Laboratory Application Assignment

In this lab application assignment you will examine a tuned class C amplifier. As you will see, the tuned class C amplifier uses a parallel resonant circuit in the collector, which results in maximum output voltage at only one frequency. The frequency at which maximum output occurs is the resonant frequency, f_r, of the *LC* tank circuit. You will also see how the tuned class C amplifier can be used as a frequency multiplier.

Equipment: Obtain the following items from your instructor.

- 2N2222A *npn* transistor or equivalent
- Two 100-kΩ carbon-film resistors
- 0.001-μF, 0.01-μF, and 0.1-μF capacitors
- 10-mH inductor
- Function generator
- Oscilloscope
- DMM
- Variable dc power supply

Tuned Class C Amplifier: Calculations and Predictions

Examine the tuned class C amplifier in Fig. 31–16. Calculate and record the resonant frequency, f_r, of the *LC* tank circuit.
$f_r =$ _____
With an input voltage, V_{in}, of 2 $V_{p\text{-}p}$, calculate and record the dc base voltage, V_B. $V_{B(dc)} =$ _____
What dc voltage do you expect to measure at the collector?
$V_{C(dc)} =$ _____
Next, predict the peak-to-peak output voltage across the load R_L if the frequency of V_{in} equals f_r. $V_{out(p\text{-}p)} =$ _____

Tuned Class C Amplifier: Measurements

Construct the circuit in Fig. 31–16. Set V_{in} to exactly 2 $V_{p\text{-}p}$ as shown. Next, set the frequency of the function generator to the resonant frequency, f_r, calculated earlier. With channel 2 of the oscilloscope connected across the load, R_L, move the frequency dial back and forth until the output voltage is at its maximum peak-to-peak value. Measure and record the frequency where $V_{out(p\text{-}p)}$ is maximum. This frequency is the resonant frequency, f_r, of the tank circuit. $f_r =$ _____
Measure and record the maximum peak-to-peak output voltage.
$V_{out(p\text{-}p)} =$ _____
Next, measure and record the dc voltage at the base and collector. $V_{B(dc)} =$ _____, $V_{C(dc)} =$ _____
Connect channel 1 of the oscilloscope across V_{in} and channel 2 across the load, R_L. Measure and record the phase relationship between V_{in} and V_{out} at f_r. $\theta =$_____
Connect channel 1 of the oscilloscope directly to the base of the transistor. Set the channel 1 volts/div. setting to 0.5 volt/div., and move the input coupling switch to dc. Draw the measured waveform, including all values, on the scope graticule in Fig. 31–17.

Figure 31–16

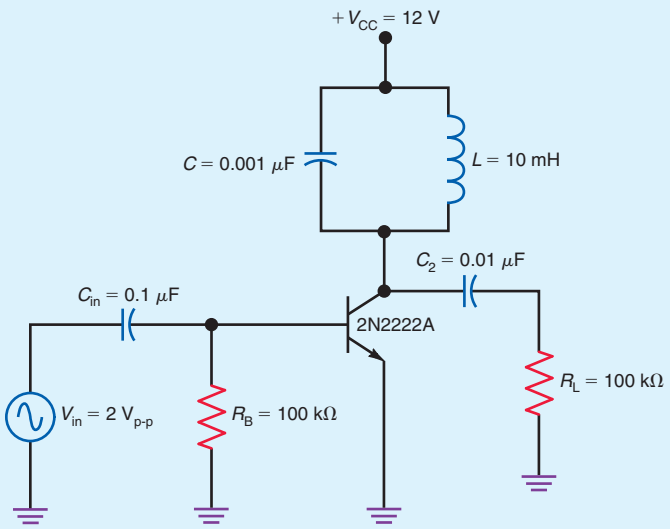
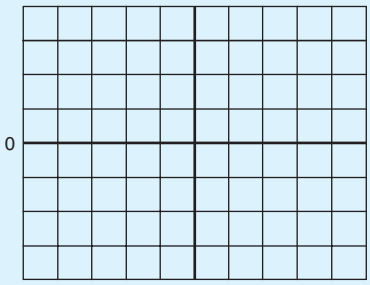


Figure 31–17



Amplifier Bandwidth

Reduce the input voltage, V_{in}, to 1.6 $V_{p\text{-}p}$. While monitoring the peak-to-peak output voltage across R_L, decrease the frequency of V_{in} below f_r until the output voltage decreases to 0.707 of its maximum value. Record this frequency as f_1.
$f_1 =$ _____

Now increase the frequency of V_{in} above f_r until V_{out} decreases to 0.707 of its maximum value. Record this frequency as f_2.
$f_2 =$ _____

Calculate the amplifier bandwidth, BW, as $f_2 - f_1$.
BW = _____

Frequency Multiplier

Decrease the frequency of the function generator to approximately one-half of f_r. (Keep V_{in} at 1.6 $V_{p\text{-}p}$.) Move the function generator frequency dial back and forth to produce the maximum peak-to-peak output voltage. Is the frequency of the output waveform twice that of the input frequency? _____
If yes, explain how this is possible.

_____

_____

_____

Is the peak-to-peak value of the output waveform the same for each individual cycle? _____ If not, explain the possible cause for this._____

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