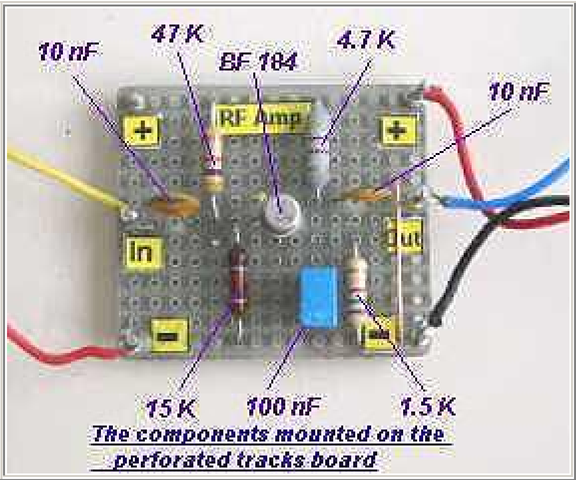
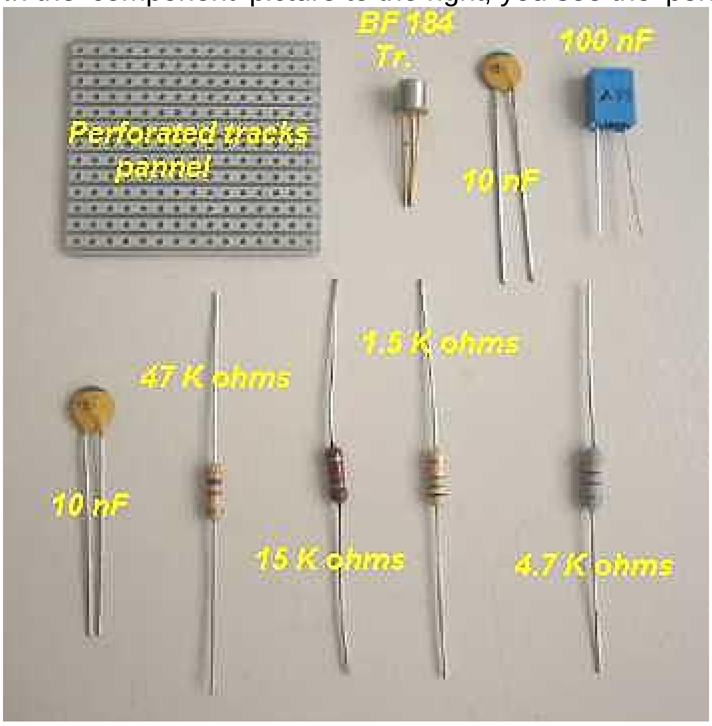
AM-FM Radio Frequency Amplifier



This 'AM-FM Radio Frequency Amplifier' is built with only a few components; which makes the project simple and direct. There are no electrolytic capacitors and the three capacitors used can be ceramic or mylar. You can employ 1/4 watt resistors or even 1/2 watt resistors which are easier to manage.

In the 'component' picture to the right, you see the 'perforated tracks' panel board. To avoid making a printed circuit board (PCB), you may use this panel board.



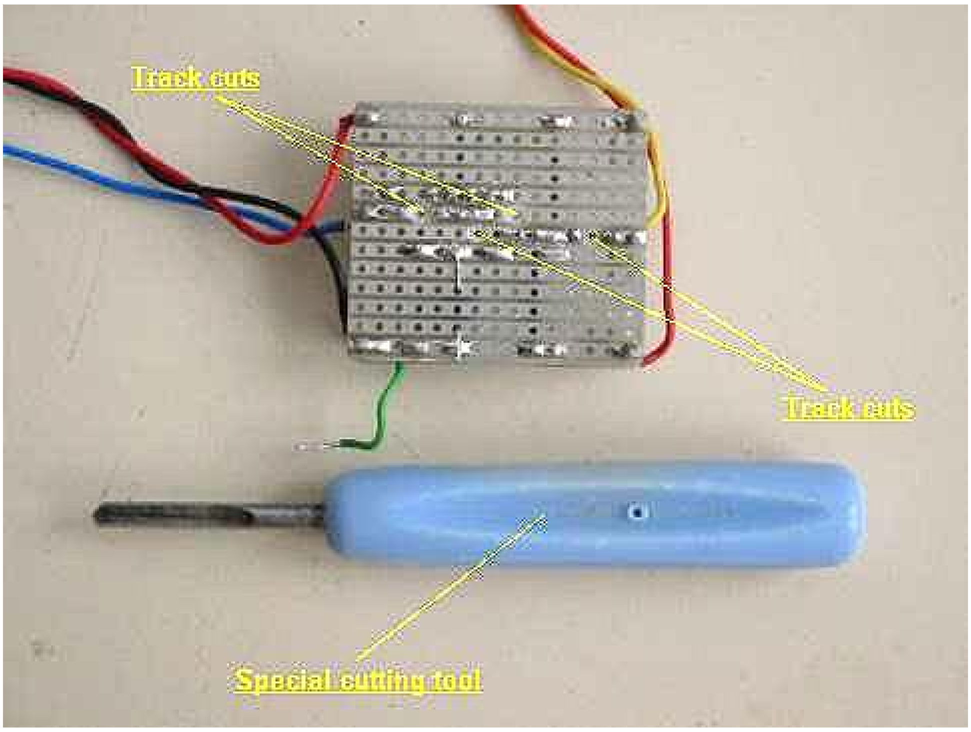
LIST OF COMPONENTS

1 - Perforated tracks panel board
1 - BF 184 Transistor
2 - 10nF Ceramic Capacitor
1 - 100nF Capacitor
1 - 47 K Ohms Resistor
1 - 15 K Ohms Resistor
1 - 1.5 K Ohms Resistor
1 - 4.7 K Ohms Resistor

With only 4 'track cuts' on the perforated panel board, you have solved the problem of drawing and etching a PCB. Please look at the picture below, which shows the 4 points where the 'track cuts' MUST be made.

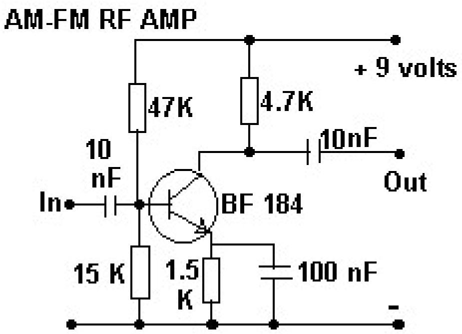
To work in a less confined space, you can choose another style of board with wider tracks and wider spacing between the tracks. Your electronics' shop should have these panels in different dimensions.

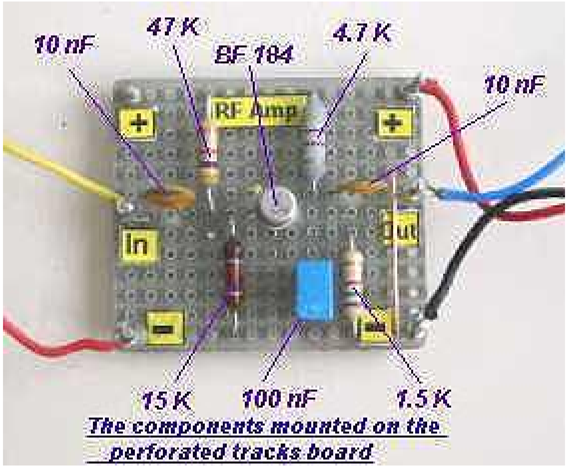
Nevertheless, what is quite important is not to make an accidental connection between tracks while soldering the components. Please inspect carefully the 'spaces' between the tracks when your work is done and see that the solder has not 'crossed over' onto adjacent tracks! For cutting the tracks on this type of panel board, there is a cheap and 'special cutting tool' (see above picture) that makes the job really easy.



The Components on the Board

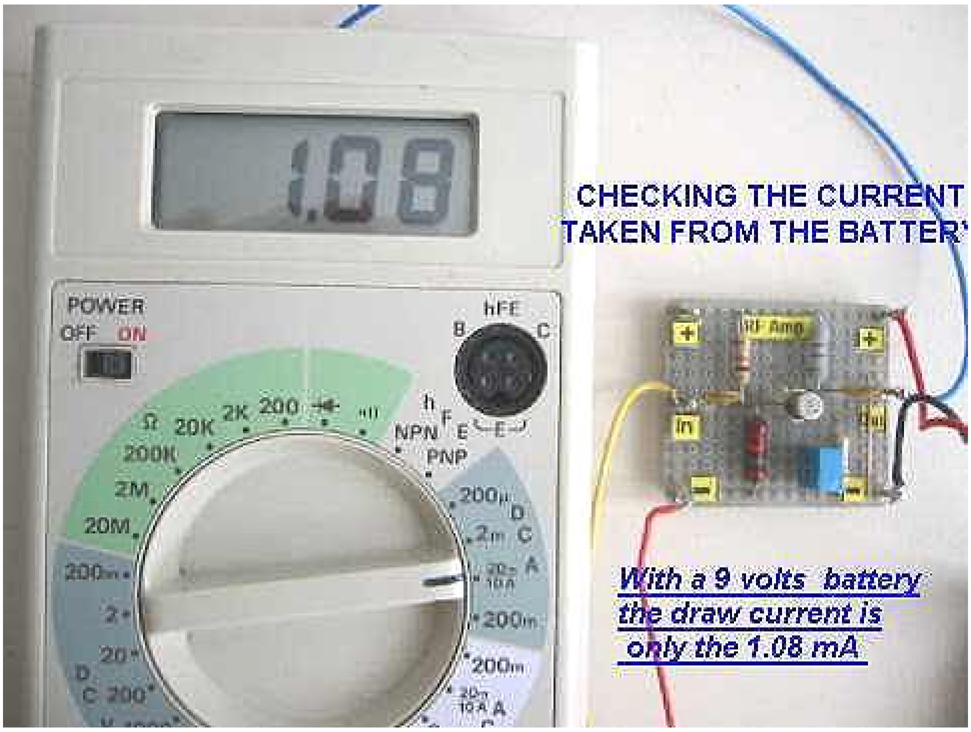
Following the circuit schematic to the right and the positioning ofcomponents to the left...is quite similar. The BF 184 transistor is in the center of theboard...two resistors in the upper half...and another two resistors and a 100nF capacitor in the lower half.It is important to notice, that the BF 184 transistor capsule MUST be connected to ground. This is acheived by a wire jumper joining its' track to the ground track of the panel board, where it is also connected to the negative pole of the 9 volt battery.





Testing the Current Draw From the Battery

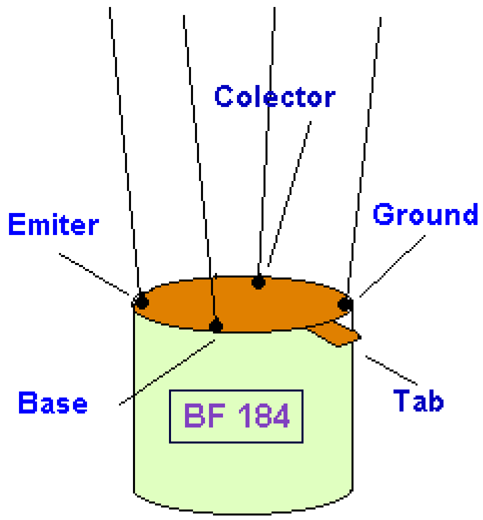
Once we have finished our work mounting the RF amplifier, the first test to perform is to observe the current that the circuit draws from the battery. An excessive current indicates a short circuit that will ruin your battery in just a few minutes.So plug your ampere meter in the circuit between one pole of the battery and one of the RF amp current entrances... taking good care of their respective polarities. Before doing this test, make sure that the controls of your multi-meter are in the exact position. An error performing this test can blow up the multi-meter fuse or even damage the instrument! We must be careful when working with our expensive testing equipment! Using a 9 volt battery, the resulting current should be around 1mA's ..more or less.



BF 184 Transistor Pin Orientation

The picture to the left shows the 4 pin orientation of the BF 184 Transistor. Make sure you study the picture well, so as not to accidently destroy the device by improper pin placement onto the panel board.

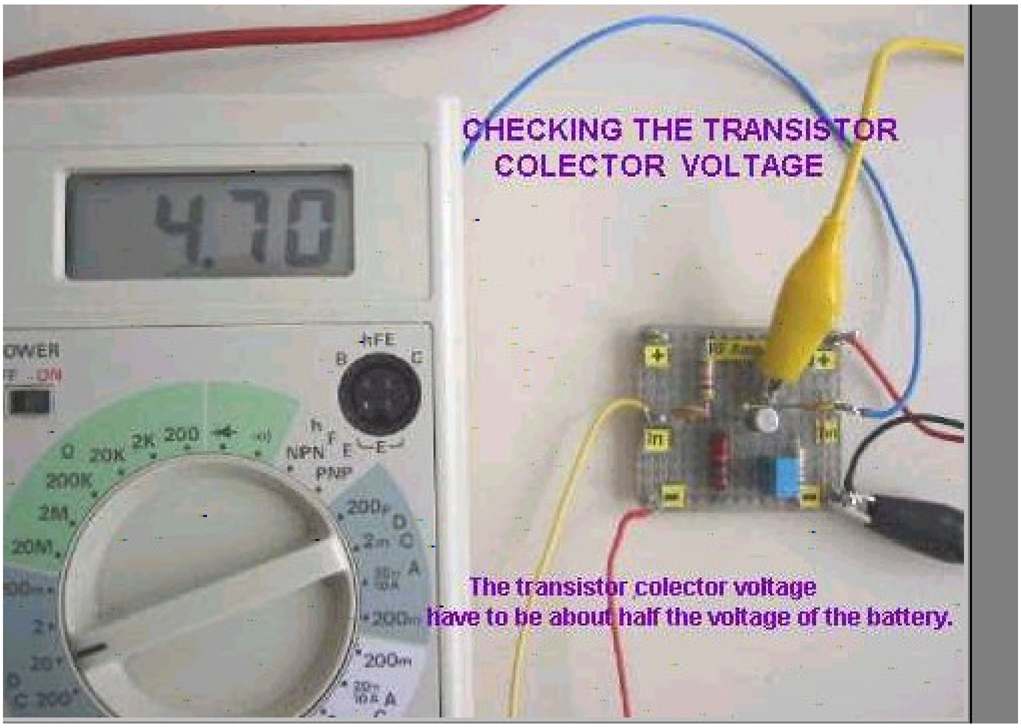
BF 184 TRANSISTOR



Pins Positions

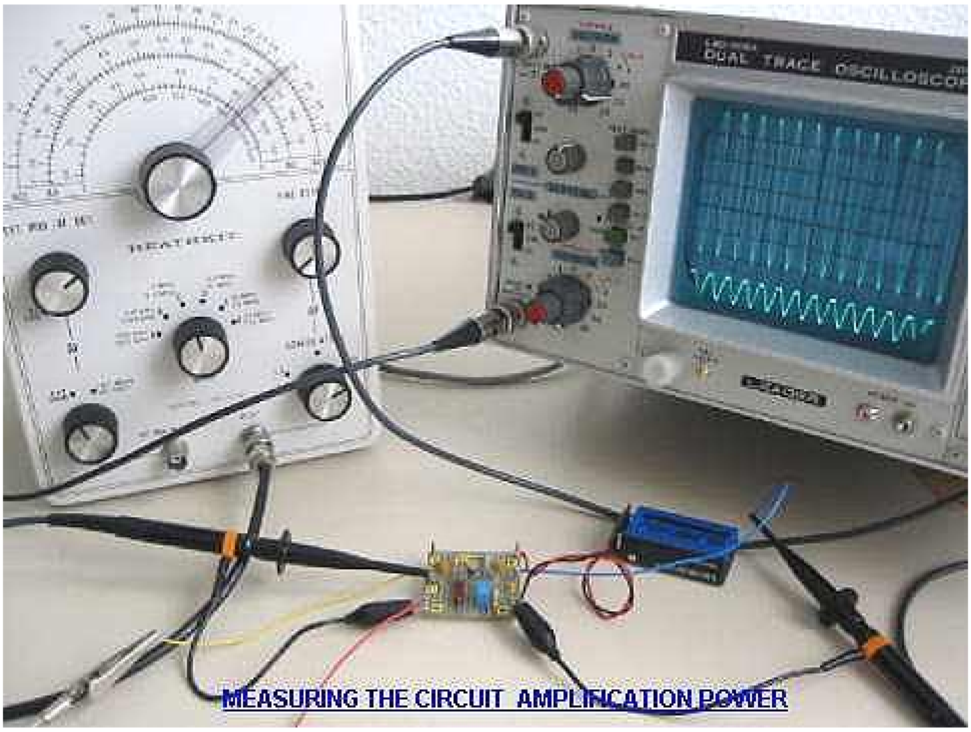
The Collector Voltage

The second test to perform is watching the collector voltage. A tension of half value of our power source indicates that the RF amplifier will work at the correct working point.This time it is easy to measure the collector voltage touching with the plus terminal of the voltmeter...the collector leg of the transistor...and with the negative terminal of the voltmeter to ground.With the component values shown in the schematic circuit, this tension is more or less 4.5 volts. What this means is that if we do not saturate the circuit with an excessive input voltage, the output will not be distortedPlease be careful not to touch, with the terminal voltage of your voltmeter, the two pins of the transistor at the same time. If this is done, a short circuit between the collector pin and the base pin will produce an excessive current into the transnsistor that will burn it in less than one second!



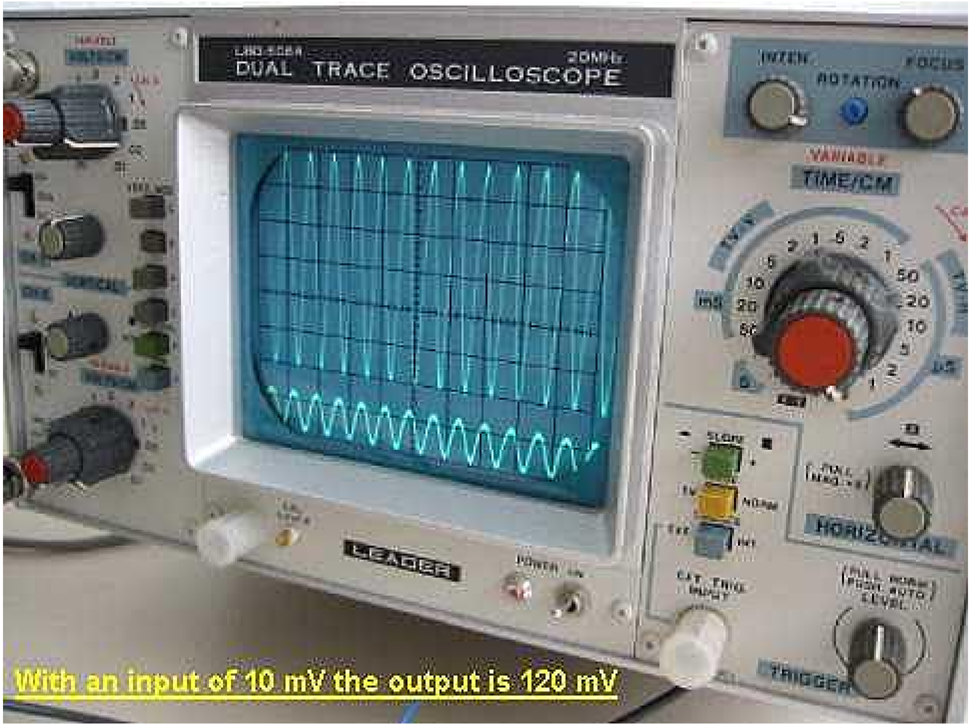
Testing the Amplification Power

Now that we are in a correct way of testing our amplifier, let us see if it accomplishes our task. For that, if we are exigent, we need an RF generator and an oscilloscope. The RF generator can give us frequencies from 100 KHz to more than 100 MHz. So you can test an ample spectrum of electromagnetic waves that include AM/Medium/Short/FM and higher frequency waves.It is preferable to work with a double-trace oscilloscope. In this case, one of the oscilloscope channels is plugged to the input of the amplifier and the other channel to the output.This test allows you to watch the amplification power and at the same time, the distortion produced by the amplifier.

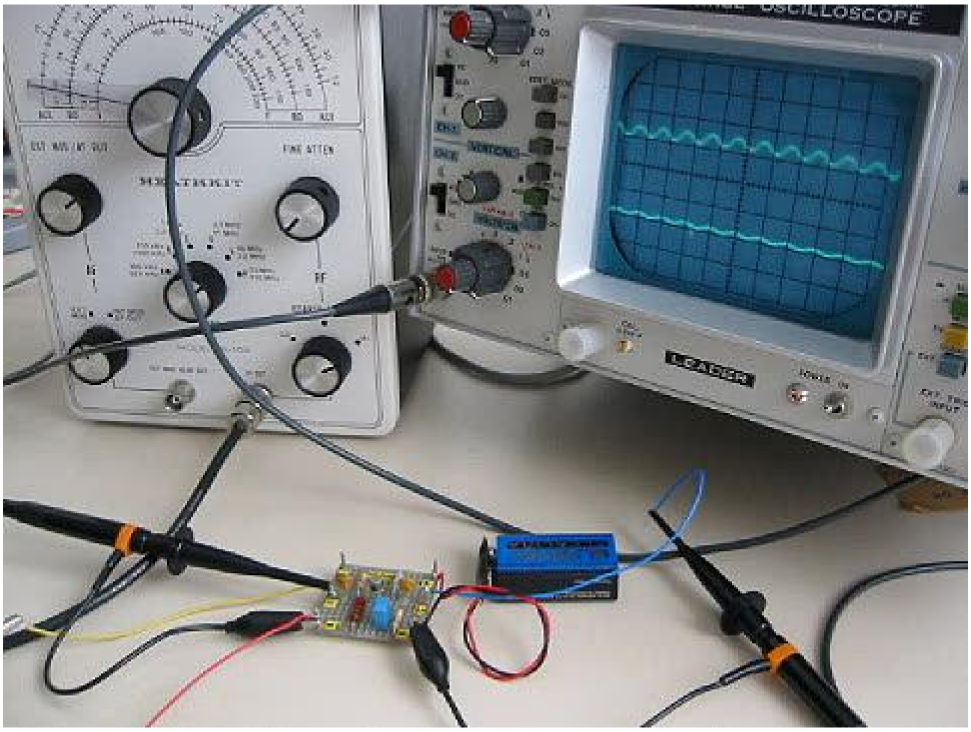


Measuring the RF Amplification

I took from the RF generator, a frequency of 850 KHz, which is more or less the half range of AM medium wave frequencies. The input voltage was 10 milivolts and found that the final output voltage was 120 milivolts. The RF amplifier didn't introduce practically any distortion and the power amplification was extremely good!



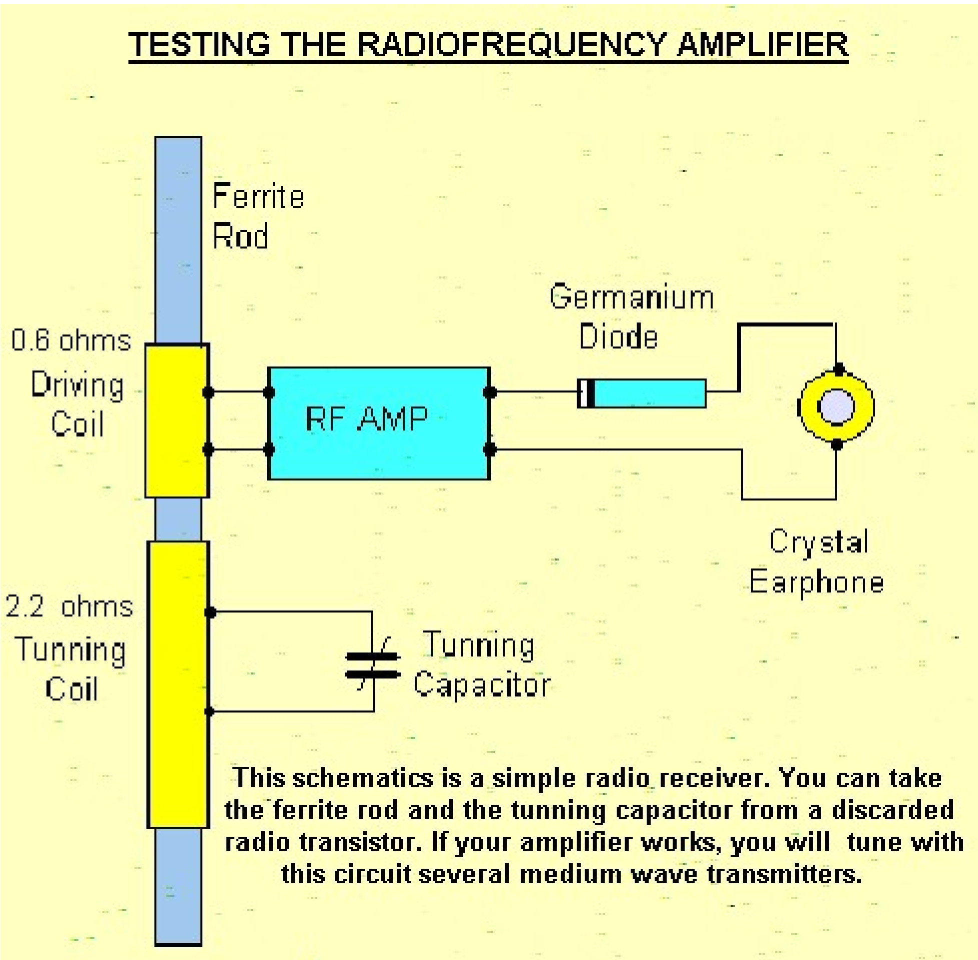
Nevertheless, when you increase the frequency, it is noticeable that the amplification decreases.To perform this test at the higher frequencies, you need special oscilloscopes that are able to reach at least 100 MHz. These instruments are so expensive that only powerful institutions can afford them. My oscilloscope only reaches frequencies up to 20 MHz...which severely limits the 'range of frequencies' under test.

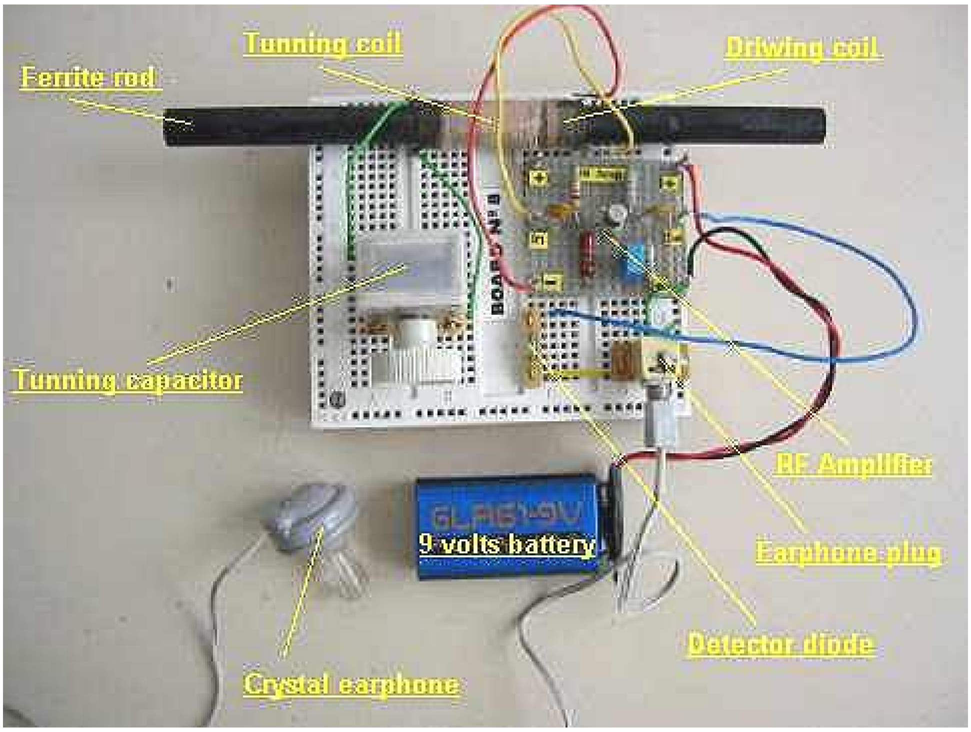


Other Ways to Test Your Radio Frequency Amplifier

If you don't have an oscilloscope, there are some other ways to properly test your RF amplifier.I used a ferrite rod as a source of radio frequency. The space that surrounds us is full of electromagnetic waves. These waves have two components; one is an electrostatic field and the other is a magnetic field. Both combine to form an 'electromagnetic' wave that reach our radio or TV sets.The ferrite rod catches the magnetic radio wave components and transforms it into micro-currents in a copper wire coil of which the ferrite rod is its' nucleus. This coil can be tuned to a specific radio wave by connecting it to a variable capacitor...in parallel. So we now have what is call a 'resonant' circuit.On the ferrite rod is another coil with only a few turns. I call this one the driving coil. This coil and the tuning coil make up a radio frequency transformer. Now we send the micro-currents induced in the driving coil to our amplifier to verify if it works. At the amplifier output, we have to connect a germanium diode as a detector. Finally, a crystal earphone will allow us to find the performance of our amplifier.The voltages developed into a coil wired on a ferrite rod are microvolts, and the currents generated are microamps. So if your amplifier works, these currents can surpass the threshold of a germanium diode being consequently detected.

I built a circuit that is really a one transistor radio frequency receiver for the medium wave band. The detector is a germanium OA90 or equivalent. Don't use silicon diodes. Silicon diodes have a higher threshold and introduce distortion as detectors.With this ferrite rod, a 420 pF variable capacitor and the germanium detector, I could tune four AM stations at home. What this means is that the amplifier worked quite well.This amplifier can work also as an aerial amplifier, which is another way of realising its' performance. If you have a receiver set and a external aerial, connect the external aerial to the input of the RF amp and the output of the amplifier to the aerial of your receiver. Turning on the radio and the RF amp, you will be able to tune those distant and difficult stations, which before were imperceptible.




Tunning coil
Driwing coil
Ferrite rod
Tunning capacitor
RF Amplifier
9 volts battery
Earphone plug
Detector diode
Crystal earphone