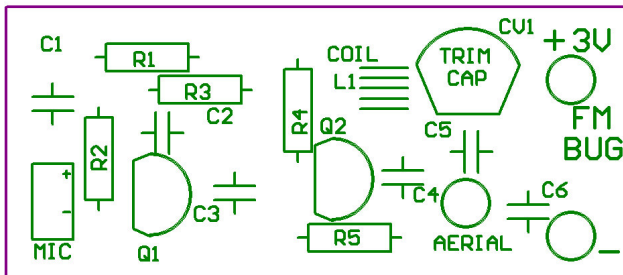


The **3V FM transmitter** uses a very simple circuit and although being quite basic, it works remarkably well. This is a low cost kit and one of our most popular.

Operating from two 1.5V batteries connected in series to provide 3V, the circuit has a relatively low current drain, but in most cases, it will still work at over 300m in the open. It can be tuned to transmit anywhere on the FM band (88 – 108MHz). Your FM radio will also need to be tuned in on the same frequency as the transmitter.

The range of FM transmitters that we have available have low power outputs and are below the legal limits for most countries i.e. Australia, USA, etc. However in some countries it may be illegal to transmit any radio frequency signals without a licence. In addition to this, concealing this unit and using it as a bug, may be considered to be an illegal invasion of privacy. You should check your local laws before constructing and using this kit.

**Fig. 1 PCB Component Overlay**

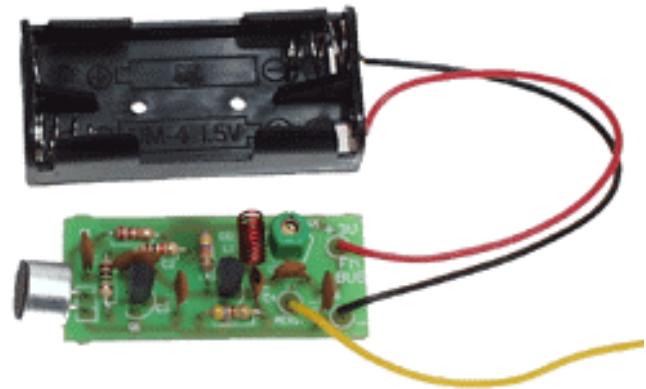


### Circuit Description

The 3V FM transmitter circuit can be divided into five main blocks.

1. The 3V power supply
2. The electret microphone
3. An audio amplifier
4. The inductor/capacitor (L/C) tank circuit consisting of the coil L1 and the trim cap CV1 coupled with Q2 and C4, form the radio frequency (RF) oscillator
5. The aerial

The audio signal picked up by the electret microphone is fed to the base of transistor Q1, which works as an audio amplifier. The LC tank circuit acts as an energy store, it is this part of the circuit that governs the frequency of the RF oscillator. Changing the inductance of the coil L1 by spreading the spacing of the coils turns or adjusting the capacitance of CV1 by turning the screw, will alter the carrier frequency. By adjusting these components it should be possible to tune the transmitter from below 88Mhz to above 108Mhz. The output of the audio amplifier



**Fig. 2 Assembled 3V FM Transmitter**

Q1 is fed on to the base of the oscillator transistor Q2 causing the RF signal to be modulated (varied) by having the audio signal superimposed on it. This is referred to as frequency modulation (FM). The output from the oscillator is then fed into the aerial, resulting in an FM radio signal being transmitted.

### Construction

Using the component overlay, the component list and the circuit diagram as references load and solder the components into the printed circuit board (PCB). It is generally easier to load the lower height parts first.

#### The Coil

You will need to wind your own coil L1 using the enameled copper wire supplied. Find a small Phillips head screwdriver, a nail or knitting needle with a diameter of approximately 3mm, using this as a former, tightly and close together wind on 10 turns of wire. Make sure to leave a tail of about 15mm at both ends to go through the PCB. Now carefully slide the coil of the former and mount it into the PCB. Stand the coil of the PCB by about 5mm and spread the coils out so that there is approximately 0.5mm space between each turn. Now solder the coil into the PCB, the enamel coating on the wire is a solder through type so it does not need to be removed prior to soldering.

#### The Electret Microphone

The electret microphone unit is a polarized component, it must be soldered in the right way round. If you look closely at the back of the unit where the pins come out you will see a small PCB. One of the pins will have a connection to a small track, which runs to the edge of the PCB and connects to the metal housing of the unit. This is the negative (-ve) pin and must be connected to the -ve point on the main PCB.

**Construction (continued)**

**The Battery Holder**

The 2x AAA battery holder supplied in the kit has fixed wires attached. The red wire must be connected to +ve and the black wire to -ve on the PCB. You will also notice that there is no on/off switch on the PCB. To turn the power on and off you will need to remove one of the batteries from the battery holder, alternatively you could fit a switch in the battery lead.

**The Aerial**

The transmitter will perform best with a half wavelength aerial (a 150cm length of hookup wire) if this is too long you can try a quarter wavelength aerial (a 75cm length of hookup wire).

**Fig. 3 Component List**

R1	RS1645	22K	0.25W 5% resistor	1
R2	RS1845	1M0	0.25W 5% resistor	1
R3	RS1605	10K	0.25W 5% resistor	1
R4	RS1685	47K	0.25W 5% resistor	1
R5	RS1445	470R	0.25W 5% resistor	1
C1,C6	CC0153	.022uF	50V ceramic capacitor	2
C2	CC0161	0.1uF	50V ceramic capacitor	1
C3	CC0137	.001uF	50V ceramic capacitor	1
C4	CC0110	6.0pF	50V ceramic capacitor	1
C5	CC0118	27pF	50V ceramic capacitor	1
CV1	CC9026	5.2-30pF	trimmer capacitor	1
Q1,Q2	BC547		transistor	2
M1	MI2000		Fet mic insert w/PCB pins	1
L1	CB2660	0.5mm	enamel copper wire	15cm
B1	BA9145		AAA x 2 battery holder	1
PCB	PC9207		Printed Circuit Board	1
Aerial	CB2201	VIO	Hookup wire L/Duty	165cm

Note:  
2 x AAA Batteries (BA2703) not included in the kit

**Calibrating the Transmitter**

Before proceeding follow the check list below.

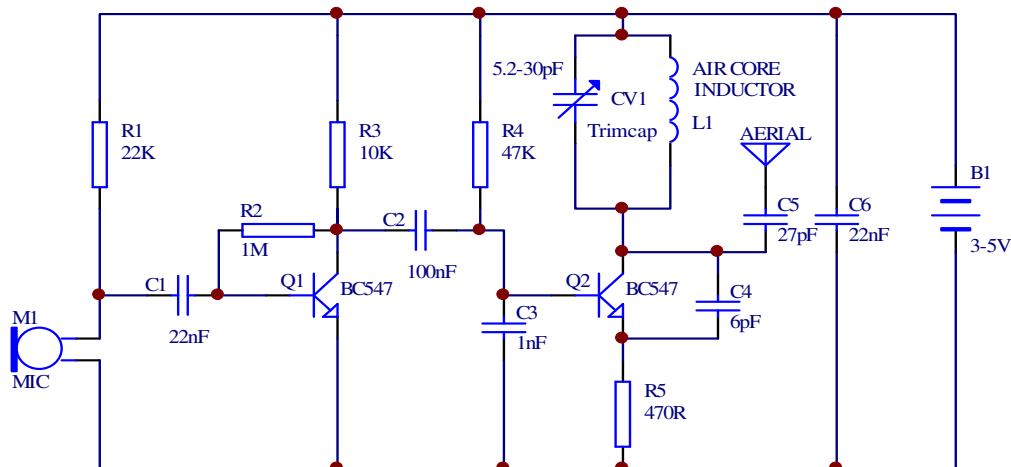
1. Check the solder joints have all flowed well
2. Check that all the components are placed correctly in the PCB
3. Check the batteries are in good condition and have correct voltage (approx 1.5V per cell)
4. Fit the batteries

You are now ready to tune the transmitter, firstly set your FM radio to about 90MHz, turn it on and place it about 3 meters away from the transmitter. Using a plastic screwdriver very slowly turn the variable capacitor VC1 until the radio picks up the transmitted signal. If you do not have a plastic screwdriver file down a plastic knitting needle. A metal screwdriver will alter the capacitance of the tank circuit, you will tune the transmitter in okay but as soon as the screwdriver is removed the circuit will de-tune. If you have problems with the tuning you could try separating the coil windings to about 1mm apart and try turning the capacitor again. If this does not work set the capacitor and try tuning in the FM radio, turn the capacitor slightly and try the radio again, keep repeating this across the full range of the capacitor. It is usually not as difficult to tune as this suggests, if you are still unsuccessful then it would be a good idea to check your assembly and soldering again.

Note:  
This transmitter is not suitable for use close to your body, as it is likely to de-tune due to the body's capacitance.

Don't forget to remove the batteries when not in use, otherwise they will be flat next time you try to use the transmitter.

**Fig. 4 3V FM Transmitter Circuit Diagram**



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