Gain Vs Bandwidth for Op-Amp Amplifiers

Different resistances, and op-amps were tested, the bandwidth was determined from the upper cutoff frequency. For the LM741 Op-amp, when the resistor values $R_1 = 2\ \Omega$, and $R_2 = 4\Omega$ were used, the output was distorted and the gain continued to increase as the frequency increased, and the upper cutoff frequency could not be determined. For the LF347BN, and the OPA2604 Op-Amps the same distortion occurred and an upper cutoff frequency could not be determined.

The upper cutoff frequency for the inverting op-amp using the LM 741, with resistance $R_1 = 200\Omega$, and $R_2 = 400\Omega$, was 25.84 kHz (Figure 1). When the resistor values increased to $R_1 = 2k\Omega$, and $R_2 = 4k\Omega$, the upper cutoff frequency decreased to 21.6 kHz (Figure 2). For the final resistor values, $R_1 = 200k\Omega$, and $R_2 = 400k\Omega$, the upper cutoff frequency increased to 22.1 kHz (Figure 3). For the LM741 Op-Amp the upper cutoff frequency decreased, but then increased when using the highest resistor values.

For the LF347BN Op-Amp, the upper cutoff frequency decreased as the resistor values increased, and the gain increased a small amount. For the resistor values $R_1 = 200\Omega$, and $R_2 = 400\Omega$, the upper cutoff frequency was 590 kHz. This Op-Amp was made to have a higher upper cut-off frequency, and it is more expensive than LM741. The upper cutoff frequency decreased to 590 kHz when $R_1 = 2k\Omega$, and $R_2 = 4k\Omega$, and decreases dramatically, when $R_1 = 200k\Omega$, and $R_2 = 400k\Omega$ to 149.7 kHz.

The same pattern that occurred when testing the LF347BN, happened when the OPA2604 was tested. When the resistor values $R_1 = 200k\Omega$, and $R_2 = 400k\Omega$ were used the upper cutoff frequency was 1.202MHz. The resistor values were increased by a magnitude of ten and the upper cutoff frequency decreased to 1.071 MHz. Finally the resistor values were increased by a magnitude of 100, and the upper cutoff frequency decreased to 190.8 kHz. The gain also increased as the bandwidth decreased and the resistances increased

Table – 1 (gain vs bandwidth)

	LM741	LF347BN	OPA2604

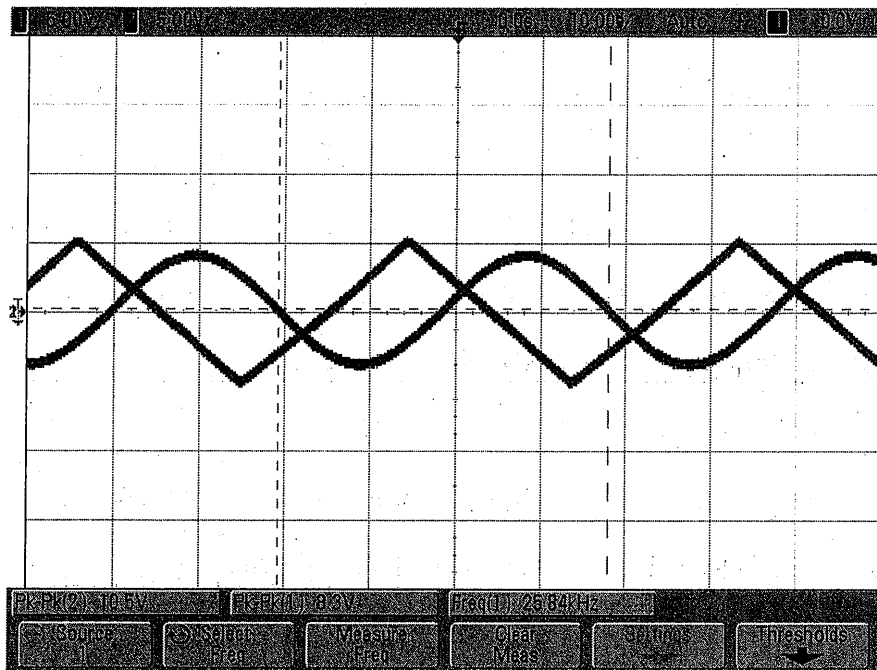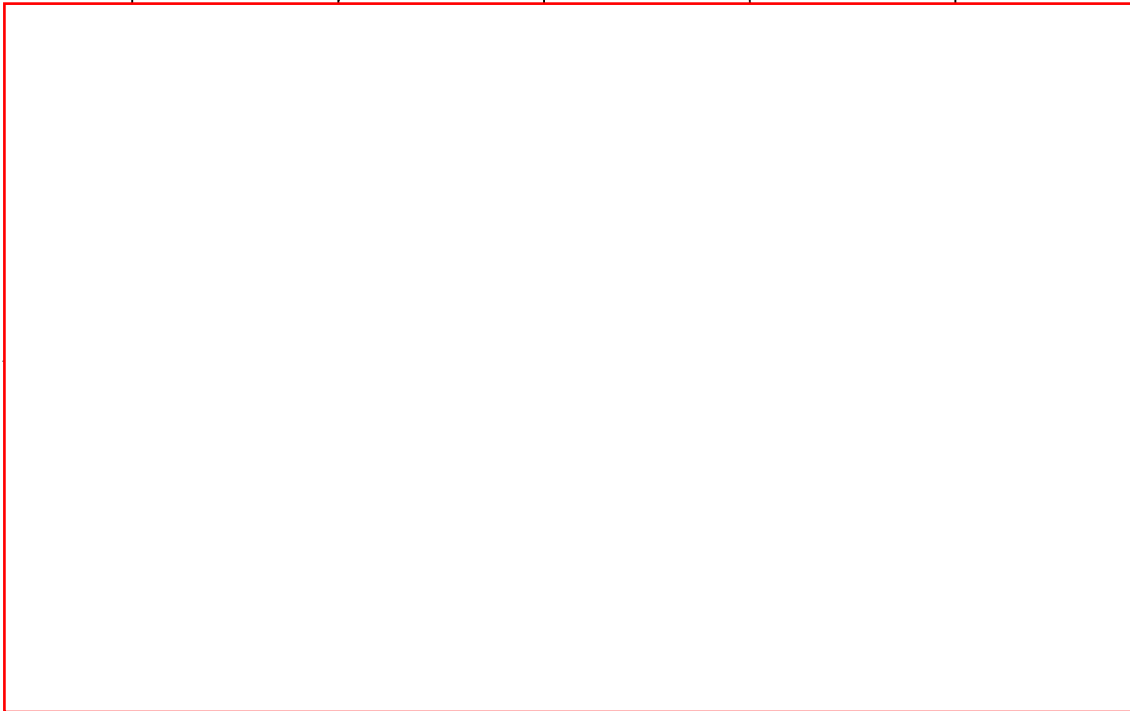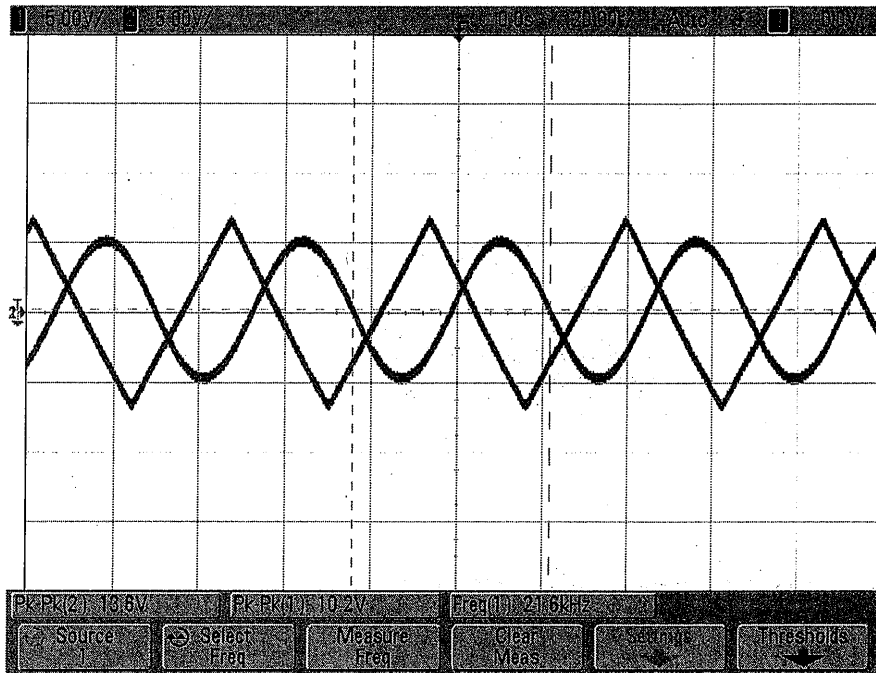Figure – 1 (LM741, R_1 = 200Ω and R_2 = 400Ω)

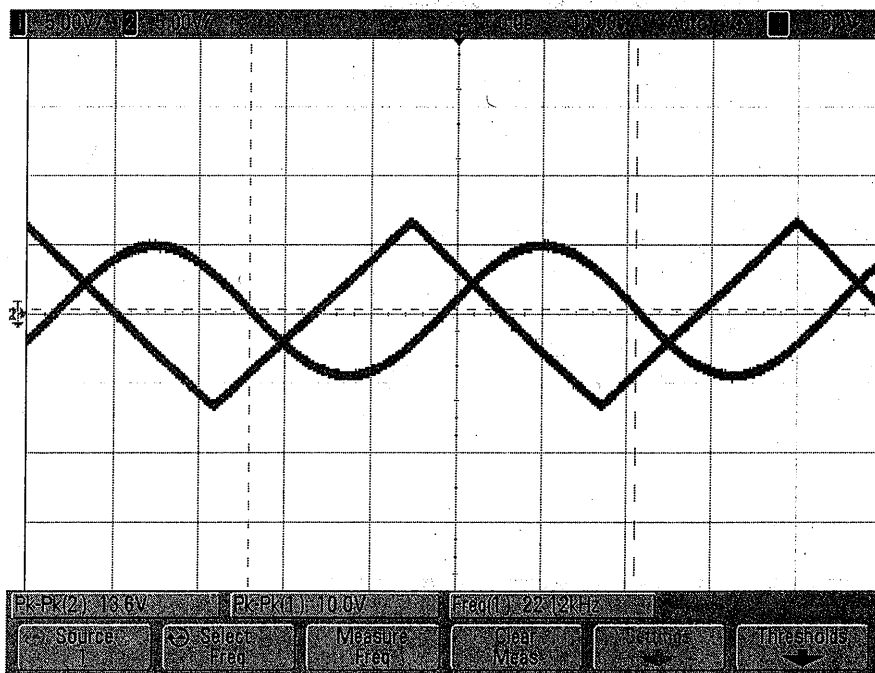Figure – 2 (LM741, $R_1 = 2k\Omega$ and $R_2 = 4k\Omega$)

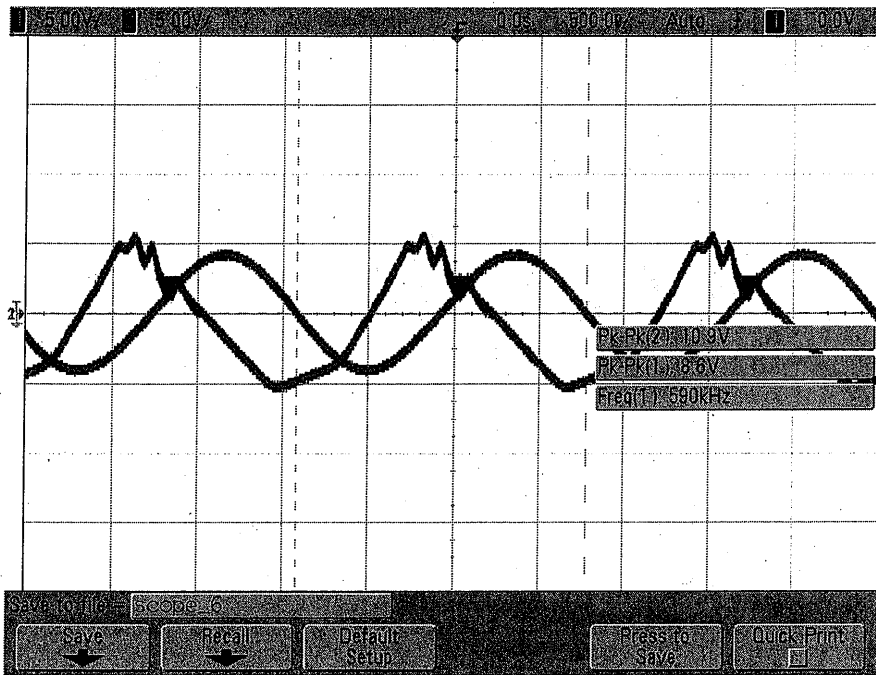Figure – 3 (LM741, $R_1 = 200k\Omega$ and $R_2 = 400k\Omega$)

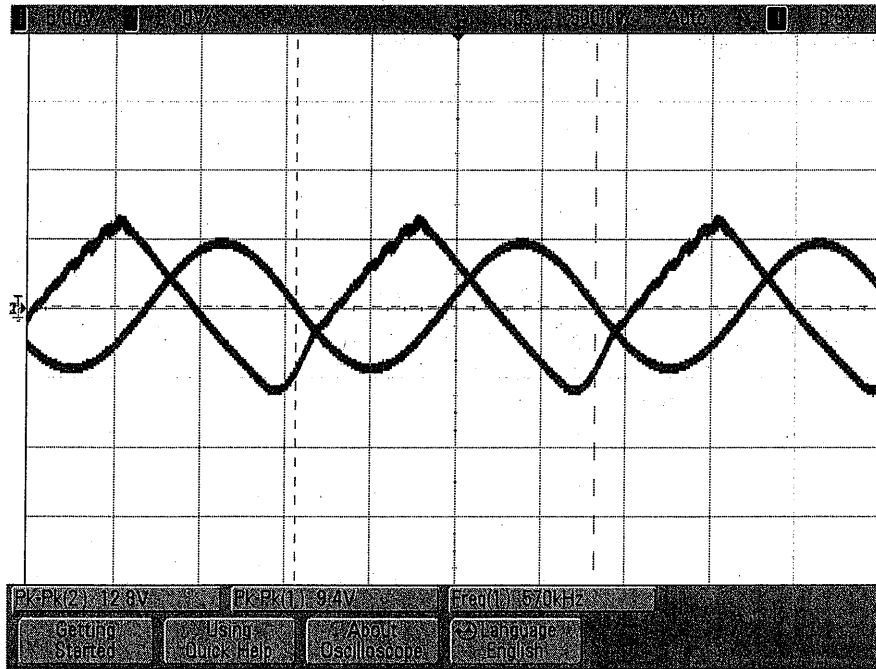Figure – 4 (LF347BN, $R_1 = 200\Omega$ and $R_2 = 400\Omega$)

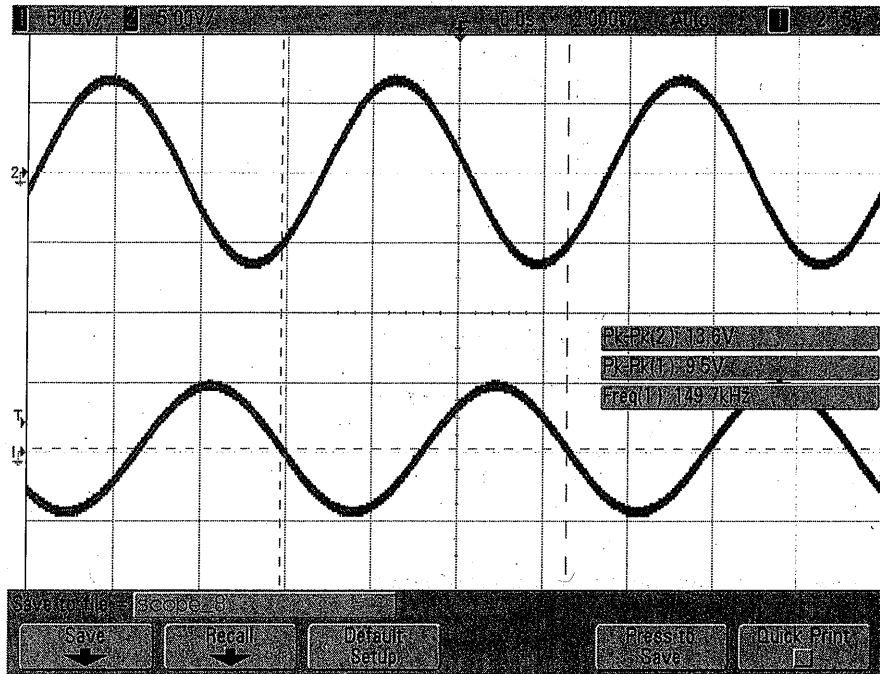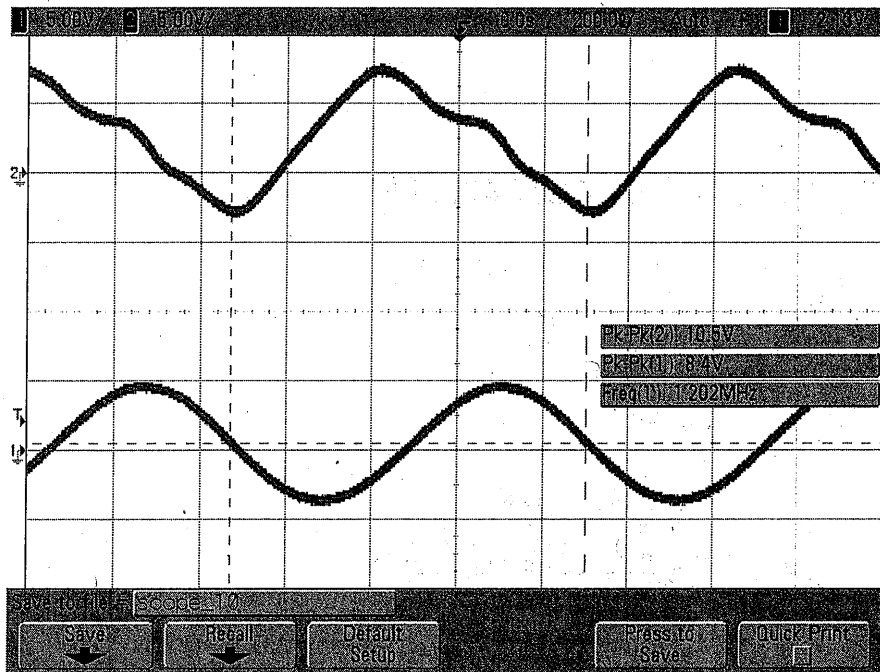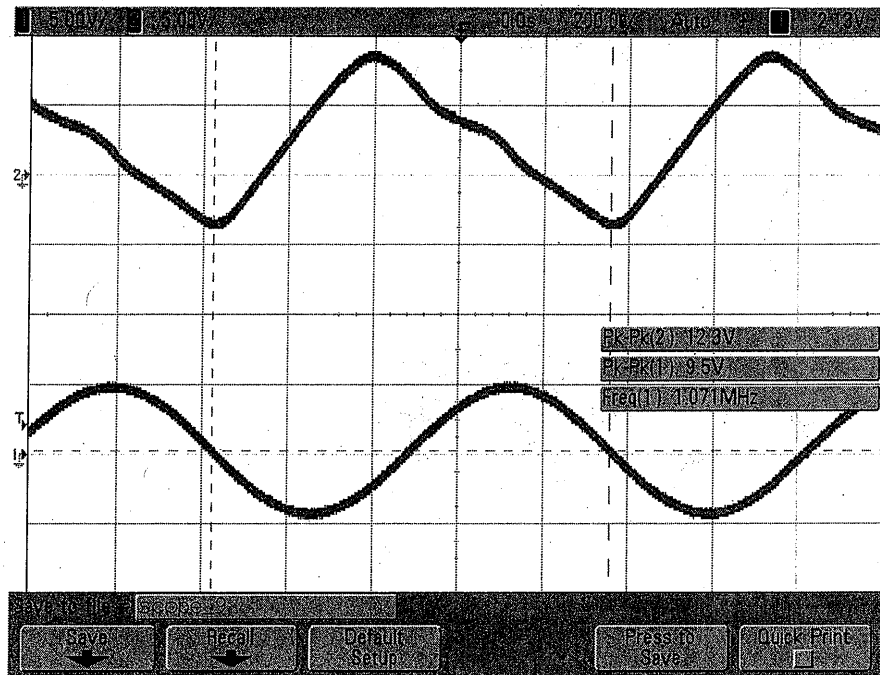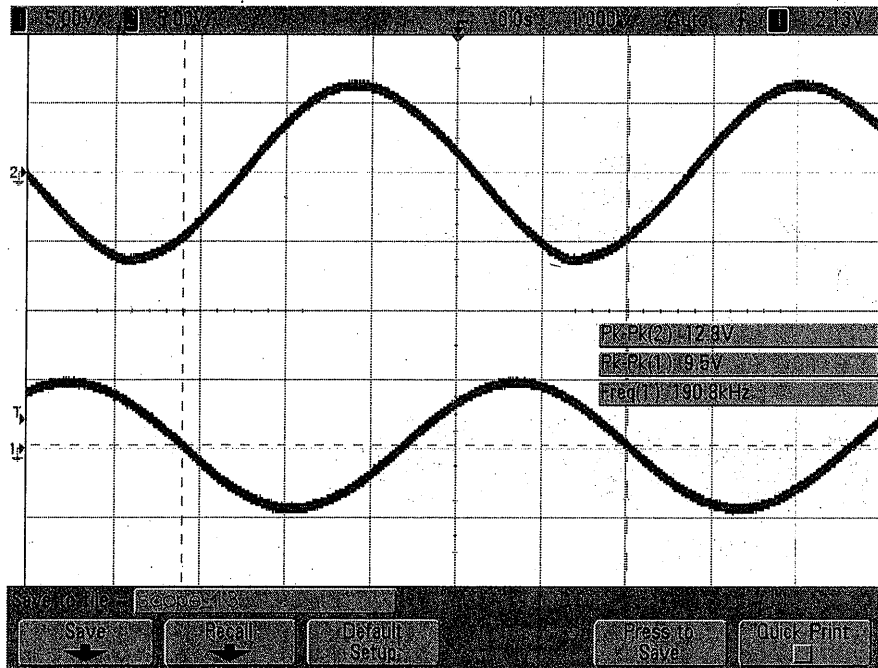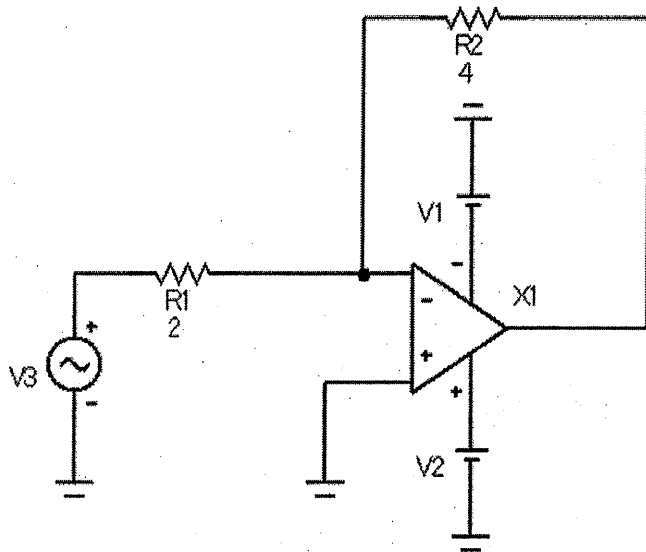Figure – 5 (LF347BN, $R_1 = 2k\Omega$ and $R_2 = 4k\Omega$)

Figure – 6 (LF347BN, R_1 = 200kΩ and R_2 = 400kΩ)

Figure – 10 (OPA2604, R_1 = 200Ω and R_2 = 400Ω)

Figure – 9 (OPA2604, R_1 = 2kΩ and R_2 = 4kΩ)

Figure – 11 (OPA2604, R_1 = 200kΩ and R_2 = 400kΩ)

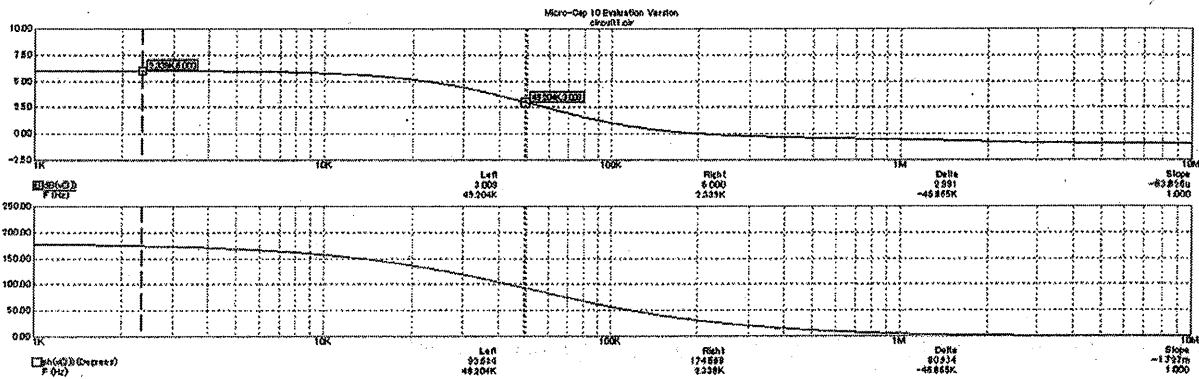Figure – 12 (Microcap simulation where $R_1 = 2\Omega$ and $R_2 = 4\Omega$)

Figure – 13 ($R_1 = 2\Omega$ and $R_2 = 4\Omega$, Upper cutoff frequency 49 KHz)
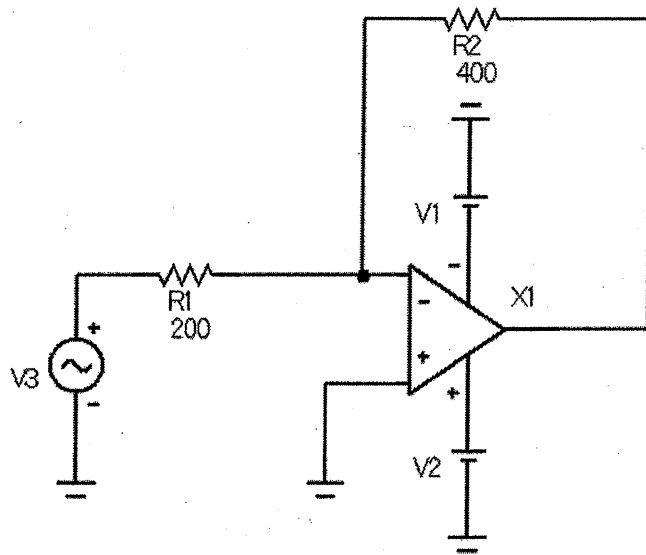
Figure – 14 (Microcap simulation where $R_1 = 200\Omega$ and $R_2 = 400\Omega$)
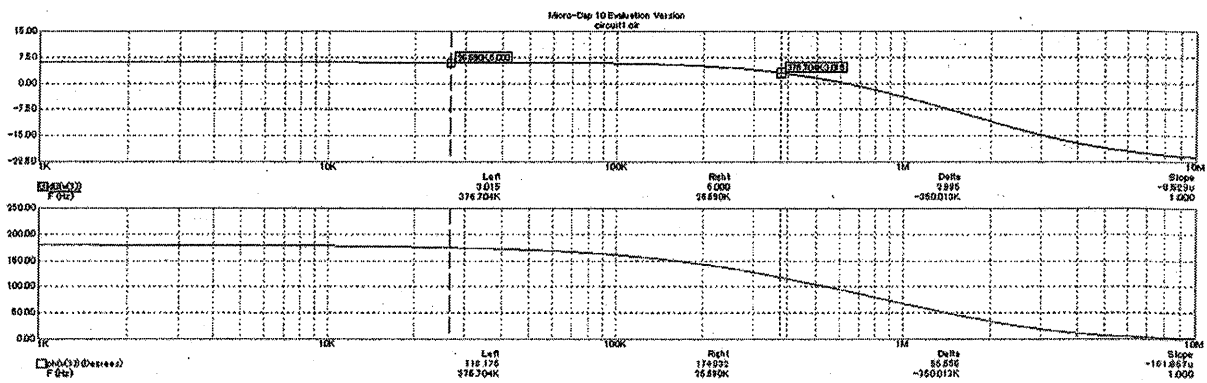

Figure – 15 ($R_1 = 200\Omega$ and $R_2 = 400\Omega$, Upper cutoff frequency 376 KHz)
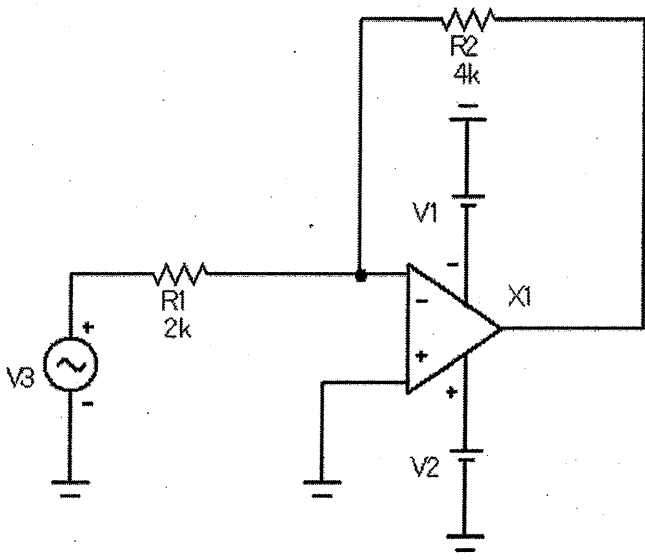
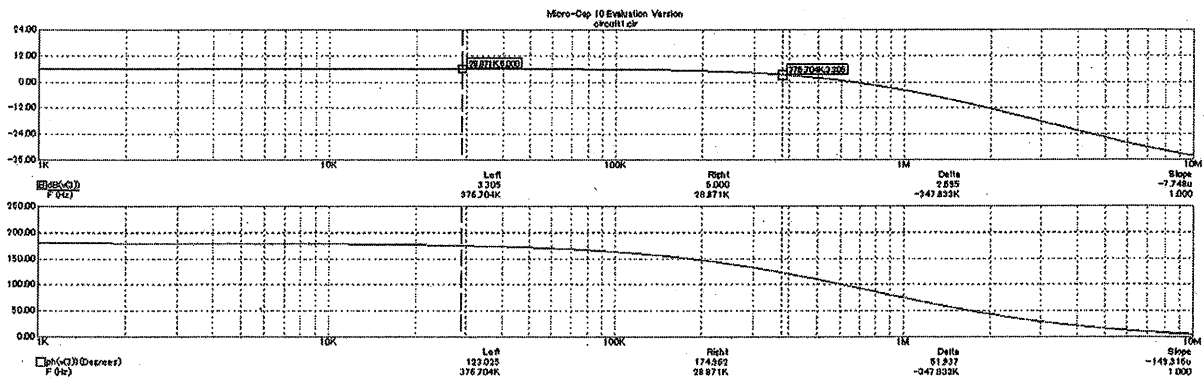Figure – 16 (Microcap simulation where $R_1 = 2k\Omega$ and $R_2 = 4k\Omega$)

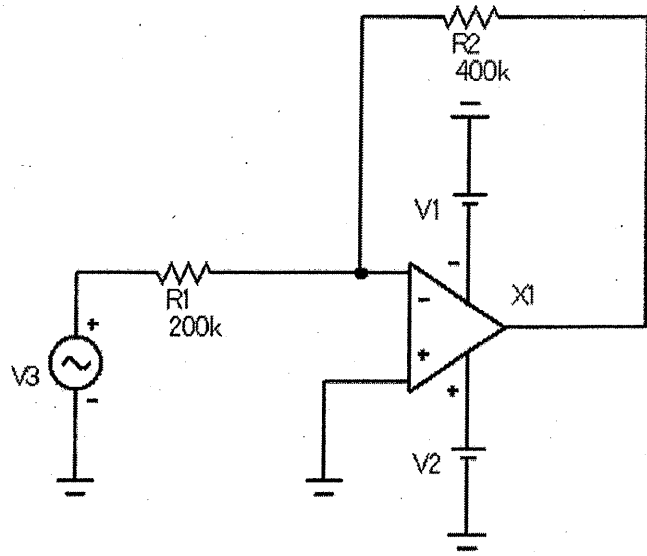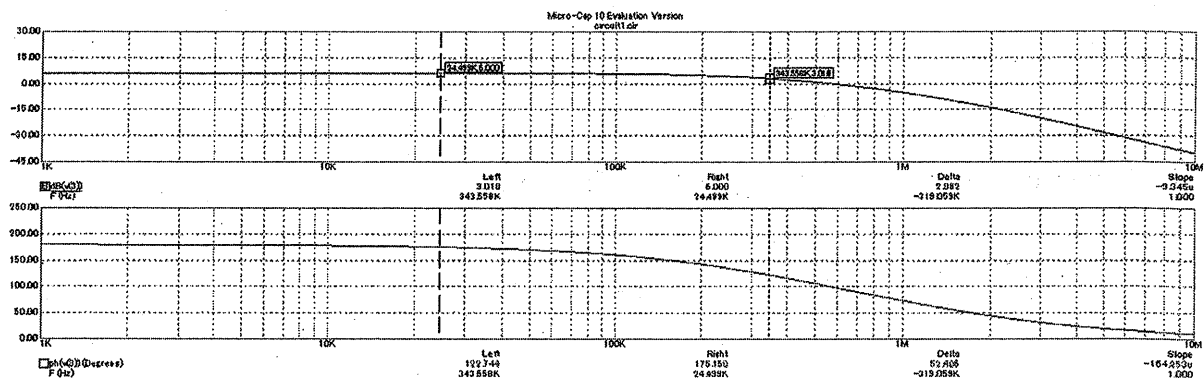Figure – 17 ($R_1 = 2k\Omega$ and $R_2 = 4k\Omega$, Upper cutoff frequency 376 KHz)

Figure – 18 (Microcap simulation where R_1 = 200kΩ and R_2 = 400kΩ)

Figure – 19 (R_1 = 200kΩ and R_2 = 400kΩ, Upper cutoff frequency 343 KHz)