

ECE 453 Lab #2 Summary

Name: _____

Score: _____ /90

All check points are worth 2 points except where otherwise noted.
 Don't forget the introduction, general oscillator theory, etc.

The Piezo Electric Quartz Crystal

- Describe crystal makeup and model
- Estimate C_0 .
- Measure f_s and f_p .
- Estimate r .
- Estimate C .
- Estimate L .
- Calculate the Q of the Quartz Crystal.
- (4 pts) Plots (large scale, zoomed-in; model, data) of Crystal reactance vs. frequency.
- Find load capacitor C_L that will resonate with Crystal at 10.245 MHz.
- Measure resonance frequencies for mystery capacitors
- Determine capacitance for each mystery capacitor

Crystal Oscillator

- Quantitatively explain the choice of R_1 , R_2 , Hint: two major aspects to consider.
- Explain the function of R_E .
- Explain the choice of C_1 and C_2 . Hint: two major aspects to consider.
- Measured bias voltages for different stages of oscillator construction.
- Observe, print, quantify (f , V_{p-p}) the oscillator waveform for specified load conditions
- Explain the changes made to the circuit
- Describe the resulting changes in operation.
- Completeness of discussion.

Active Buffer Design

- Explain choices of R_3 , R_4 , and R_{E2} .
(Hint: consider buffer input/output impedance, voltage swing, power, bias stability)
- (4 pts) Explain component changes needed to satisfy power requirement
- Observe, print, quantify (f , V_{p-p}) the completed oscillator waveform with 50 Ω load.
- (4 pts) Discuss differences between output waveform of the oscillator with/without the buffer.
- Printout of VSA spectrum listing output powers and frequencies of first seven harmonics.
- Evaluate THD.
- Compare fundamental output power on VSA with power from oscilloscope (V_{p-p} , 50 Ω).
- Note drift and stray capacitance effects
- Phase noise printout and comment

Voltage Controlled Oscillator Design

- (4 pts) Table of oscillation frequency, power, varactor voltage, capacitance (total, varactor)
- From the table, plot C_{var} vs. V_{var} and power vs. frequency
- Printout of VSA spectrum listing output powers and frequencies of first seven harmonics.
- Evaluate THD
- Note drift and stray capacitance effects
- Phase noise printout and comment
- (4 pts) Overall comparison of the two oscillator design with respect to fundamental output power, THD, phase noise, drift, and stray capacitance effects

General Lab Procedure

- (12 pts) Introductions, conclusions, background. Organization, readability. Troubleshooting. General in-lab performance.