**2.4-2.6GHz FSK Receiver**

**Abstract**

Frequency Shift Keying is currently used in many applications such as wirelessly transmitting binary data. Using high frequency sinusoids, a transmitter shifts between two frequencies which are later interpreted a logic ‘1’ or ‘0’. A 2.4 – 2.6GHz FSK receiver was designed, simulated in ADS and built using the rapid prototyping equipment in the Lab for Interconnected Devices at Portland State University. The receiver included a LNA on the front end, a Wilkinson power divider, resonant cavity filters and diode detectors. Later a 7-segment display and appropriate logic was used to interpret the data and display what the binary value is.

**Requirements**

* Operate at 2.4 and 2.6 GHz
* Reliably distinguish between 2.4 and 2.6GHz Signals
* Amplifier with at least 10dB gain and S11 <-10dB.
* 3dB power divider
* 2.4 and 2.6GHz Bandpass filters
* Diode detector to output DC when signal is received.

**LNA**

The LNA is the front end of the receiver. Its purpose is to amplify very weak signals with out adding much noise to the system. This is done through various input and output matching techniques. Initially, a packaged LNA (PSA-5043+) was going to be used, however after several iterations the measured performance did not meet specs, and instead an LNA (shown in figure X) designed for a previous project was used. The alternate LNA has a gain of about 13dB at 2.4GHz and about 11dB at 2.6GHz and S11 around -10dB at 2.4GHz. This was decided to be sufficient to be used in the final receiver.

**Wilkinson Splitter**

A simple Wilkinson power divider, designed for 2.5GHz was implemented. The design was simulated in ADS, and the layout was done in Eagle CAD,

**Filters**

There were two different types of filters that were investigated in this project. First, a lumped element filter, using a combination of microstrip capacitors, and SMD components was designed in ADS. Second, a resonant cavity type filter was used.

**Pipe Cap Filters**

**Lumped Element**

**Diode Detectors**

**Display**

As a bonus, a 7-segment display along with some digital logic was used to display data. The output of the diode detectors is sent to comparators, which sends signals to an OR gate and a 7-segment display driver to decide when to light up the display, and whether the signal is 2.4GHz or 2.6GHz. If the signal is 2.4GHz, the display will show a ‘0’ and when the input signal is 2.6GHz, the display will show a ‘1’.

The comparators have a comparison threshold of approximately 10mV, which is set by a resistive voltage divider. In total, there are three comparators that are being used; the first is used to detect the 2.4GHz signal, the second and third are used for the 2.6GHz signal. When the output of the 2.4GHz diode detector goes above 10mV, the output of comparator 1 goes high, this sends a signal to the OR gate, which allows the display to turn on. Comparator 2 is used in the same way for the 2.6 GHz signal, and comparator 3 is used in parallel with comparator 2 to send a signal to the 7-segment display driver to make the display show a 0 if it is low or a 1 if it is high. Shown below in figure XX is the display showing both conditions.

**Board Layout**

**Measurements**

**Conclusion**

**References**