INDRAPRASTHA INSTITUTE *of* INFORMATION TECHNOLOGY DELHI

Department
of
Electronics & Communication Engineering

Circuit Theory and Devices

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Lab 3: Prototype Design of a SONAR Transmitter

Date: 02/09/2023
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OBJECTIVE:

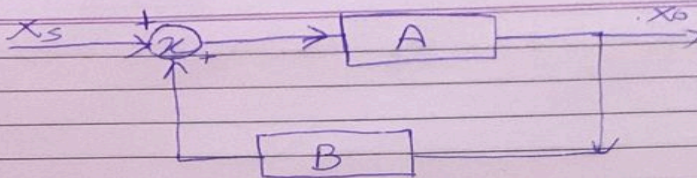The objective of this lab assignments is to learn how to
a. Read a datasheet for finding out the key information relevant to a design.
b. Develop a prototype of a Sonar transmitter on a breadboard and test its desired outcome.
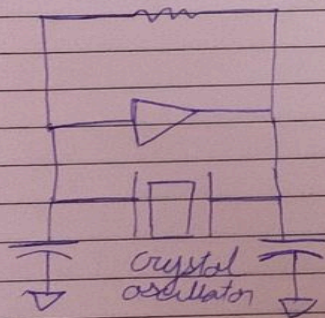
Theoretical Calculations:

CTD Lab

$$X_0 = A(x_S + x_f) = A(x_S + X_0 B)$$
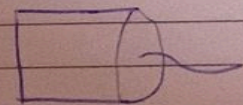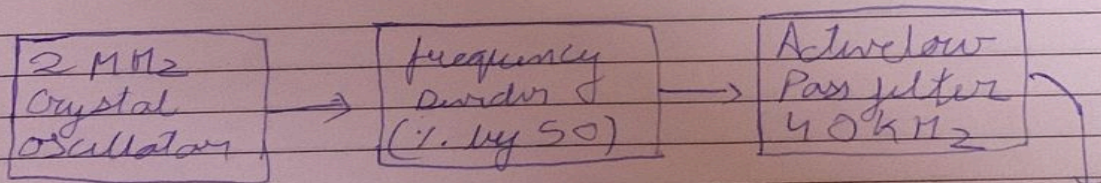
$$x_f = X_0 B$$

$$\frac{X_0}{X_S} = \frac{A}{1 - AB}$$

X_0 will be shifted by Phase of $180°$

$C_1 \rightarrow$ Shift the phase by $90°$
$C_2 \rightarrow$ Shift the phase by $90°$

Crystal $\rightarrow$ Shift the Phase by $180°$
oscillator

crystal
oscillator

Total Phase Shift by $360°$ means
We will get the same signal as
output from this Block

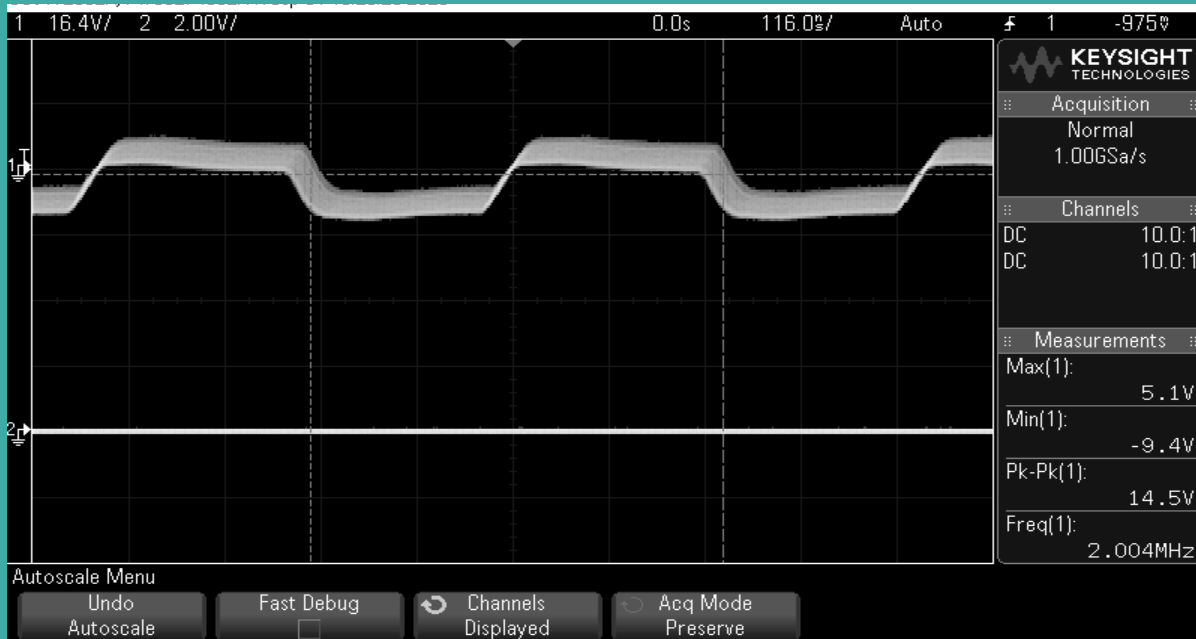| 2 MHz Crystal oscillator	frequency Divider (÷ by 50)	Active low Pass filter 40 KHz

Observations:

- **FOR TP**1-A 2MHz oscillating signal is present at TP1.

- **FOR TP2**-By using the IC4017 and dividing 2MHz by 10, the oscillating signal at TP2 has a frequency of 200 KHz.

- **FOR TP3**-By dividing 200 kHz by 5, the oscillating signal at TP3 is at a frequency of 40 kHz. The signal is divided by the frequency divider from 2MHz to 40KHz overall.
An active low pass filter is used to pass the signal from TP3 through. 40KHz is the filter cutoff frequency.

- **FOR TP4**-The FFT capability of DSO is used to check the frequency information of the signal from TP4; the frequency with the largest peak is at Delta(X)=4us with a span of 1MHz.
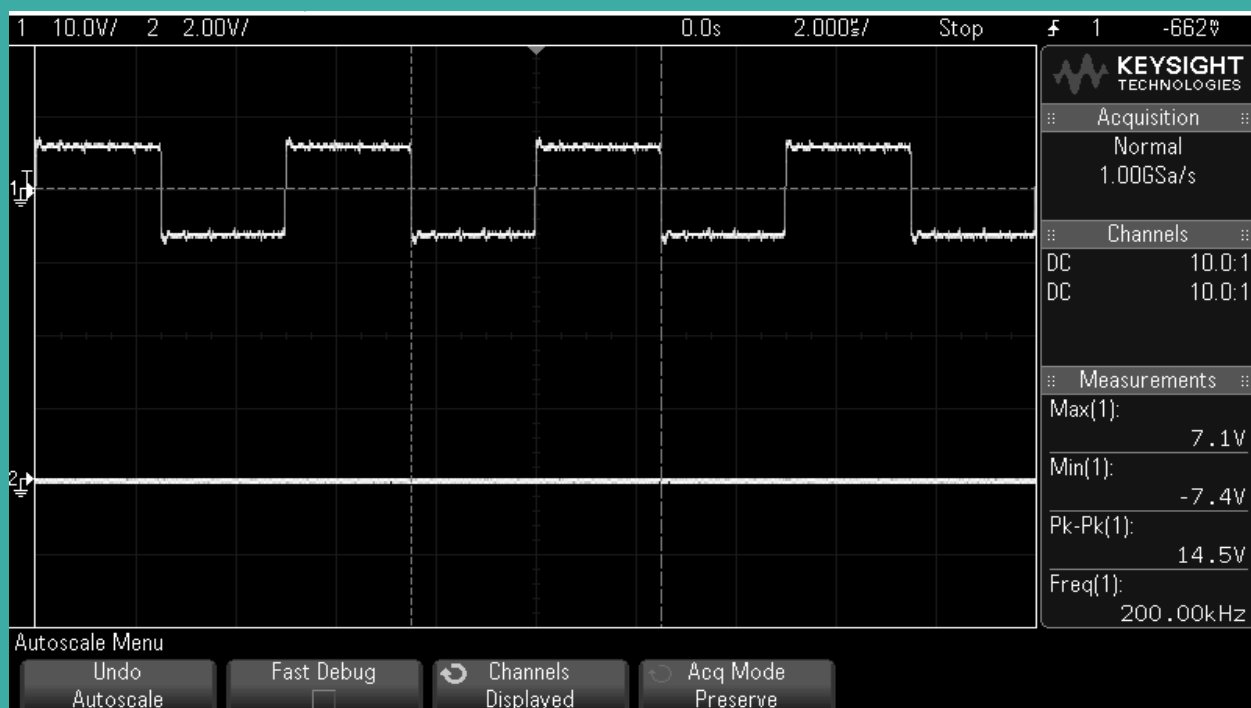
Following are the respective plotsn we got on DSO:-

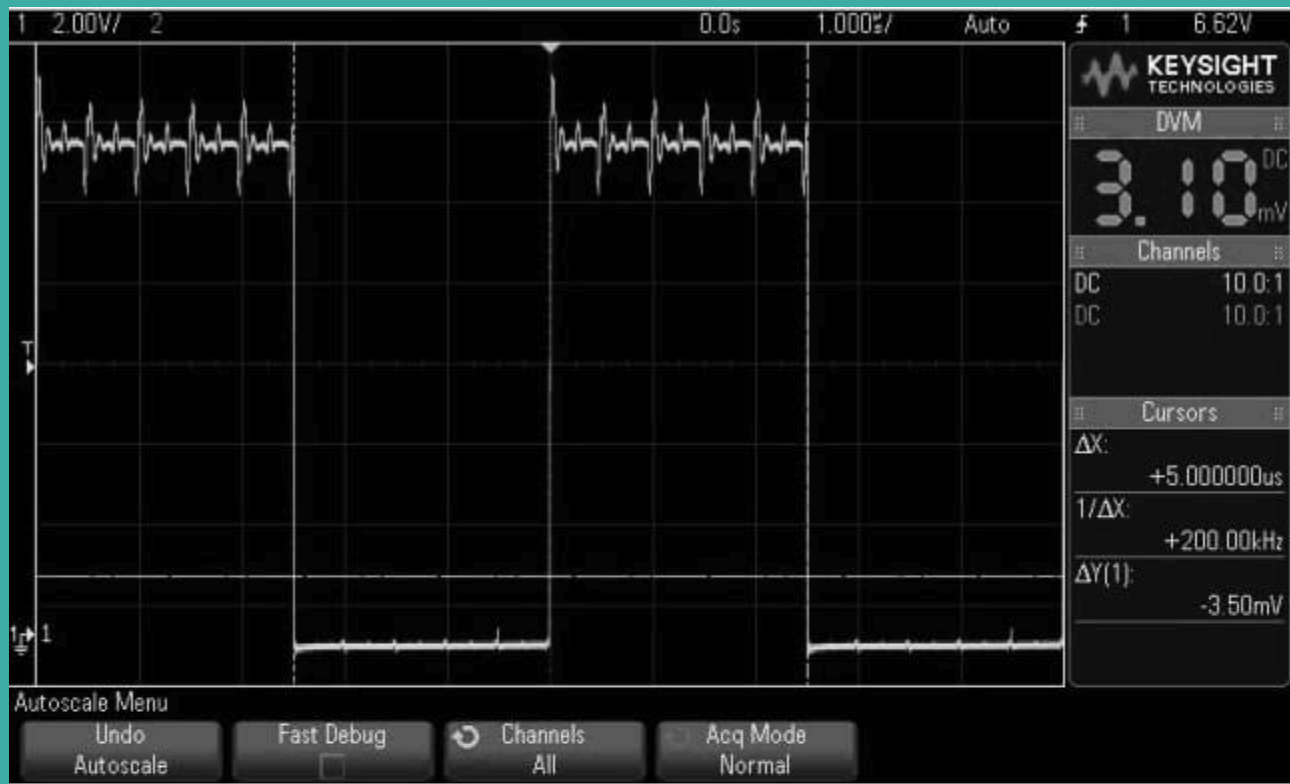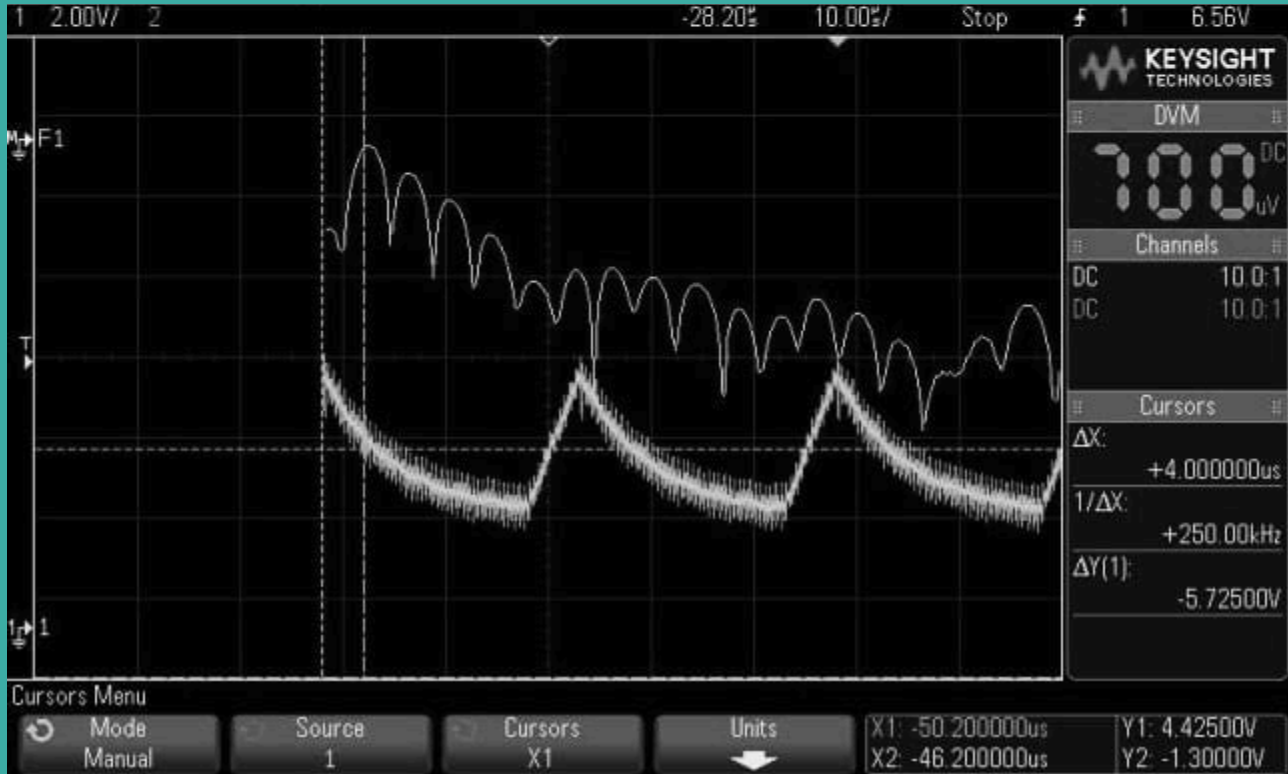## TP1:   1:

TP 2:

TP 3:

TP 4:

Conclusions:

The transmitter utilizes a crystal oscillator to generate a sinusoidal wave with a frequency of 2MHz. This 2MHz input signal is then subjected to a frequency division process, resulting in a 40KHz (f_o) output signal achieved by dividing it by a factor of 50. To ensure the elimination of any higher order harmonics, a low pass filter is employed.