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# OSH 10

## Introduction

In this lab we are building the power amplifier as well as the transmit mixer for our transmitter circuit.

## Problem 1

We build the components for the transmitter switch that protects the receiver while transmitting

## Problem 2

Now we build up the power amplifier circuit.

- Since the output power of the transmitter is around 2W, we need to add a 40dB attenuator to protect the lab oscilloscope.
- We connect the function generator across R14 and set the output to 1 $V_{pp}$ and 7.04 MHz.
- We take measurements as we increase the output voltage, compensating for the 40 dB loss. We use the following equations.

$$P_{out} = \frac{V_{pp}^2}{16R_L} \text{ where } R_L = 50\ \Omega$$

$$P_{supply} = V_{supply} * I_{supply} \; where \; V_{supply} = 12V$$

$$Efficiency = \frac{P_{out}}{P_{supply}}$$

$$G = 20\log_{10}(\frac{V_{out}}{V_{RF}})$$

Table 1

| Input RF Voltage($V_{pp}$) | Gain (dB) | Supply Current (A) | Supply Power (W) | Output Voltage ($V_{pp}$) | Output Power (W) | Efficiency (%) |
|---|---|---|---|---|---|---|
| 1.712 | 9.52 | 0.041 | 0.492 | 5.12 | 0.0327 | 6.7 |
| 1.803 | 12.4 | 0.049 | 0.588 | 7.52 | 0.0706 | 12 |
| 1.866 | 14.58 | 0.056 | 0.672 | 10 | 0.125 | 18.6 |
| 1.922 | 16.26 | 0.063 | 0.756 | 12.5 | 0.195 | 25.8 |
| 1.965 | 17.65 | 0.071 | 0.852 | 15 | 0.281 | 33 |
| 2.012 | 18.788 | 0.079 | 0.948 | 17.5 | 0.383 | 40.4 |
| 2.053 | 19.77 | 0.086 | 1.032 | 20 | 0.5 | 48.4 |
| 2.094 | 20.624 | 0.094 | 1.128 | 22.5 | 0.633 | 56.1 |
| 2.168 | 21.24 | 0.102 | 1.224 | 25 | 0.781 | 63.8 |
| 2.189 | 21.98 | 0.111 | 1.332 | 27.5 | 0.945 | 70.9 |
| 2.229 | 22.58 | 0.119 | 1.428 | 30 | 1.125 | 78.8 |

Figure 1: Plot of Efficiency vs. Output Power

Figure 2: Plot of Power Amplifier Gain vs. Input Voltage

## Problem 3

Next we work on the transmit mixer and verify its functionality.

- We adjust C34 to get the maximum voltage level.
- The resonant frequency as measured across the crystal and inductor is **4.9MHz**.