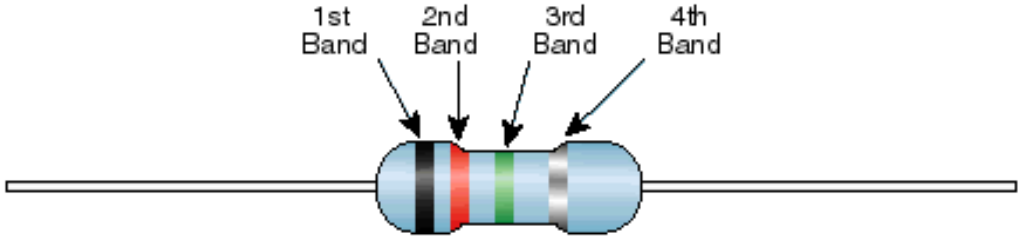
Standard EIA Color Code Table 4 Band: ±2%, ±5%, and ±10%



Color	1st Band (1st figure)	2nd Band (2nd figure)	3rd Band (multiplier)	4th Band (tolerance)
Black	0	0	10^0	
Brown	1	1	10^1	
Red	2	2	10^2	±2%
Orange	3	3	10^3	
Yellow	4	4	10^4	
Green	5	5	10^5	
Blue	6	6	10^6	
Violet	7	7	10^7	
Gray	8	8	10^8	
White	9	9	10^9	
Gold			10^{-1}	±5%
Silver			10^{-2}	±10%

Chart Provided By XICON

Figure A: Resistor color code, from
http://www.parts-express.com/resources/resistor-color-code-chart.cfm

a. Passive Elements

Resistors

Graphical resistance calculators are available on the web. See, for instance:
http://www.dannyg.com/examples/res2/resistor.htm

iPhones also have a resistance calculator app.

An excellent brief history, tutorial and exercises for the color code can be found at:
http://www.uoguelph.ca/~antoon/gadgets/resistors/resistor.htm

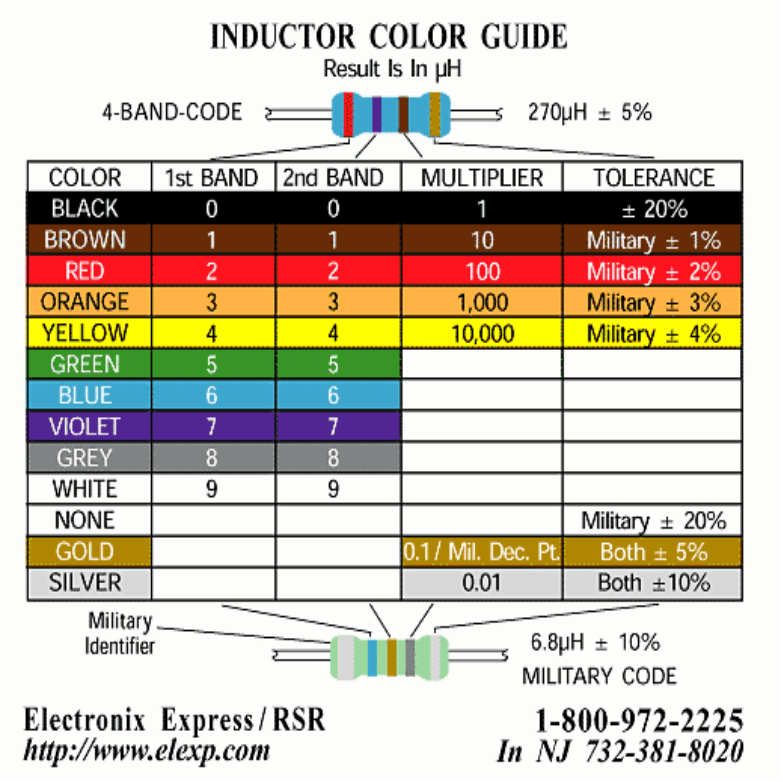
Capacitors

Capacitors used most by hobbyists are electrolytic, mica and ceramic. Electrolytic capacitors are most often can-shaped and must be placed in a circuit with the proper polarity. An electrolytic capacitor can explode if it experiences a reverse bias.

Generally, the capacitance value of an electrolytic capacitor is written on its body. For many flat capacitors (i.e. mica caps), a numeric code gives information as to the capacitance value. Frequently this is a three digit number, where the value is the first two digits followed by the number of zeros indicated by the third digit, in pF (picofarads – pico is 10^{-12})). So a capacitor labeled "105" would be 10 x 100,000 = 1,000,000 pF. This is equivalent to 1 μF (μ is micro, or 10^{-6}). A letter added to this code indicates tolerance. As another example, "474J" indicates a 470,000 pF, or 0.47 μF, capacitor (the "J" indicates a 5% tolerance).

Inductors

Figure A2 - Inductors and toroid.



COLOR	1st BAND	2nd BAND	MULTIPLIER	TOLERANCE
BLACK	0	0	1	± 20%
BROWN	1	1	10	Military ± 1%
RED	2	2	100	Military ± 2%
ORANGE	3	3	1,000	Military ± 3%
YELLOW	4	4	10,000	Military ± 4%
GREEN	5	5		
BLUE	6	6		
VIOLET	7	7		
GREY	8	8		
WHITE	9	9		
NONE				Military ± 20%
GOLD			0.1 / Mil. Dec. Pt.	Both ± 5%
SILVER			0.01	Both ±10%

Figure A1: inductor color code (from http://www.elexp.com/t_induct.htm)

b. ELEC 3030 Required Parts (Fall 2014)

Resistors (all ¼ watt unless other-wise indicated)	Totals
10	2
100 (1/2 watt)	5
150 (1/2 watt)	1
220 (1/2 watt)	1
330	2
470 (1/2 watt)	2
1k	14
1.2k	1
2.7k	1
3.3k	2
4.7k	1
5.0k	1
10k	8
12k	1
20k	2
22k	1
27k	1
100k	2
1meg	2

Capacitors	Totals
lytic	
1uF	8
10uF	1
47uF	10
100uF	1
250uF	1
1000uF	1
mica/ceramic	
100pF (.0001uF)	1
.022uF	1
.047uF	2
0.1uF	1
trimmer	
9-120pF (note 1)	2

Inductors	Totals
10 uH	1
100 uH	2
10,000 uH	3
Transistors	
Q2N3904	7
Q2N3906	2
J2N3819	1
Diodes	
D1N4148	3
IC (note 2)	
LM386	1
TL071	1
8 ohm speaker (Note 3)	1

Notes:

(1) Trimmer – the following trimmer ranges from 9pF to 120pF
http://www.jameco.com/webapp/wcs/stores/servlet/ProductDisplay?search_type=jamecoall&catalogId=10001&freeText=94466&langId=-1&productId=94466&storeId=10001&ddkey=http:StoreCatalogDrillDownView

(2) LM386 and TL071 – make sure to get the "DIP" version of this (fits in solderless breadboards) rather than the "SOIC" version (surface mount component)

(3) 8 ohm speaker – strongly prefer speakers that do NOT have wires pre-soldered on

c. **Local Transmission**

(initial version of this section prepared by Mr. Ramesh Bokka, 2010)

Goals:

- Understand the concepts of Transmission and reception.
- Understand the concept of modulation.
- Successfully transmit the signals from one antenna and receive the same signals through the other antenna.
- Become familiar with the frequencies of transmission.

In radio transmission, an intelligence signal modulates a higher frequency carrier wave. The two most common radio transmission modulation techniques are amplitude modulation (AM) and frequency modulation (FM). Our lab uses AM whereby the amplitude of the carrier signal is varied by the intelligent signal.

To build a local AM transmitter, our carrier will be the BK Precision 4040 Function Generator with an intelligence signal fed to the "MOD input" port. The intelligence signal can be music from an iPod, for instance. We are looking for transmission over very short ranges (within the laboratory) so one of our own manufactured antennas should suffice.

In this lab you can observe how the transmission is affected by the change in modulation, signal strength and frequency of transmission.

Local transmission:

1. To start with, you need two antennas for this. One is for transmitting the signals and the other is for receiving. Estimate the frequency range of your receiving antenna over which it is capable of picking the signals. This can be estimated by using the formula

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

where C is the capacitance range of your trimmer capacitor.

2. An intelligence signal is fed from the audio source to the input of the function generator (VCG/MOD input).

3. Connect the output of the function generator to the antenna as shown in Figure c.2.

4. Turn on the modulation, and set the buttons on the function generator to AM and external modulation.

5. Now, transmit the signals with your first antenna with different frequencies and check if your receiving antenna can receive the signals by adjusting the trimmer capacitor.

6. Change the modulation of transmitting signals and see what happens with the receiving signals at the output i.e., from the speaker.

Figure c.1: Intelligent signal supplied from an iPod through pin.

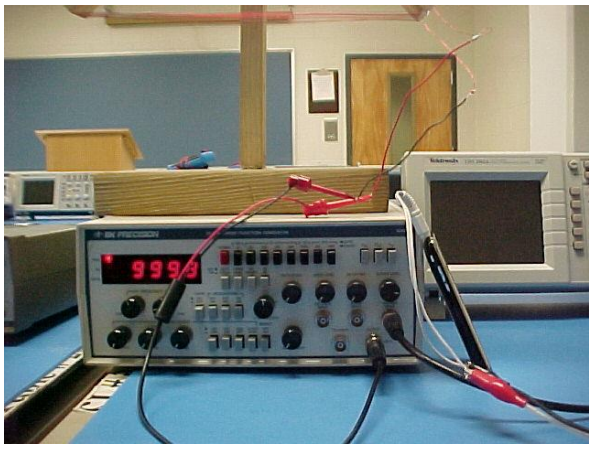


Figure c.2: Intelligent signal is modulated with 1000 kHz signal transmitted through antenna.

7. Vary the output signal strength level and observe the difference at the output.

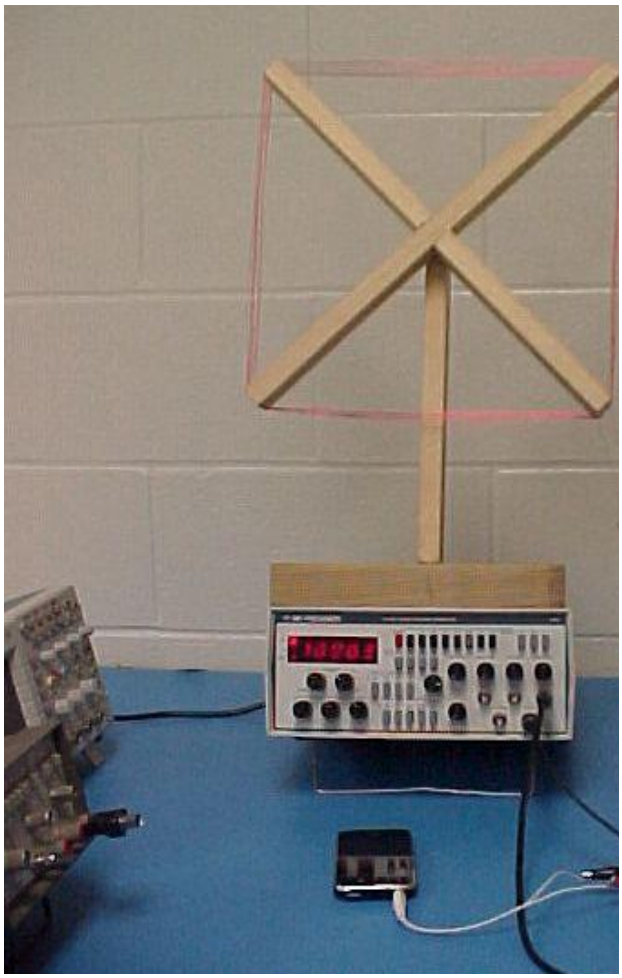


Figure c.3 Complete setup of transmission antenna.