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INFORMATION TECHNOLOGY
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Department
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Circuit Theory and Devices

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Lab_5: Prototype design of a SONAR receiver

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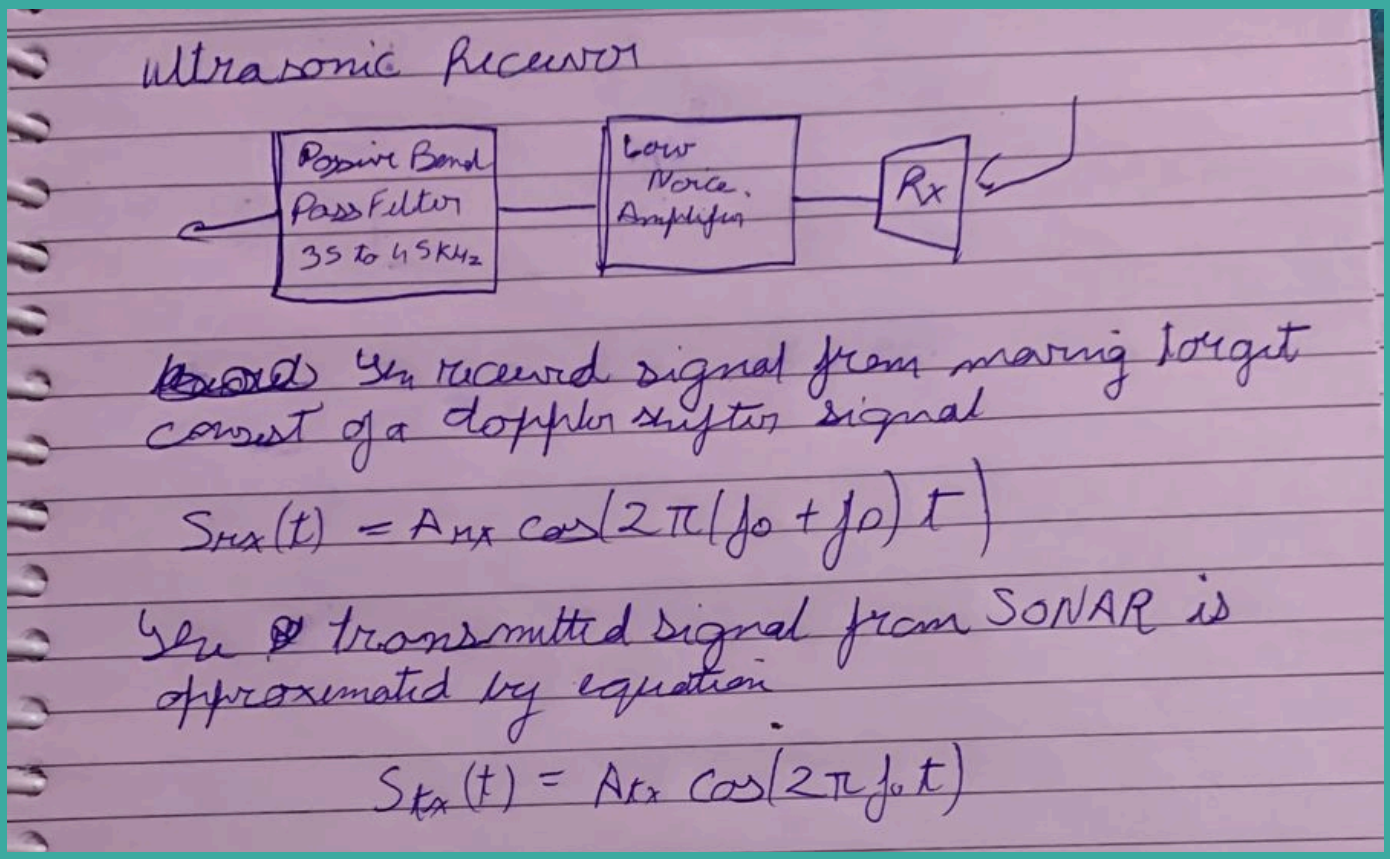
Objective:

a.To develop a prototype of a SONAR receiver on a breadboard and test its desired outcome.
b.With SONAR Tx and Rx, observe the Doppler shift in the received signal from a moving metal target.

Theoretical Calculations:



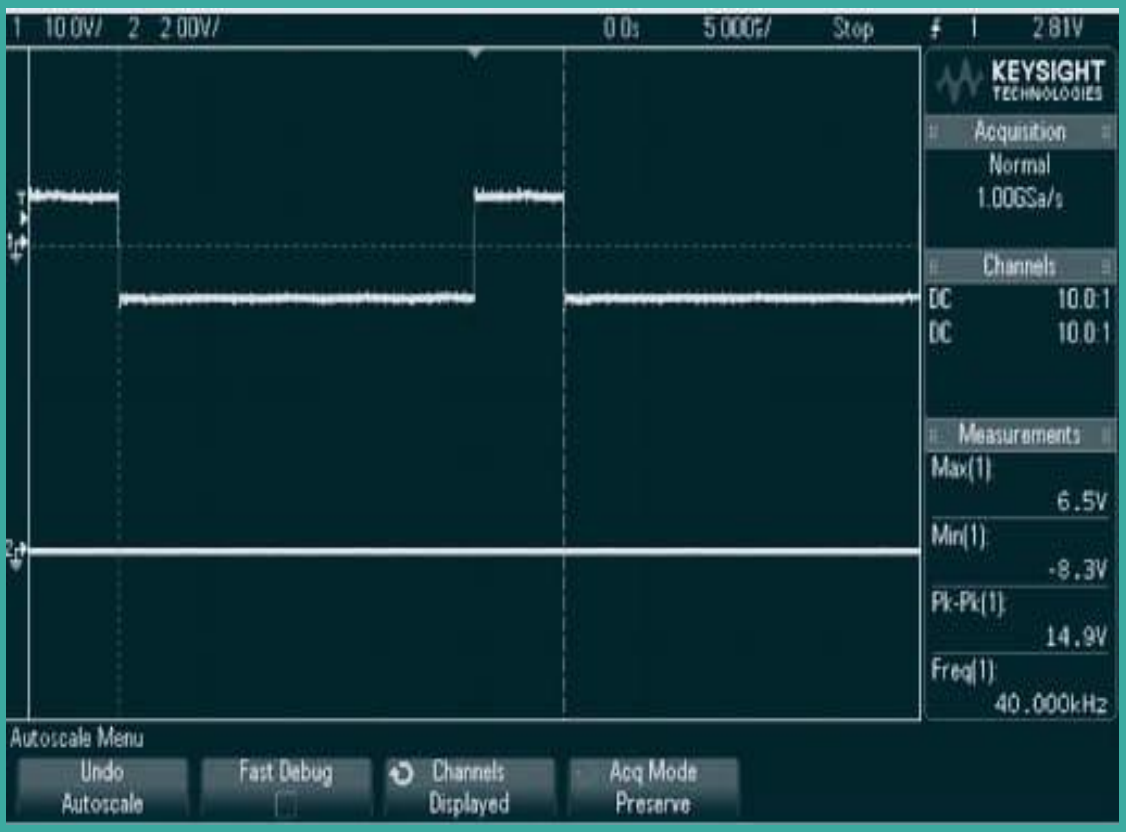
Observations:

1. The output signal frequency of the LNA at TP1 was detected, which we knew would be somewhat amplified, and the output was observed to be 42Khz at the TP1 point. We created a low noise amplifier and provided 40Khz from the DSO to the LNA.
2. We knew that by passing the output through BPF after that, the frequency would be reduced.
3. We then had our whole receiving circuit.
4. (Lab 3)The transmitter circuit underwent some modifications, the first of which was a shift in the crystal oscillator frequency from 2 Mhz to 4 Mhz. The signal frequency at TP1 was then determined to be 400Khz (4Mhz/10) using IC 4017, and at TP2 it was discovered to be 40Khz (4Mhz/10).
5. Then, a transducer was attached to the transmitter circuit, and its 40 kHz frequency was output.It was passed on the rotating motor and then it was reflected to the receiving transducer of the receiver circuit.
6. The final frequency was observed to be nearly 50Khz.

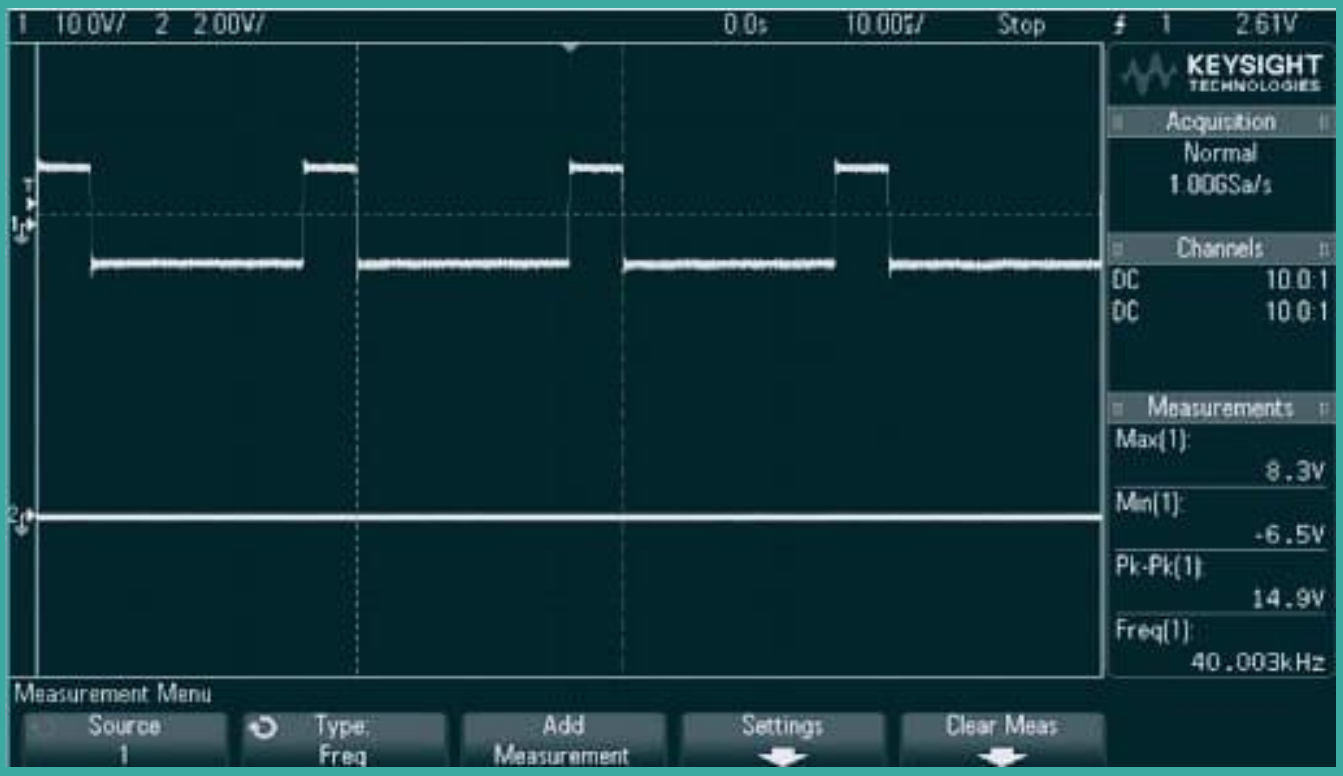
Plots:

Transmitter circuit plots:

Signal frequency after division of 400KHz by 10 →



Signal frequency after passing the signal through the active low pass filter→



Conclusions:

1. (Arx <Atx) The transmitted signal is substantially stronger than the received signal. In order to increase the voltage, the signal is therefore sent via a low noise amplifier.
2. To eliminate higher order harmonics and restrict outside interference, band pass filters are used.
3. When a metal target travels ahead of the sonar, the frequency of the received signal should exhibit a Doppler shift starting at 40 KHz since the doppler effect results in a shift equal to 1/r4 the original frequency.