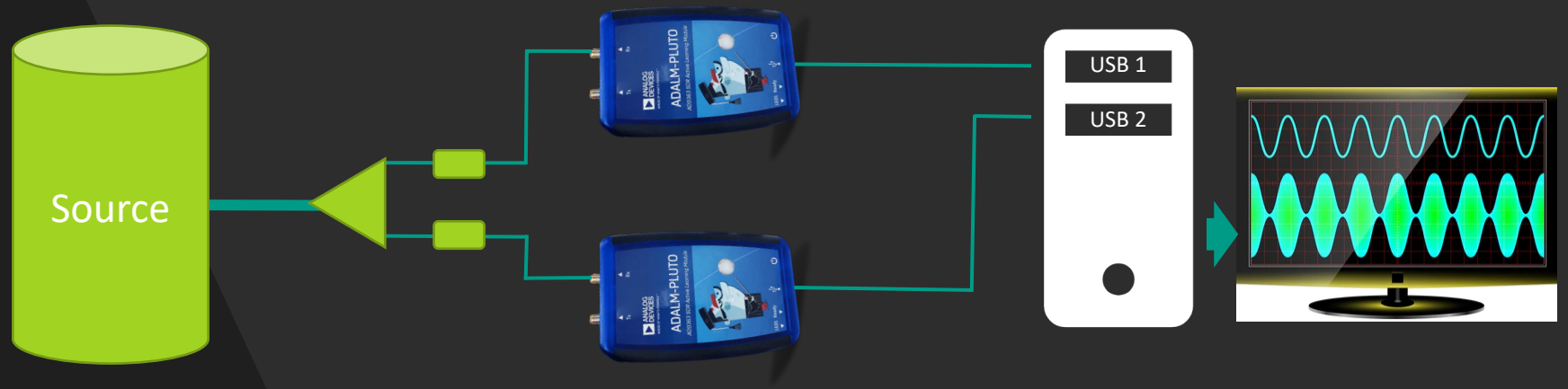


- Design/Produce Working Prototype
- Reduce Cost of Envelope Detection
- Display Sweep Length and Control Frequency

Kyle York

Requirements and Design

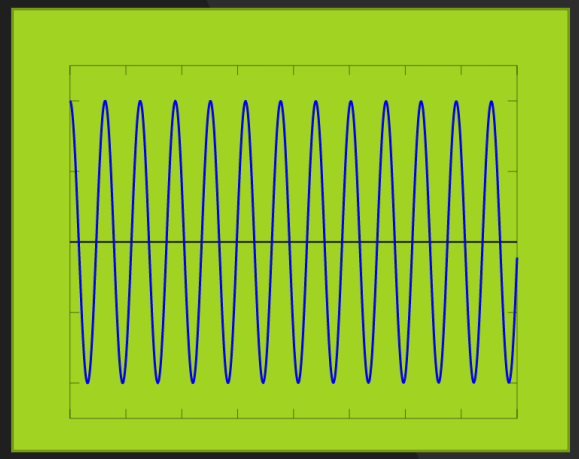
- NI, Envelope, Trigger, Range
- Planning → Initial Design



Jonathan Burt

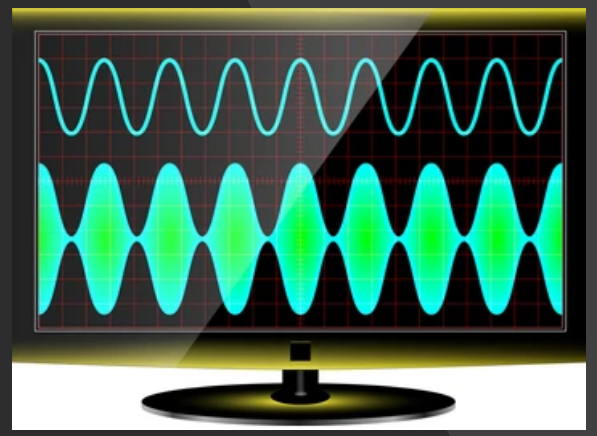
Basic Engineering Interpretation

- Most Basic Signal Flow Chart for the Project



Analog

61.44 MSPS ADC

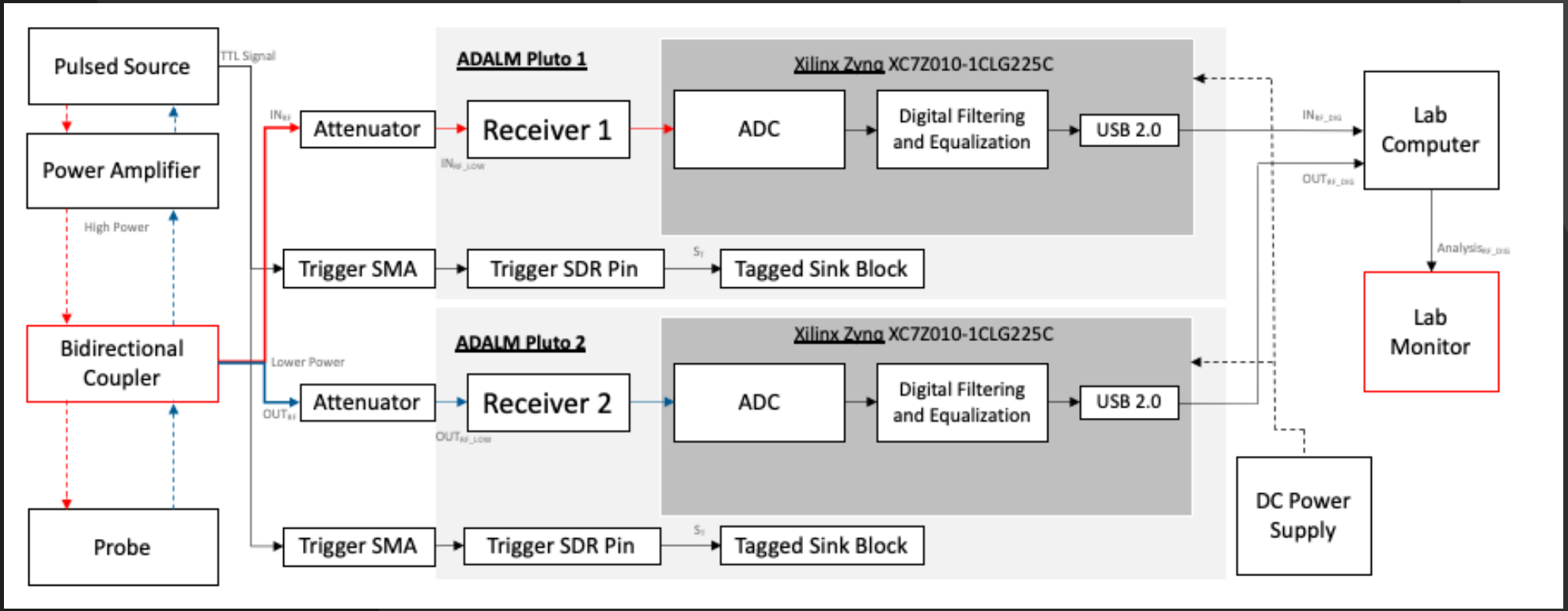


Digital

Emil Lobachev

Complex Engineering Interpretation

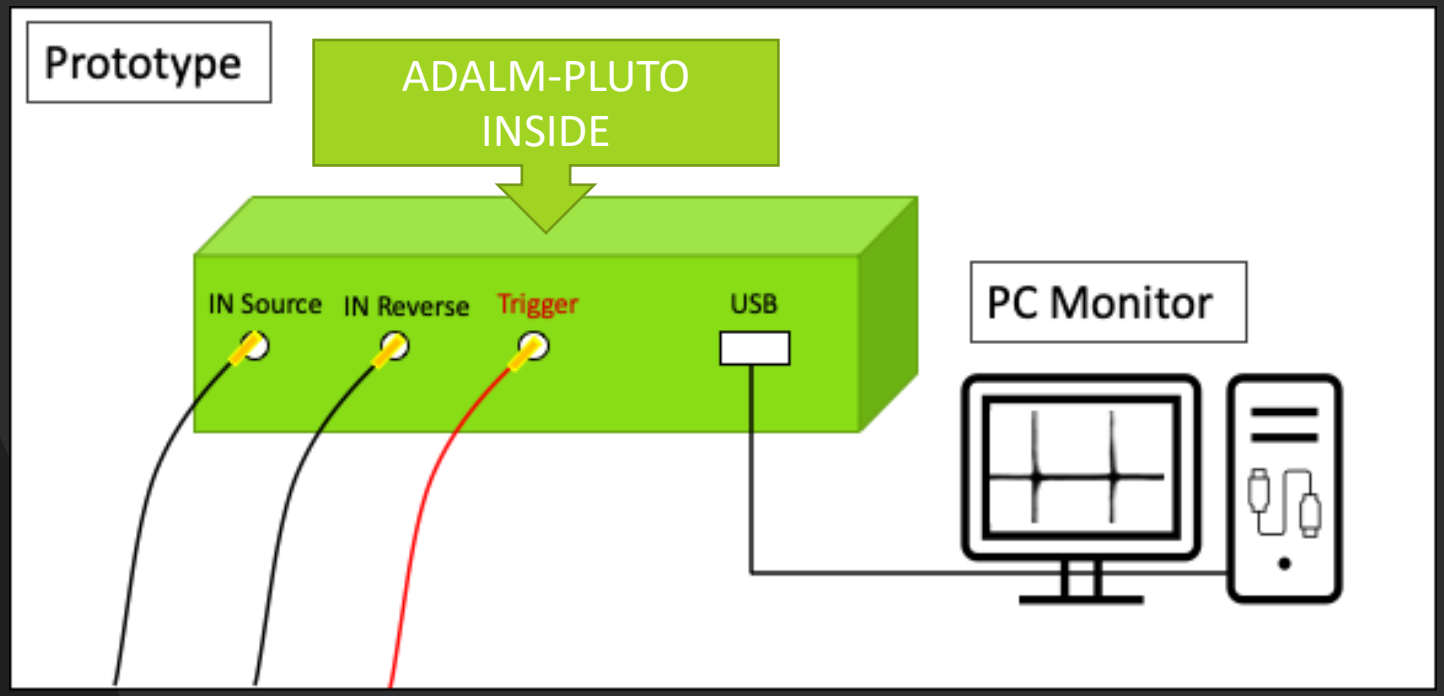
More Complex Signal Flow Chart for the Project



Emil Lobachev

Final Prototype Schematic

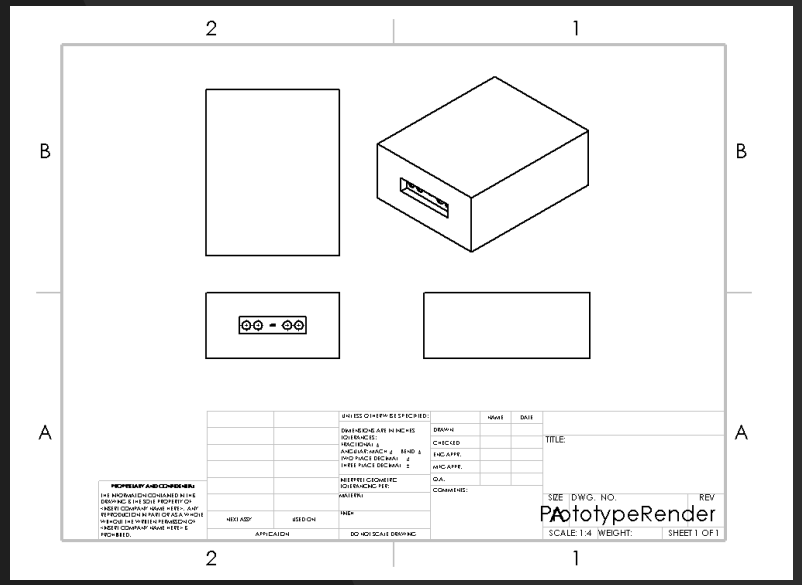
- First Prototype Model

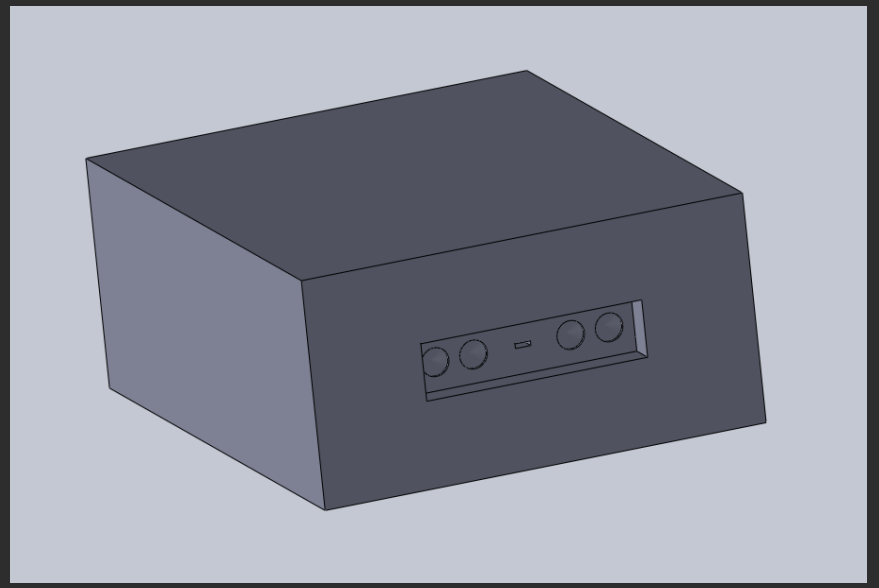


Asher Rich

Final Prototype Schematic

First SOLIDWORKS 3D Model

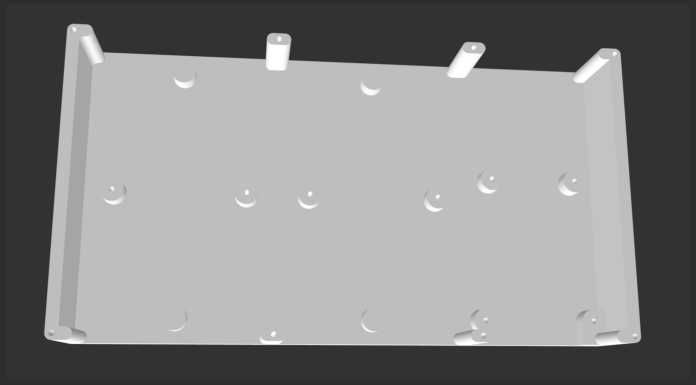


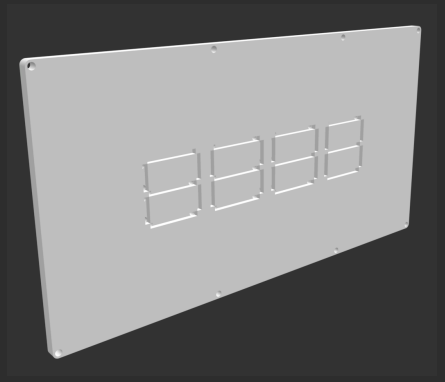


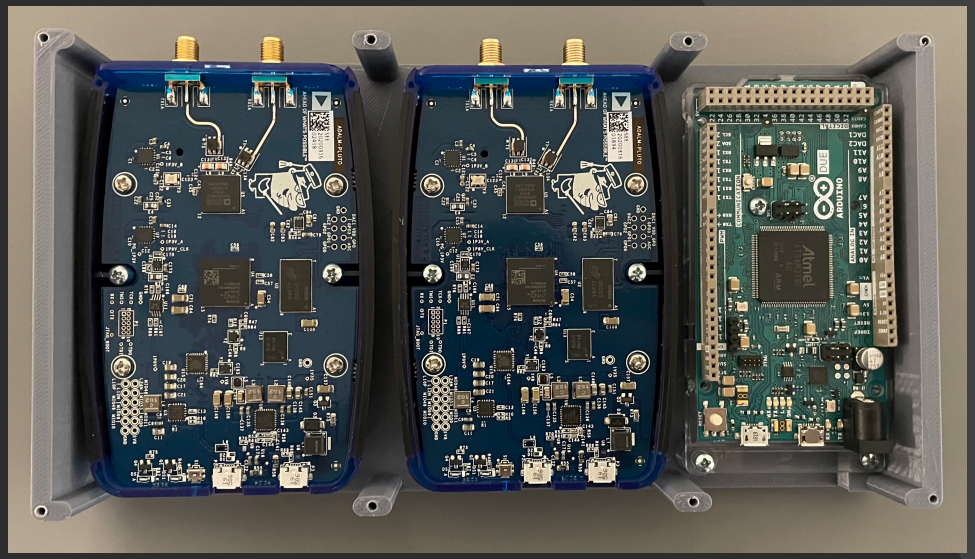
Asher Rich

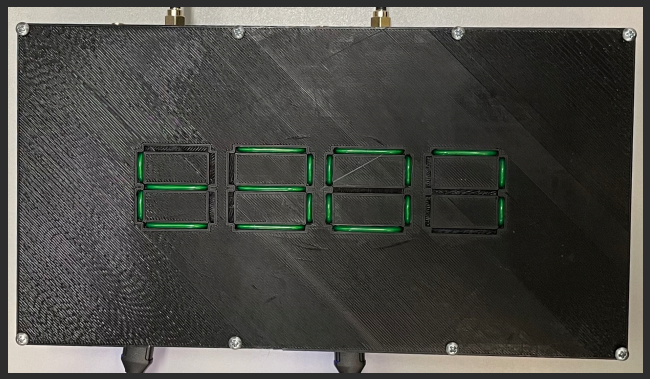
Final Prototype Assembled

Finished Model









Asher Rich

Background

- ADALM PLUTO SDR
- IIO-Oscilloscope
- Test Signals

Software Defined Radio (SDR)

- Radio communication system
- Used for visualizing RF signals in this project

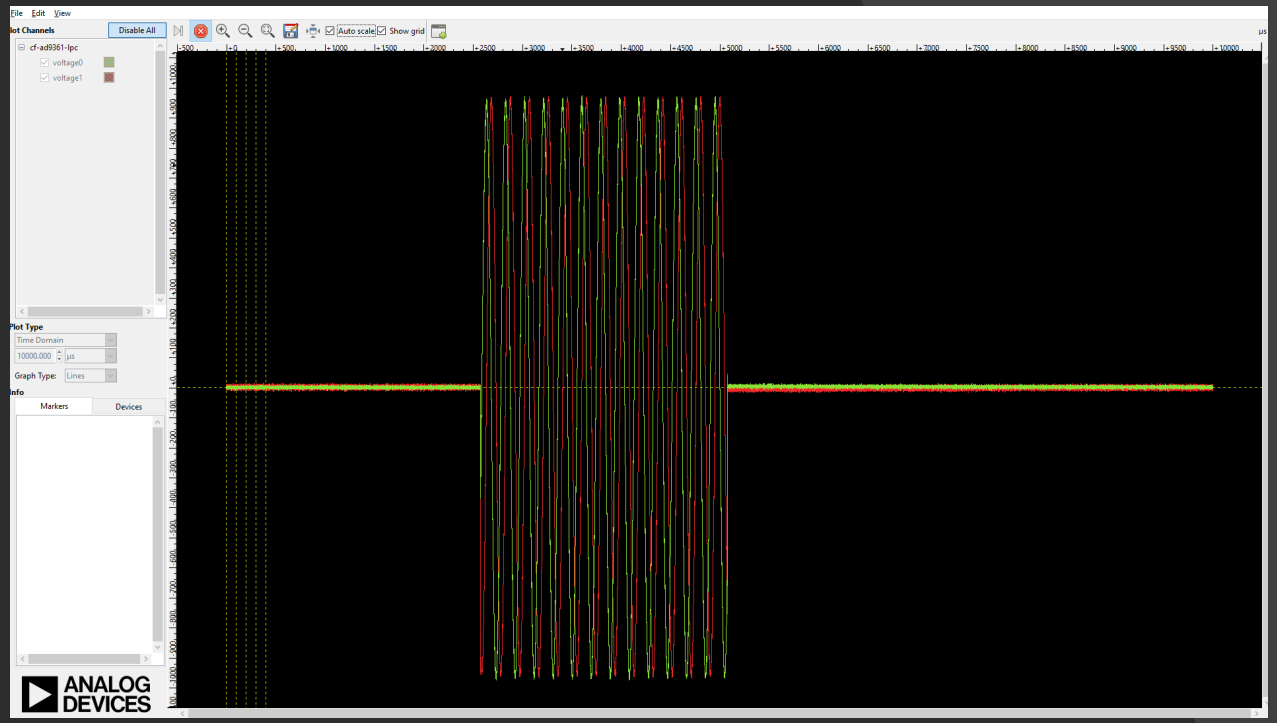
Gabriel De Leon

ADALM PLUTO SDR

- ADC resolution: 12 bit ☑
- Sampling rate: up to 61.44 MSPS ☑

IIO-Oscilloscope

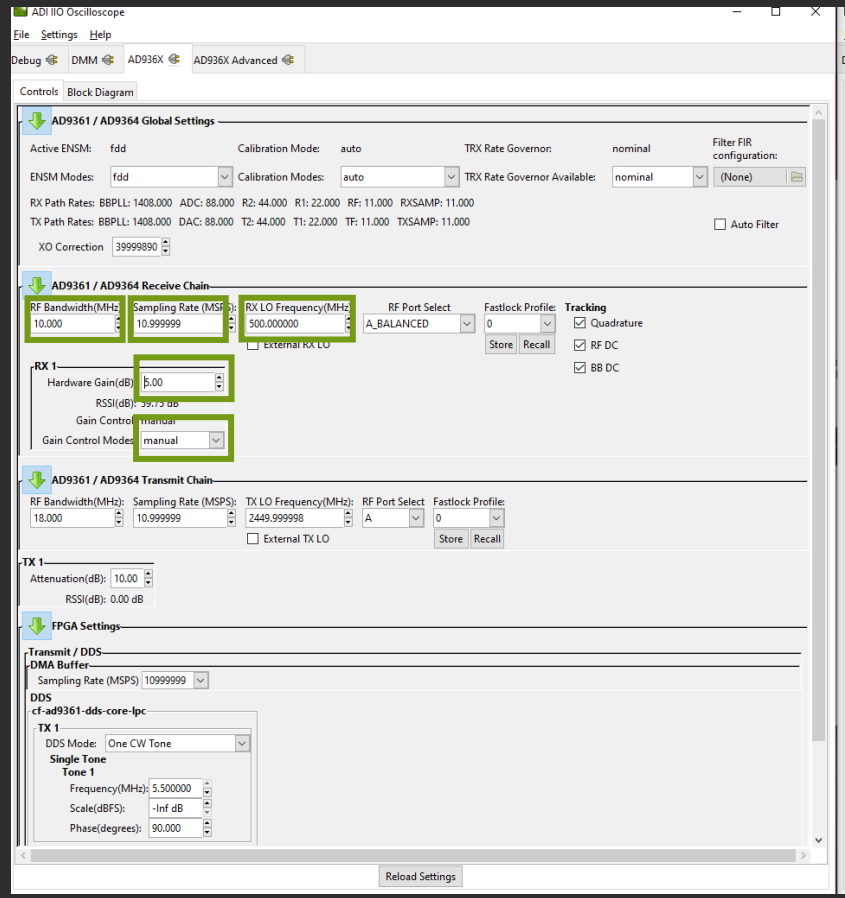
- Plot forward/reverse RF signals
- Displays ADC Code

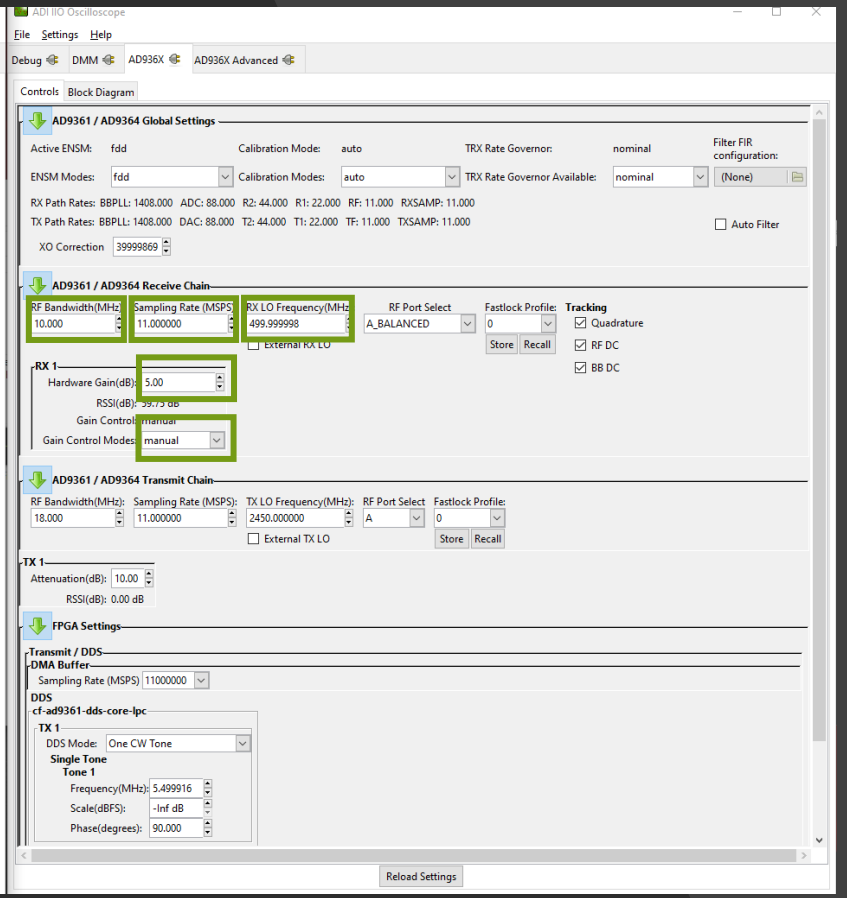


Gabriel De Leon

IIO-Oscilloscope

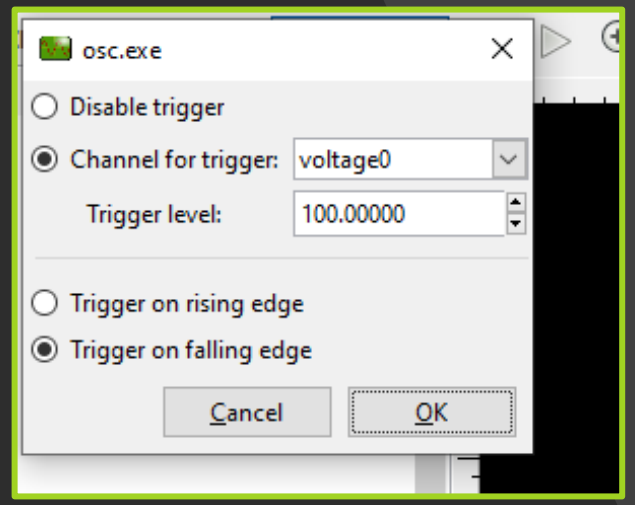
- RF Bandwidth
  10 MHz
- Sample Rate
  11 MSPS
- Tune-in Freq
  500 MHz
- HW Gain
  5 dB





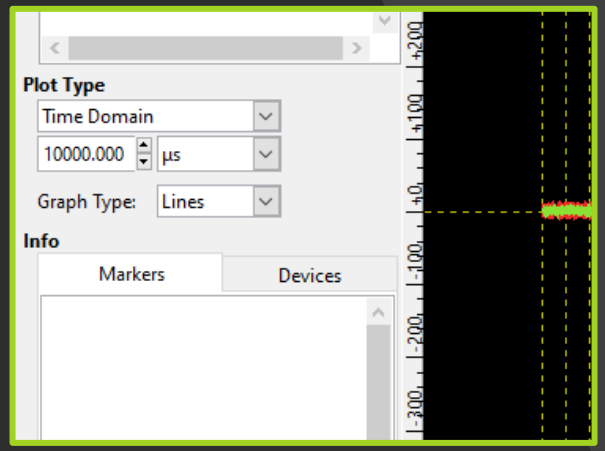
IIO-Oscilloscope

- Trigger settings



IIO-Oscilloscope

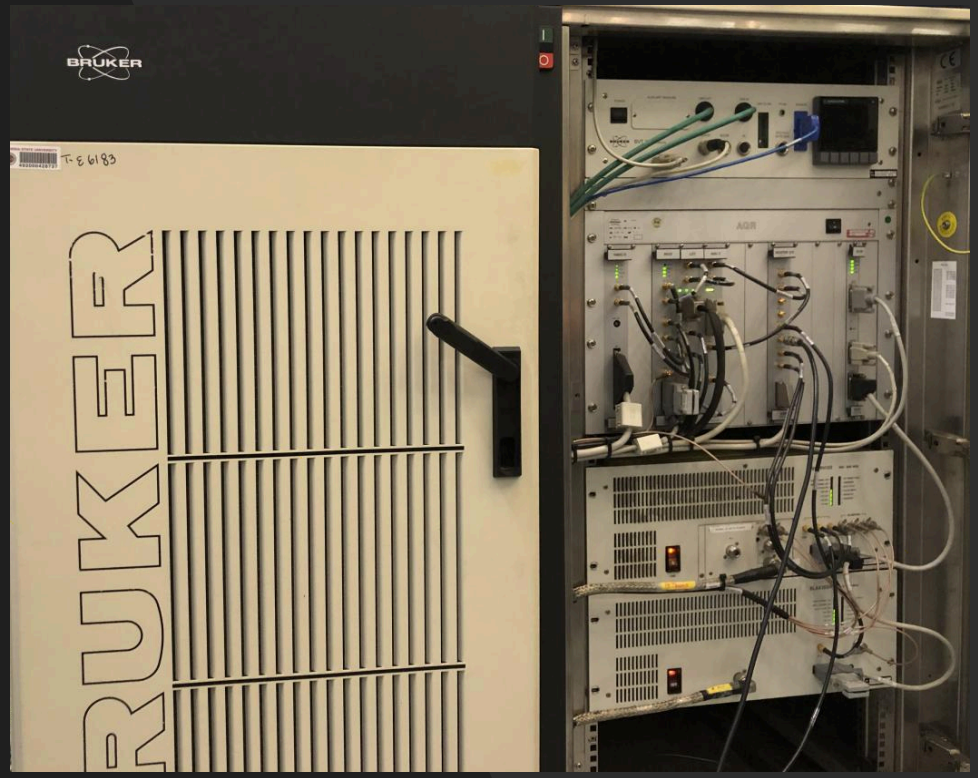
- Time Scale Settings on Plot



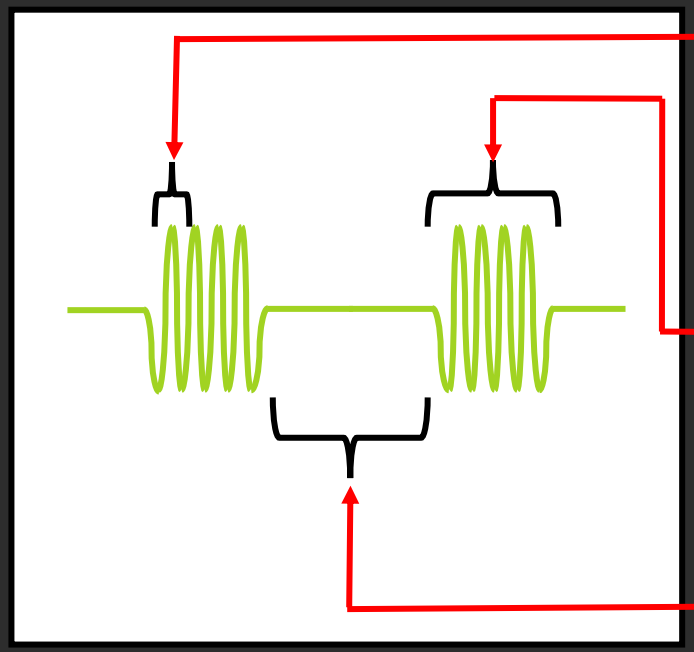
Gabriel De Leon

Test Signals

Pulse Generator



Test RF Signal Settings:



- 500 MHz Frequency
- 2.5 ms Pulse Trains
- 200 ms Delays

Asher Rich

Documentation

- Testing and Validation
- Team Website
- Operation Manual
- Final Report

Emil Lobachev, Jonathan Burt, Asher Rich, & Kyle York

Testing and Validation

T307 SPR21

Testing & Validation

College Of Engineering
SDII

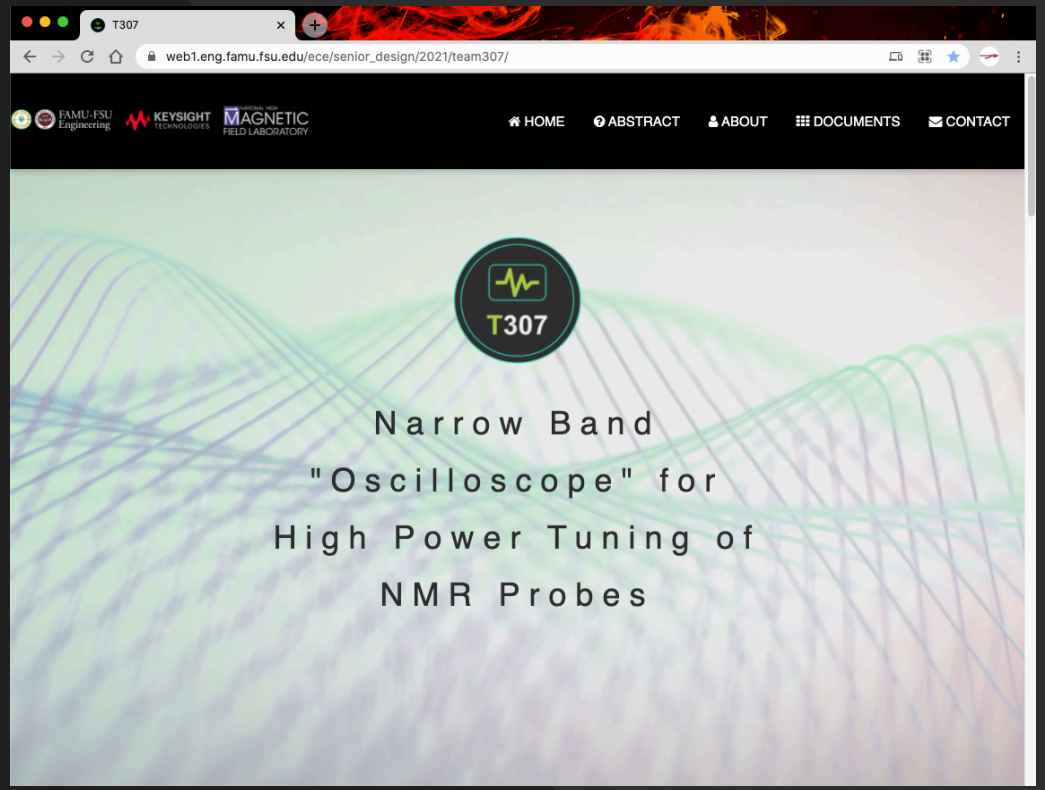
Test Types

- Unit Tests
  - Integration Tests
    - Acceptance Tests

Emil Lobachev

Team Website

Here's how it looks



Access to all related documents

DOCUMENTS

FALL SEMESTER	*SPRING SEMESTER*
CUSTOMER NEEDS	ABSTRACT
TARGETS	SPRING PROJECT PLAN
CONCEPT GENEREATION	BLOCK DIAGRAM
CONCEPT SELECTION	TESTING AND VALIDATION
VDR1	OPERATION MANUAL
VDR2	ENGINEERING DAY DESIGN POSTER
VDR3	VDR4
	VDR5

Jonathan Burt

Operation Manual

T307 SPR21

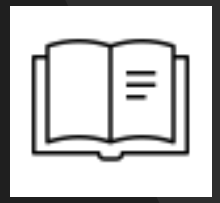
Operation Manual

College Of Engineering
SDII

Table of Contents

Asher Rich

Final Report



T307 SPR21

Final Report Document

College Of Engineering
SDII

Table of Contents

Kyle York

Finished Prototype Demo

- Video Demonstration

Prototype Final Demonstration

- Final Demo

https://www.youtube.com/watch?v=xZnUgrdPSTs

Acknowledgements

- Dr. William Brey
- Dr. Rajendra Arora
- Paul Holcomb
- Dr. Samuel Grant




Jonathan Burt

Summary

- Team Introduction
- Project Description
- Background
- Documentation
- Finished Prototype Demo
- Acknowledgements
- Summary

References

1. “A Narrow Band “Oscilloscope” for High Power Tuning of NMR Probes”, Project Proposal, W. Brey, 2020.
2. “NMR Operation at NYSBC”, NYSBC Solid State NMR Short Course,

   http://comdnmr.nysbc.org/comd-nmr-educ/comd-nmr-lecture-notes/lecture-notes/solidstateNMRcourse.pdf
3. “Design, Care and Feeding of NMR Probes” tutorial presented by Kurt Zilm at the 2011 ENC

   http://www.enc-conference.org/Portals/0/Probes_2011_Part_I.pps
4. G. Amouzandeh, V. Ramaswamy, N. Freytag, A. S. Edison, L. A. Hornak and W. W. Brey, "Time and Frequency Domain Response of HTS Resonators for Use as NMR Transmit Coils," in IEEE Transactions on Applied Superconductivity, vol. 29, no. 5, pp. 1-5, Aug. 2019, Art no. 1102705, doi: 10.1109/TASC.2019.2902522.
5. “Zilm - The Inner Workings of NMR Probes For BioSolids NMR”, Stowe 2013, Yale University
6. Shaik, Asif. “Frequency Modulation.” *Physics and RadioElectronics*, 10 Oct. 2018, www.physics-and-radio-electronics.com/blog/frequency-modulation/
7. Sunnylearning, director. *PCM - Analog to Digital Conversion*. *YouTube*, YouTube, 16 Nov. 2018, www.youtube.com/watch?v=HlGJ6xxbz8s&t=356s.
8. StevesLectures, director. *Pulse Code Modulation (ITS323, L11, Y15)*. *YouTube*, YouTube, 20 Sept. 2015, www.youtube.com/watch?v=9hkHO-klwME.
6. Google Images & WikiMedia,

   https://commons.wikimedia.org/wiki/File:Matlab_Logo.png

   https://www.google.com/search?q=SDR+CONSOLE+V3&safe=off&rlz=1C5CHFA_enUS696US696&hl=en&source=lnms&tbm=isch&sa=X&ved=2ahUKEwinsMHMhMruAhWqxYUKHYwUAw4Q_AUoAnoECAUQBA&biw=1017&bih=626&dpr=2

Jonathan Burt

Questions