

# E157 Design Project 2: Receiver

Design a receiver using Mini Circuits ( <https://www.minicircuits.com/> ) modules in the RF lab that can decode the message being sent from the transmitter in the RF lab (described below). Your receiver may use any architecture that you see fit, but you must perform a careful analysis of the receiver's expected performance. In particular, you should have analytical predications and experimental confirmation of its system temperature, IIP2 and IIP3. You should express these calculations with a spreadsheet showing the expected and measured signal power, noise temperature and and power of distortion products at each stage (possibly in multiple frequencies of interest).

You must demonstrate your receiver working at a range of 3m. You may demonstrate functionality at other ranges, and the longest ranged receiver will receive extra credit. The deliverable for this lab is a completed lab report template, which is linked on the course webpage.

Transmitter details:

- The transmitter has 3dBm of Output Power, poor antenna matching (~-10dB return loss), and modest (6dBi) directionality.
- The output is frequency shift keyed: 0 bits are transmitted at 2.256 GHz and 1 bits are transmitted at 2.296 GHz.
- The transmitter repeats a message continuously at a bit rate of 10kbps. Each message begins with the pilot frame 01010101. The remaining bits represent 8-bit ASCII encoded characters.

You are allowed to use lab instruments in prescribed ways:

- Use an oscilloscope as the ADC stage of your receiver.
- You may use benchtop power supplies to power your receiver and provide reference voltages.
- You may not use a signal generator to provide LO signals (except when debugging), though you may use a signal generator to provide test inputs to your receiver. Though feel free to break this rule if we are out of VCOs.
- You may use a spectrum analyzer or VNA for debugging and characterizing receiver performance.
- Rolling carts and extension cords are often helpful for debugging in a range test like this.

A few odds and ends:

- Our supply of modules is more limited than I would like. Share them gracefully.
- We have a modest budget to order additional modules. Be sure to get your orders in by Monday of the last week of classes because we use two-day shipping.
- Beware of blocker signals from Wi-Fi at 2.4-2.4835 GHz.