

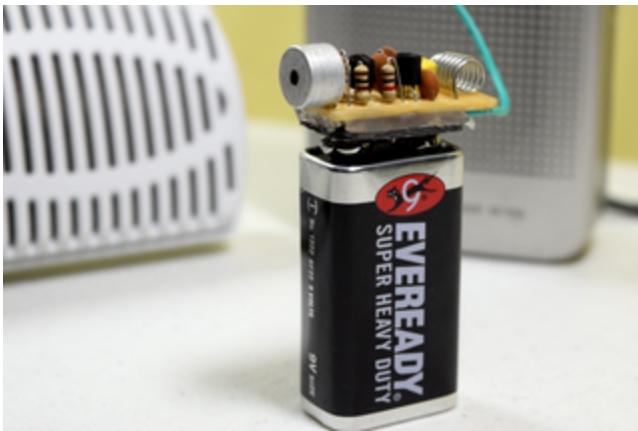
# AUTODESK Instructables

## The Ultimate FM Transmitter (Long Range Spybug)

By [ASCAS](#) in [CircuitsElectronics](#)

### Introduction: The Ultimate FM Transmitter (Long Range Spybug)





Have you ever wanted to broadcast your own radio station within your neighborhood? Ever get curious on where people get those "Surveillance Bugs" from spy and action movies? This small and simple FM transmitter is the toy that geeks have always wanted.

FM transmitters can be complicated to build, that's why I'm teaching you how to make a foolproof FM transmitter. There's no need to buy kits, this tutorial includes the PCB layout and the schematics. It has a range of up to 1/4 mile or more. It's great for room monitoring, baby listening and nature research.

### **My Experience:**

FM transmitters remind me of my early years in electronics. When I was 8, I came across Art Swan's FM transmitter circuit. At the time I had no idea of where I'm supposed to buy the parts, so I recycled mine out of junk. I guess the biggest struggle that you're going to face is finding a trimmer capacitor. I'll give some tips on the last step of this instructable. In a nutshell, I highly recommend this project for everyone and also those who are still new in electronics.

>>>>>[WARNING: You may experience nostalgia! :D](#)<<<<<

### **Technical Specifications:**

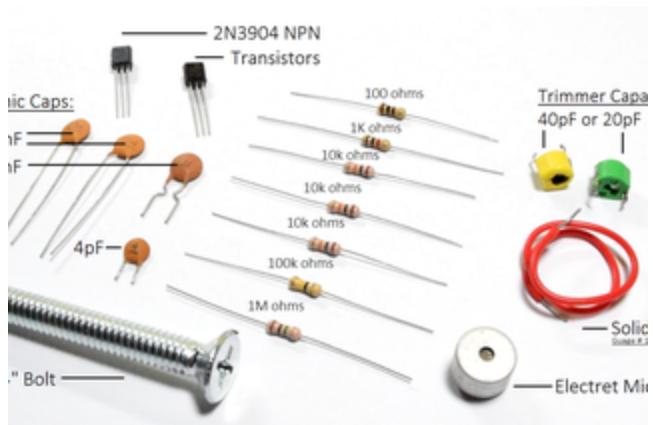
- 1/4 Mile Radius Range
- Powered By A 9V Battery
- Lasts For Several Days
- Adjustable 87-108MHz

**Please Watch:** Celebrating the 1st episode of my new YouTube channel! It's my first time to document a project with videography. I hope you guys enjoy the vid! Please leave a comment below, I would appreciate some advise regarding the video.



**Disclaimer:** This project is for educational purposes only and is not intended to air/ interfere with present radio channels. Neither site nor I, am liable for careless actions. Please check for the legality before attempting the project within your area. As long as

# Step 1: Gather the Parts



All of these are available on any branch of RadioShack! :)

---

## MISC:

- Copper Clad PCB/ Perfboard
- Solid Gauge # 18 Wire
- Electret Microphone
- 1/4" Bolt

---

## Transistors:

- 2N3904 General NPN Transistor (2x)

---

## Capacitors:

- 15pF or 40pF Trimmer Capacitor
- 100nF Ceramic Capacitor (2x)

- 10nF Ceramic Capacitor

- 4pF Ceramic Capacitor

---

### **Resistors:**

- 1M Ohm 1/4w Resistor

- 100K Ohm 1/4w Resistor

- 10K Ohm 1/4w Resistor (3x)

- 1K Ohm 1/4w Resistor

- 100 Ohm 1/4w Resistor

---

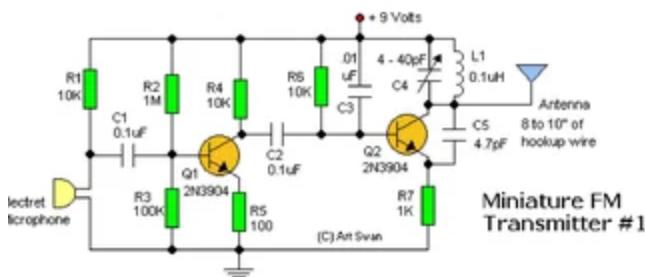
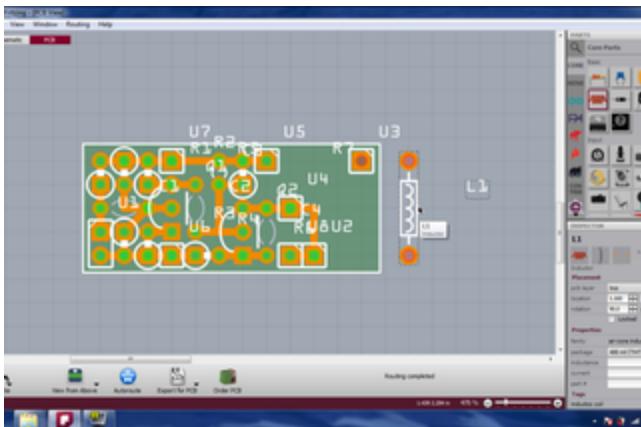
### **Tools:**

- A Pair Of Pliers

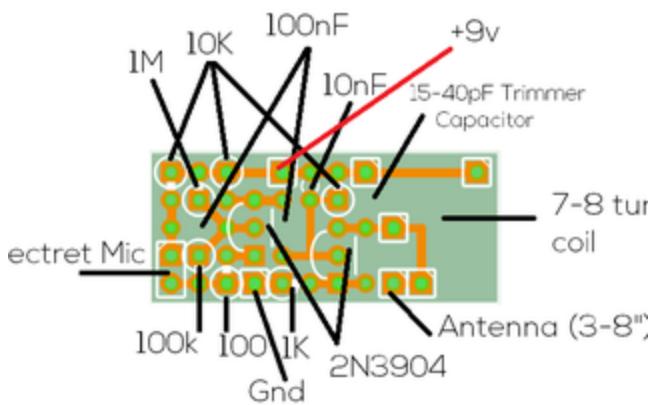
- Soldering Iron

- Hot Glue Gun

## Step 2: PCB & Schematics



This miniature transmitter is easy to construct and its transmissions can be picked up on any standard FM receiver. It has a range of up to 1/4 of a mile or more. It is great for room monitoring, baby listening, nature search, etc. L1 is 8 to 10 turns of 22 gauge hookup wire close wound around a non-conductive 1/4 inch diameter form, such as a pencil. C4 is a small, screw-adjustable, trimmer capacitor. Set your FM receiver for 100.0 MHz, blank space in the lower end of the band. Then, with a non-conductive tool, adjust this capacitor for the best reception. A little experimenting and patience may be in order. Most of the parts values are not critical; you can try adjusting them to see what happens.

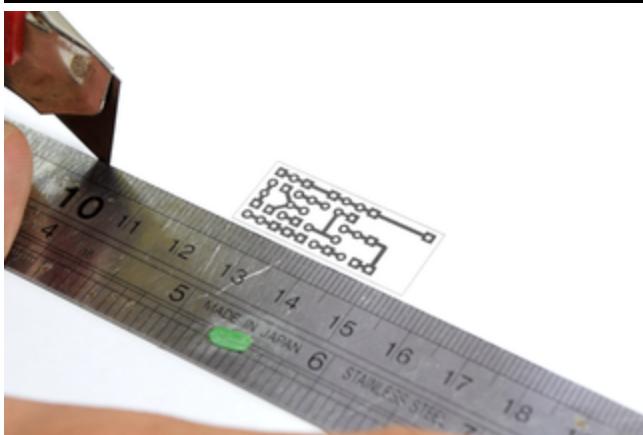


I designed a compact PCB layout for Art Swan's miniature FM transmitter circuit using Fritzing. Use this step as your reference for the assembly.

**About The Circuit:** These is the exact description of Art Swan, the circuit's Author, "This miniature transmitter is easy to construct and can be picked up on any standard FM receiver. It has a range of up to 1/4 mile or more. It's great for room monitoring, baby listening and nature research"

**Download Link:**<https://docs.google.com/file/d/0BwP5mrDB0vNYaHFnME...>

## Step 3: Print the PCB Layout

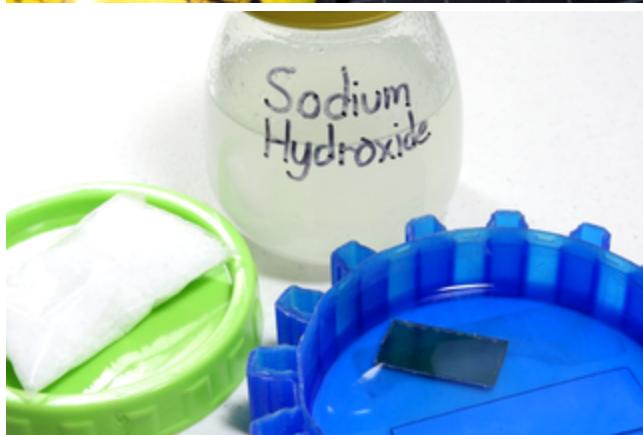


Download the PDF file then print it with your printer's standard setting then cut the printed layout. Be careful when cutting, the tip of my thumb got sliced by the sharp cutter blade.

---

**Download Link:** <https://drive.google.com/file/d/0BwP5mrDB0vNYaHFn...>

## Step 4: Develop the PCB



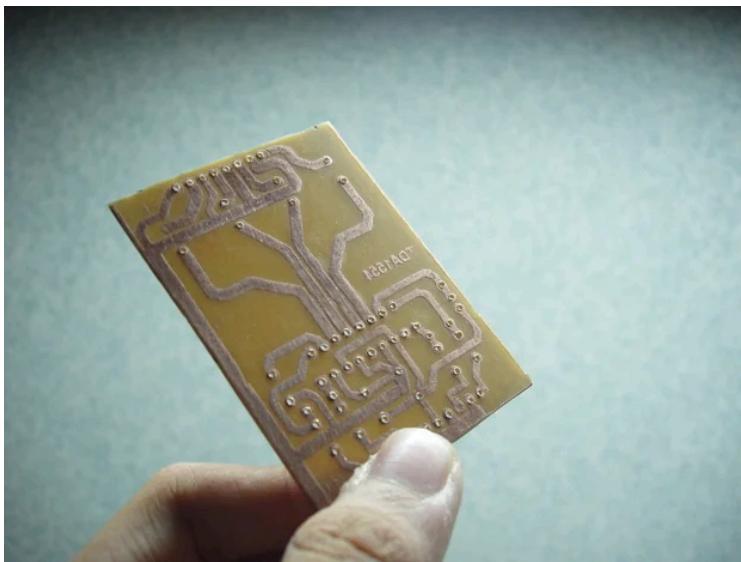


I'm using something what's called presensitized PCB fabrication, it's different from the toner transfer method. If you're not familiar with presensitized PCBs, better go with the toner transfer method.

---

**Presensitized PCBs:** I expose mine directly to a 10W fluorescent lamp for 5:20 minutes then use a dilute solution of Sodium Hydroxide to develop the exposed PCB.

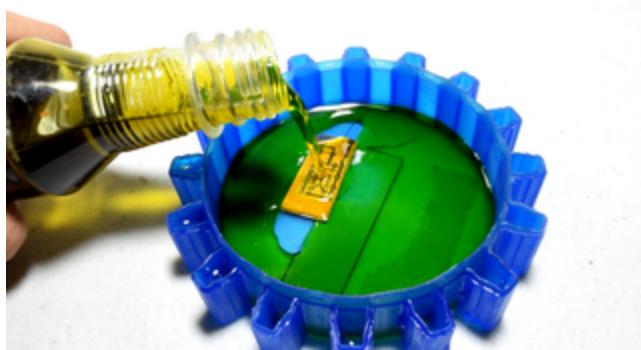
[Here's a separate tutorial for the PCB fabrication:](#)



## How to make a PCB

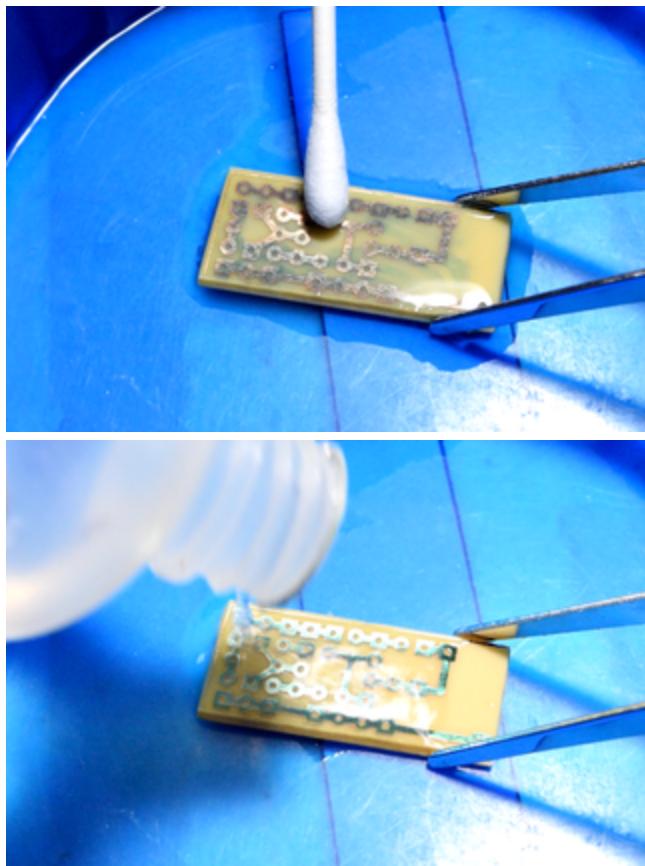


### Step 5: Etch the PCB



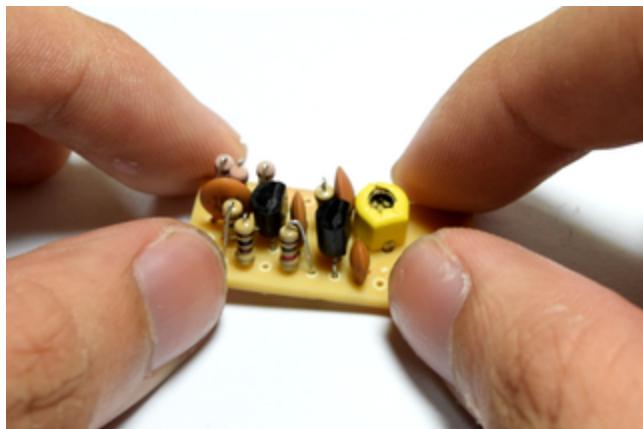
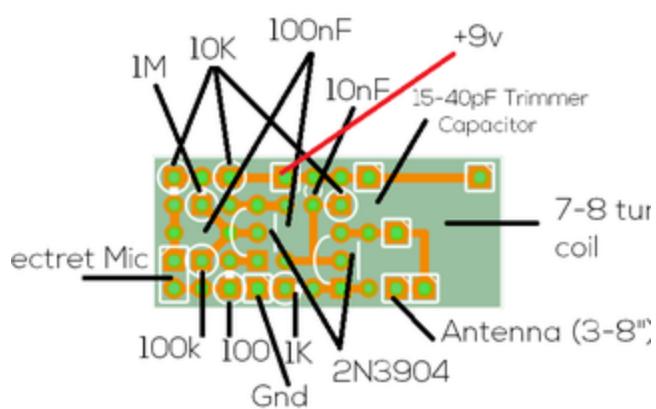
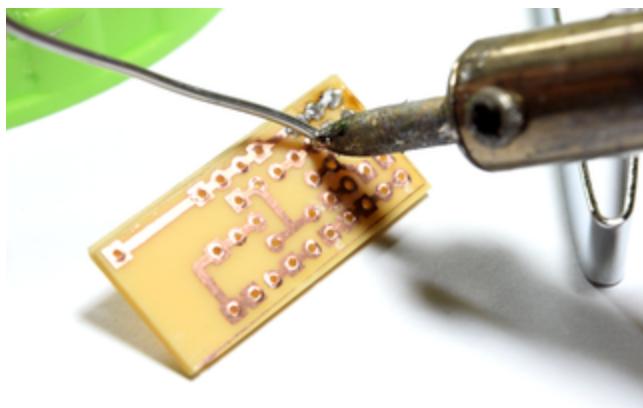
Pour Ferric Chloride on a plastic tray then start to etch the PCB.

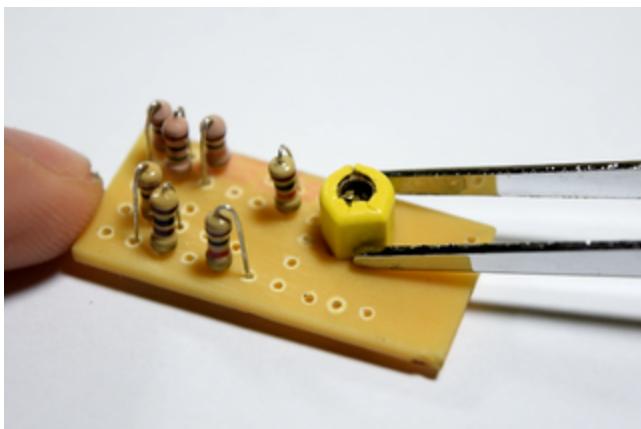
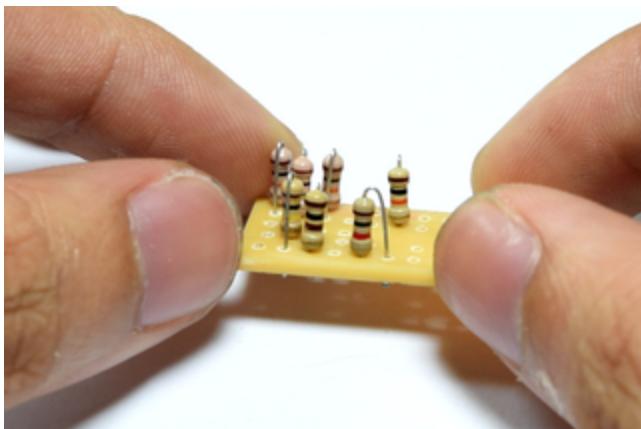
## Step 6: Clean the PCB



Use a swab and Acetone to remove the photo-positive layer/ toner.

## Step 7: Solder the Components





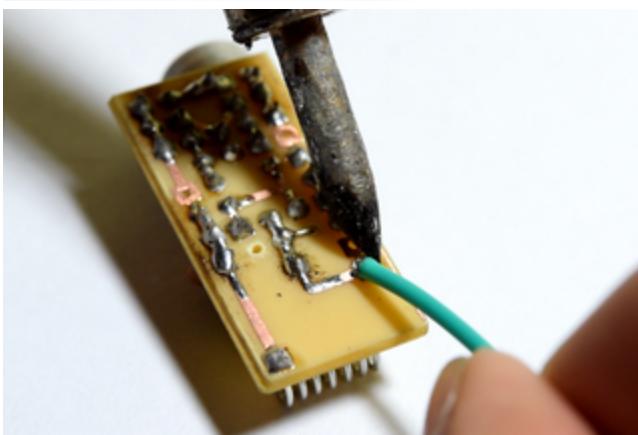
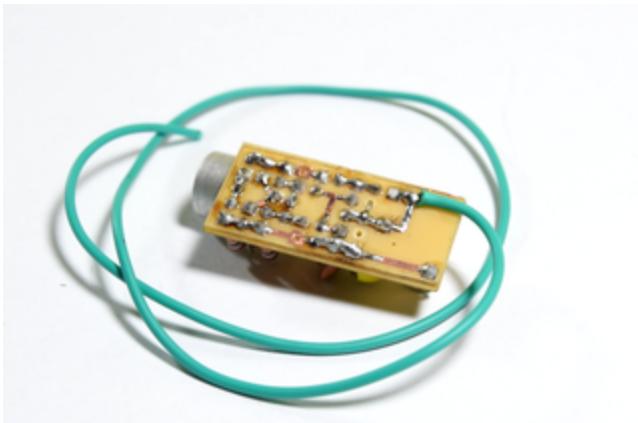
Use step #2 as your reference. Solder the smaller parts first. Start with the resistors, the capacitors, the transistors, the coil, the antenna then the 9V battery clip.

## Step 8: Construct the Coil



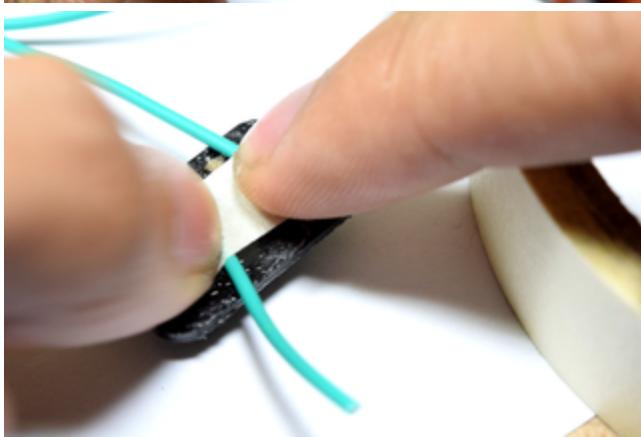
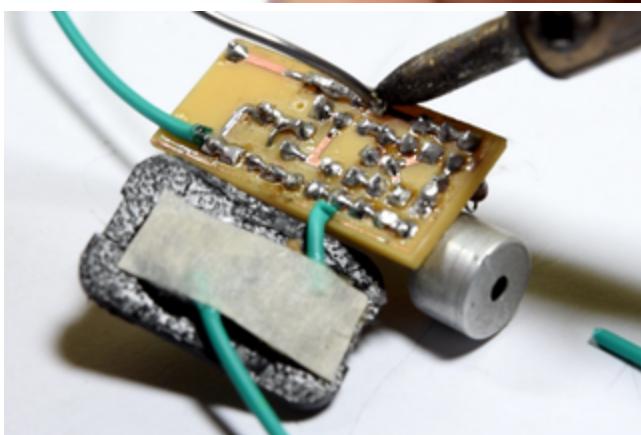
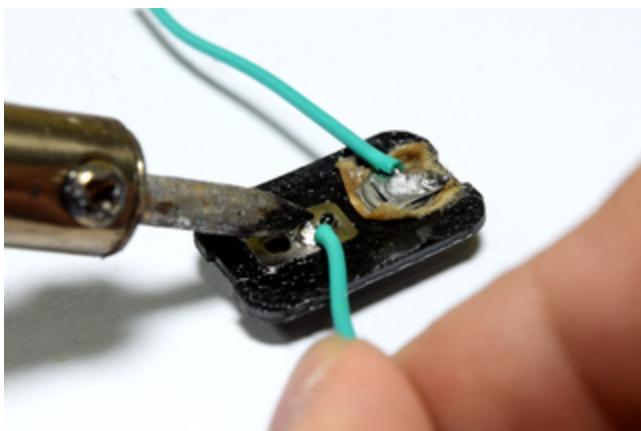
Strip a solid gauge #18 wire. Use a 1/4" bolt then turn the wire 7-8 times.

## Step 9: Adding the Antenna



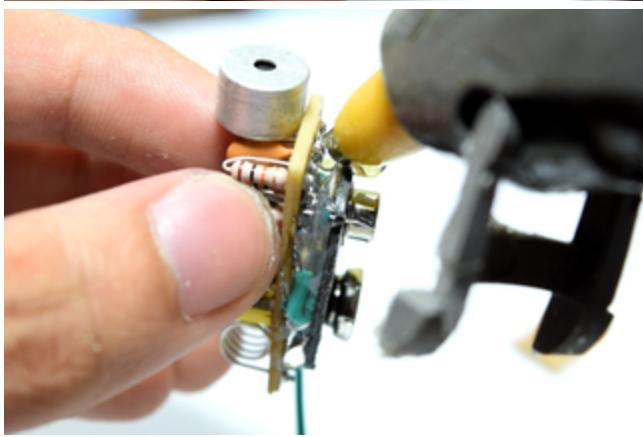
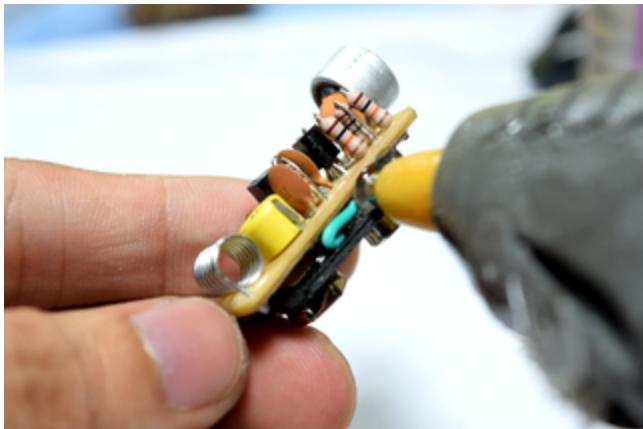
Solder a hook-up wire to the antenna pin, it's located on the 2nd transistor's collector pin. Use a maximum of 8 inches an a minimum of 5 inches.

## Step 10: Recycle a Battery Clip



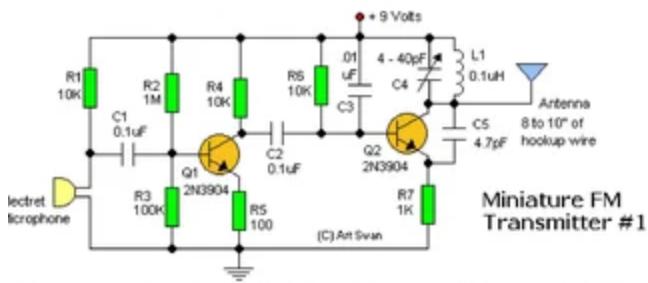
The key to this compact transmitter is the ingenious battery clip. You can get one by dismantling an scrap 9v battery.

## Step 11: Glue Them Together



Apply a generous blob of hot glue to hold the clip and the transmitter circuit together.

## Step 12: Breadboard Version



This miniature transmitter is easy to construct and its transmissions can be picked up on any standard FM receiver. It has a range of up to 1/4 of a mile or more. It is great for room monitoring, baby listening, nature search, etc. L1 is 8 to 10 turns of 22 gauge hookup wire close wound around a non-conductive 1/4 inch meter form, such as a pencil. C4 is a small, screw-adjustable, trimmer capacitor. Set your FM receiver for a clear, blank space in the lower end of the band. Then, with a non-conductive tool, adjust this capacitor for the best reception. A little experimenting and patience may be in order. Most of the parts values are not critical; you can try adjusting them to see what happens.



Recently, people have been asking me if it's possible to make this project without having to fabricate a PCB. The answer is yes. In fact I built my first FM transmitter on a perfboard. I guess some are new to this, no worries I'm here to teach you.

---

The answer to this is a "Perfboard/ Prototype board. It's a PCB designed for prototyping circuits. There are three types of perfboards, the one that suits our needs is the dot matrix version. If you're new to this, make magazine has handy YouTube tutorial.

## Circuit Skills: Perfboard Prototyping



### Step 13: Tune the Transmitter



Turn on your radio then tune it to your desired channel frequency. You'll get more range from the vacant channels. Don't touch the coil, just turn the trimmer capacitor until you hear a feedback from the radio.

## Step 14: Q&A - Tips & Tricks



## **Where Can I Buy The Parts?**

If you live in the US, all the parts that I've used are available from Radioshack. You don't believe me? The parts from my first non-recycled transmitter came from RadioShack, Long Island, NY branch.

## Any Alternatives For The Trimmer Capacitor?

Most likely, you'll find one from a scrap transistor radios however you can replace it with a 20pF ceramic capacitor then rely on the coil's adjustment for compensation. Trimmer caps are color coded, only use the Red, Green or Yellow. I used the yellow since it covers a wider range.

## Which Wire Should I Use?

Only use solid wires that has a thickness of 18 - 22 gauge. When I was still a novice hobbyist, I was worried about the strict selection of parts. Don't worry too much, eventually you'll learn to improvise when parts are not available.

## Why Does The Frequency Change After Tuning?

Let's admit it, tuning the radio is a bloody challenge! If you use a metal screw driver to tune the trimmer cap, chances are you'll end up having a different frequency broadcast the moment you lift the screw driver. This is why non conductive screw drivers are recommended.

## Where Can I Find A Non-Conductive Screwdriver?

You'll easily find one from a PC repair shop, or maybe from a hardware store. If you really can't find one, the famous Little Bits kit comes with it.

## Is It Possible To Connect A 3.5mm Audio Jack?

Yes, it's possible! All you need to do is to link the common ground then solder a 1K ohm resistor each channel (L & R) forming a junction. Now solder a wire from the junction to U1's collector pin (refer to the schematic). You can now connect your MP3 player! I'll post an additional step regarding this mod.

## Can I Hook This On A 12v Car Battery?

This project would still operate at voltages between 7v-14v, so yeah it's compatible. If you want to stay safe and prevent the circuit from burning, solder a 10 ohm resistor in series with the FM transmitter and 12v battery.

## **Is This Legal?**

As long as you don't use it to spy on others and not use a long & huge antenna then yes, it's legal. Just don't use it near an airport. For more info, please read the [FCC Rules](#).

## **Step 15: Don't Forget to Leave a Comment [Stay Tuned]**



Please don't forget leave a comment below. Thank you!

### **Schedule:**

2nd Week - DIY Pocket Spudgun

3rd Week - Homebrew Continuous Tazer

4th Week - Crystal Radio

5th Week - Solar Car (School Investigatory Project)