Communication Circuits

Lab 7 – Radio Frequency AM - Tone Modulated Transmission

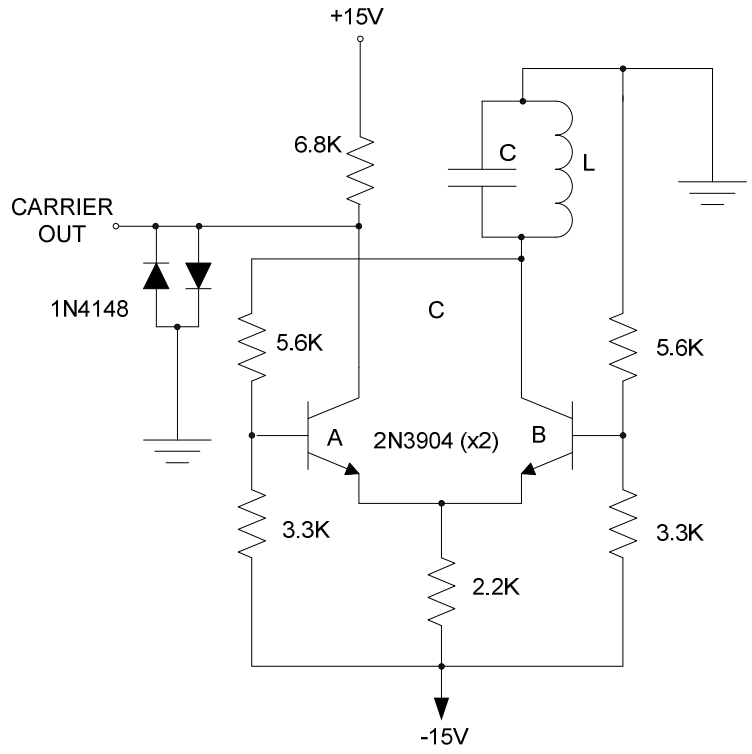
Background:

The purpose of this lab is to investigate Radio Frequency (RF) transmission of a DSB+C AM signal, and verify the transmission using a standard AM radio receiver. The modulating signal will be from a function generator, and the carrier will be generated by your circuit. To avoid conflicts between carriers, each group will be assigned a carrier frequency, which must be verified on the oscilloscope.

Note: since this is an RF lab, it is very important to keep your jumper wires *as short as possible*, to prevent unwanted RF radiation and oscillation. Keeping wires short will yield the best results. Bypassing capacitors may be needed at the breadboard to keep power supply noise to a minimum.

Part I:

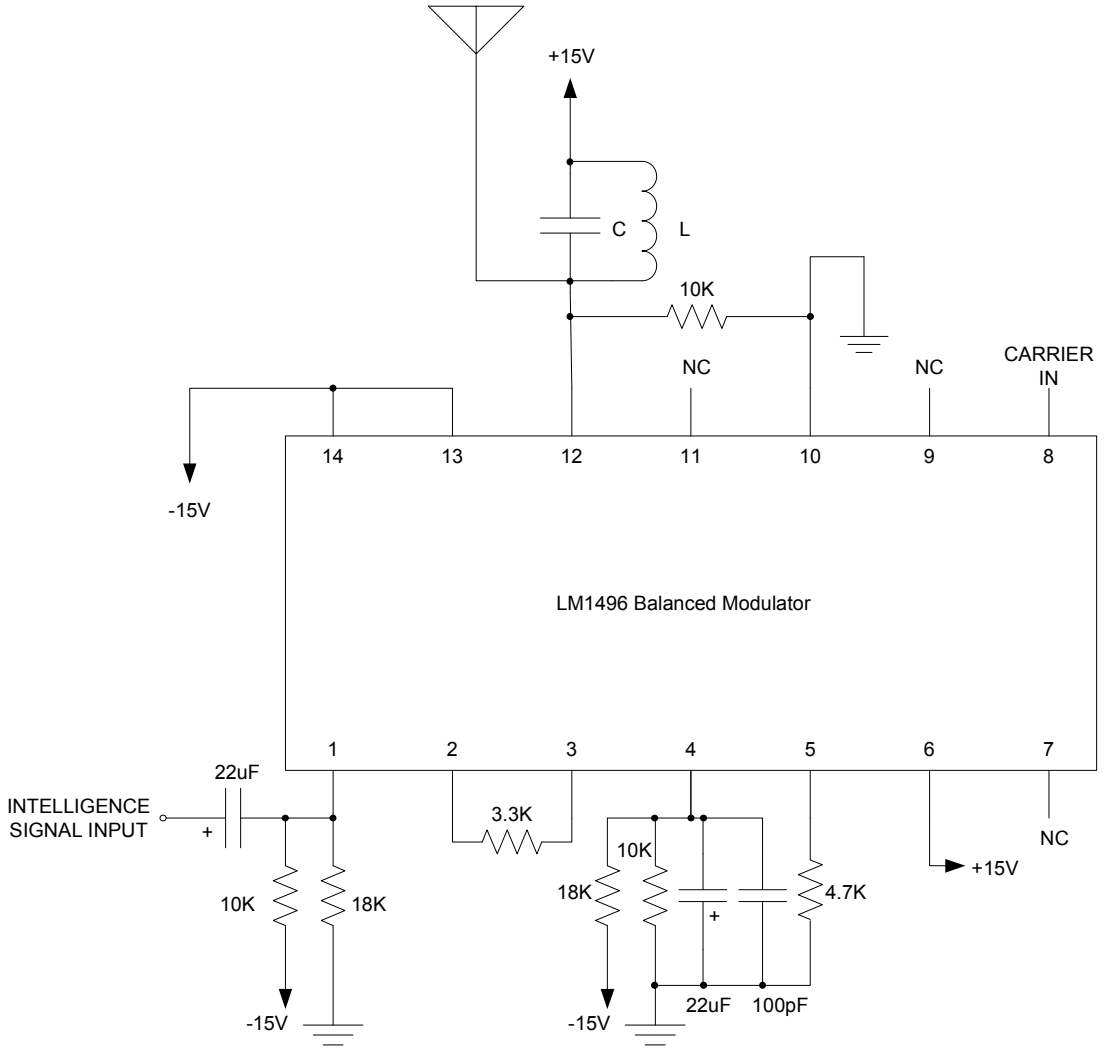
The carrier will be generated by a Colpitts Oscillator. As a review, construct the Colpitts oscillator below. L and C must be assigned so that each lab group is using a different carrier frequency [see table at end of lab].



Test the oscillator to confirm proper carrier frequency generation. Document this frequency in your lab books. The output of the oscillator is clamped by two diodes, so the output should look like a square wave with a peak to peak voltage of about 1.5V.

Part II:

Once the carrier frequency has been established, construct the balanced modulator (LM1496) circuit below. The balanced modulator 'chops' the input frequency at the rate of f_c, very much like the analog switch and operational amplifier of Lab 5 and 6. The resistor combinations indicated in the circuit sets up the LM1496 in DSB+C operation.



The L and C used in the LM1496 circuit must match the L and C chosen for the Colpitts oscillator which determined the f_c. Once this circuit is ready, execute the following:

a) Power the circuit without any intelligence signal.
b) Connect a scope to the antenna lead and record what is seen. It should be only the carrier frequency.
c) Connect an intelligence signal 3Vp-p @ 1KHz (sine – 0V DC offset) and monitor this as channel 'B' of the scope, while channel 'A' is on the antenna lead.
d) Vary the amplitude of the intelligence signal. At what amplitude do you get 100% modulation?
e) Connect a 1' length of wire as an antenna and confirm transmission with the use of a portable AM radio receiver. Vary the frequency of the intelligence signal to confirm your transmission.
f) What does it sound like on the receiver when you over modulate?
g) Congratulations, you have built a working radio station…

General questions:

1. What is the range of your transmitter?
2. What is the purpose of the LC at the output of the modulator?

NOTE: It would be wise to save this circuit, as next weeks lab will add to this circuit just as it is.

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

Lab Group	L	C	F_r (KHz)
1	47µH	220pF	1570
2	68µH	180pF	1440
3	68µH	220pF	1300
4	100µH	200pF	1130
5	47µH	560pF	981
6	100µH	390pF	806
7	68µH	820pF	674
8	47µH	1800pF	547