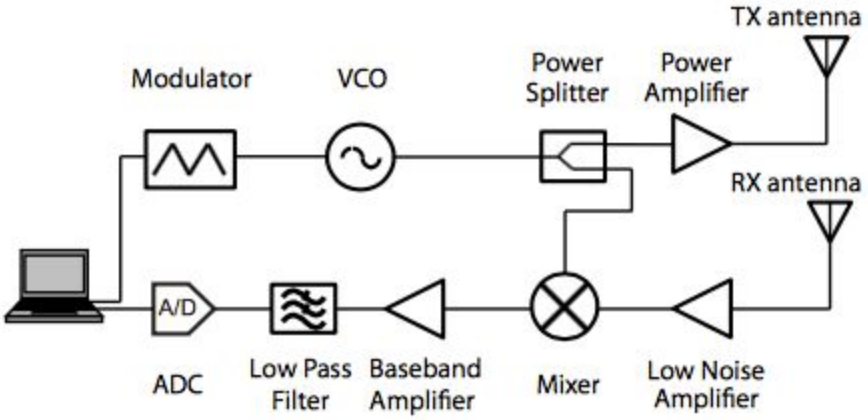
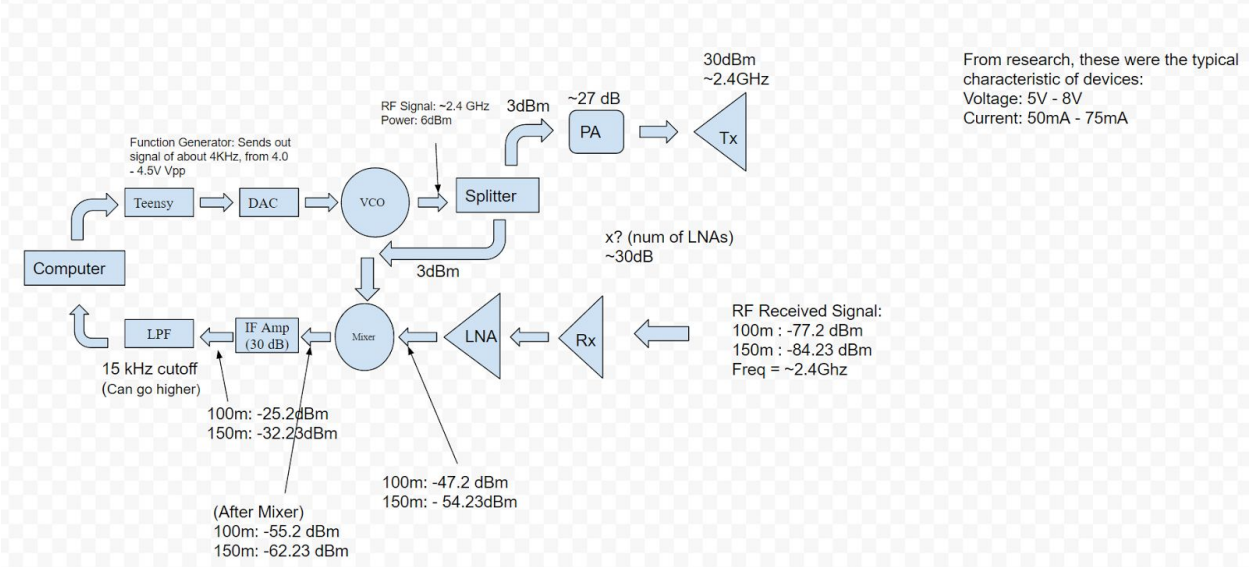
The purpose of quarter 2 of EEC 134 is further improve on quarter one design. One significant aspect is the weight of the radar. One could convert both the baseband and RF components onto PCBs circuits. But first one needs to determine their overall system. The diagram below provides a system's design of the radar.



Starting at the modulator, we need some form of way to modulate the signal. Ideally, you would want a signal that can go from a low to high voltage depending on the VCO characteristics, which will be talked about later. But, quarter 1 method of using a teensy, which provides a very easy solution. One should be familiar with how it works from the previous quarter. Other solutions one can use is a waveform generator chip. However the downside of this option is fact that it requires a huge amount current, thus boosting the amount of power being used(which is a factor for the final competition). At the same time, you will have to tune the chip by providing different supply voltages(often more than one), which is difficult since the competition will only provide one. Next, is the VCO. One needs to consider what VTUNE voltages the VCO can operate at. One things to consider is if one is using a Teensy 3.1, one can only use VCO chips that transmit signals from about 0-5V. For the splitter, usually these are not too difficult to operate, but some have limits as to how much power can be inputted, or else one could be wasting power or burning out the chip. For the power amplifier, usually one amp will be suffice depending on how much power wants to be transmitted(use the range equation to determine what characteristics, but there are limits on this). Note, cascading too many power amplifiers would be considered wasteful. The reason being is that there is a linear region of operation for each amplifier(one can check the data sheet for this or determine this experimentally). One wants to stay in linear region of operation or one could have to deal with distortion. But more importantly, one will hit the compression region, where there is no amplification really occurring. But overall, one wants to generally send about 15-30dBm of power. These regions seems to provide the best results for many. Note, antenna does have gain but this does really mean that the signal will be boosted by that amount.

For the receiving side, is recommended that one keep quarter 1 system specifically the active amp+LPF. The reason being is that is provides a simple solutions in order to recover the signal. One could easily get a gain of 30(and more) and this system provides a good bandwidth for which signals should be passed along. However, depending on how much power is being

transmitted determines the receiver design(specifically the RF portion). The reason being is because one does not have to provide more than about 1V pk-pk to to avoid burning out the sound card on the computer. Thus in order to compensate for this one needs to select a reasonable gain, which will be set by the LNA. One thing to consider is that cascading LNA together may provide an issue. Even though gain will compress as well, one needs to consider the noise figure of this section. Quarter 1 uses LNA that has a noise figure of about 1dB. By adding more LNAs to each other, one is increasing the noise figure as well, thus increasing the distortion of the signal. Even though LNA are made to attenuate noise, there is a noise floor one needs to consider. Finally, one needs to consider if the mixer will be able to work at the voltages provided throughout the system. Additionally, only a certain amount of power can be applied at the LO feed, which can be checked on the spec sheet. Here is the system design used by Falcon 9. This system reads up to 50 meters fine, but after realizing there was too much gain, there was too much noise. One way to know if signal will be recovered is looking at the waveform on audacity. If the signal looks smooth and sinusoidal, chances are something will be picked up. If for some reason one gets a square wave, this means that the system is being over driven. This will result in nothing on the signal processing. Solutions to this are reducing the gain or adding attenuators to the receiving or transmitting side.



Extra: The ADC shown on the system design is built into the computer. Unless one wants to do the embedded processing, this is suffice. But if embedded processing wants to be achieved, one needs to do more research on ADC chips. For example, how much bits can it work with? Ideally 16 is good enough. Also, how does the ADC send out data? This part will not be talked about it detail since it is an extra components not necessary. Overall, one needs to consider the weight and power consumption of their radar. Range is not a huge factor as compared to accuracy