

LAB NO.: 7 [Frequency Demodulation and Phase Lock Loop (PLL) Circuits]

OBJECTIVES:

1. To study the operation of a PLL circuit.
2. To observe demodulation process in the PLL demodulator with an LM565 integrated circuit.
3. To test the demodulator in the presence of the interfering signals.

EXPERIMENTAL PROCEDURES:

Part A:

- A. Build the 565 phase-lock loop circuit as shown in **figure 1**. Select the center frequency to be 200 KHz. Design and build a low pass filter as shown in **figure 2** which will cover the selected frequency range. VCO running frequency can be calculated using the following equation:

$$f_o = 1.2/4R_1C_1$$

- B. Connect a carrier signal (200 kHz, 4Vp-p) to the input of the PLL, determine the input frequency at which the output signal is zero and use this as the center frequency for a frequency modulated generated signal. The experimental value may differ from the calculated value.
- C. With the generator unmodulated, compare the phase of the voltage controlled oscillator output with the phase of the input signal applied from the generator. Use the dual channel scope to measure the phase difference. Change the generator frequency and measure how much frequency change produces how much change on the voltage controlled oscillator. Then frequency modulate the generator about its center frequency with a low frequency modulating sine wave and measure how large a frequency deviation it takes to cause the loop to go out of phase lock. Repeat with square wave modulation with a different frequency.
- D. Connect a message signal (2 kHz, 400mVp-p) to the FM input of the signal generator which produces the carrier signal. This will produce FM output.
- E. Connect the FM signal to the input of the PLL. Observe the demodulated output with sine and square wave modulation at various deviations and modulating frequencies.

Part B:

1. Using the FM radio in the lab, observe the broadcast FM signal spectrum on the spectrum analyzer, and the measurement of its bandwidth.
2. Using the previous FM signal generated in **PART A**, observe its FM spectrum on the spectrum analyzer and verify its bandwidth using the Carson's rule.

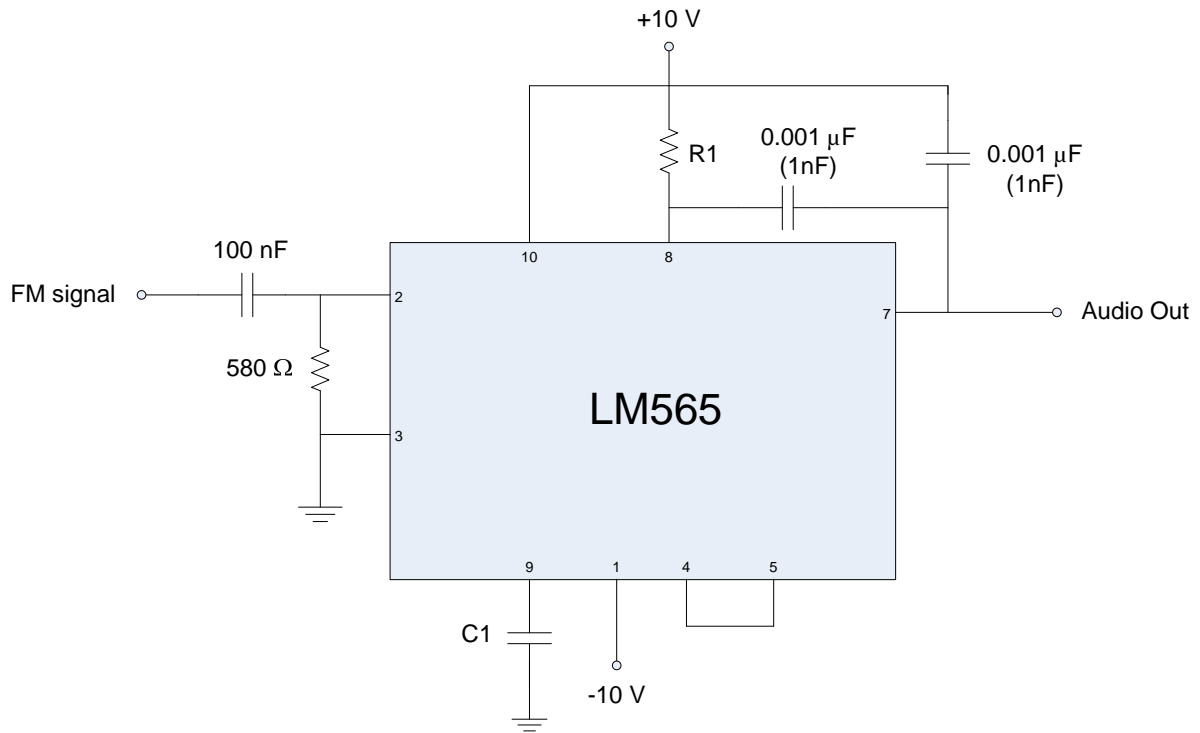


Figure 1: PLL circuit.

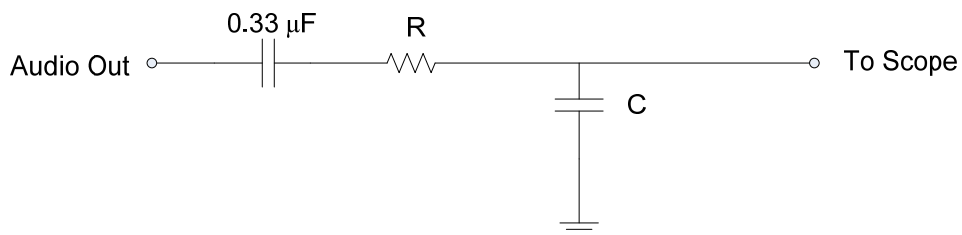


Figure 2: Low Pass Filter circuit.