**Downconverter/Baseband Preamp Module**

This portion of the radar converts the high RF signal coming in from the TX/RX module to a low RF signal. It also contains the preamp so that the weak electrical signal can be processed by the DSP module.

The circuit schematic for this module can be seen in Figure X. The initial circuit was based off the simplified block diagram given in the project assignment packet. I began the circuit by looking at the data sheets of the various parts needed. I selected the following parts: LMV751 low-noise op-amps, MCA1-85L+ frequency mixer, GALI-1+ amplifier, resistors, capacitors, and a potentiometer. The resistors and the capacitors were used in conjunction with the amplifiers to get the desired gain. The potentiometer was selected so that the gain of the preamp can be easily altered. The remaining parts will be discussed in more detail below.

The low-noise op-amps were selected to be used as the preamp gain amplifiers. Resistor values were chosen such that the first op amp gives a gain of 1000. The second op-amp uses the potentiometer to have a variable gain value. The DSP module needs 3.3 V of input, so the variable gain amp will allow us to alter the input gain such that it is the correct value.

The GALI-1+ was chosen as the amplifier that connects the source module with the frequency mixer. This is because upon inspection of the data sheet, the frequency mixer was found to need +4 dBm of input and the GALI-1+ was the smallest amplifier provided with a gain of 10 dB. Capacitor values were chosen based on the frequency value of 5.8 GHz to accompany the amplifier. These values were able to be taken from the third lab because the same amp and frequency were used for the lab.

The frequency mixer takes in the local oscillator value from the amplified source module input and the RF input directly from the TX/RX module. The mixer is used to mix the two frequencies, creating a new output frequency. It is the first step of the downconverter system for this module. The next step of the downconverter is the low pass filter. The low pass filter was first created using the LMV751 op amp along with a resistor and a capacitor. The filter was then altered from the op-amp based filter to a single-pole stub filter. The new filter is a simpler way to filter the signal. The stub length was set to a quarter of the wavelength. The calculations used to find the wavelength can be seen below.

The εr value used was 4.6 and the frequency used was 5.8 GHz. The final value of the stub length was calculated to be 0.2374 inches.