4. Prepare the wire coil. Using the 1/8" mini plug (such as an audio jack on your mp3 player or phone), wrap the 20 gauge wire tightly around the tip four times. Bend 3 cm feet and cut the wire. Solder as shown in the circuit drawing.

5. Prepare the transistor. The transistor, labeled 71 on the diagram, is a small black panel with three leads, labeled C, B, and E. With the flat side facing you, connect the center pin to the "B," and the right "E." Using the needle-nose pliers, bend the central lead "B" straight toward the flat face of the transistor about a 45 degree angle to the sides, and bend feet in all. Double check that the leads are arranged as in the drawing before soldering in place.

6. Place the voltage regulator, IC1. The voltage regulator reduces the flow of voltage from the solar panel to help ensure that the battery does not get overcharged. Because it reduces the voltage to 5 volts, it is less than the 6 needed to run the transmitter, over time the battery will be slowly discharged. The voltage regulator, however, vastly increases the length of battery life.

It's important to connect the voltage regulator in the proper direction. With the label on the component facing you, the left pin is the input and the right pin is the output. Connect the input pin to the pad shared with the red wire of the solar panel. While connecting the output pin to the pad where the wire to the battery will go. The center pin connects to ground. 

IV. Connect the Inputs.

Kogawa's original design runs off a 9 volt battery. It was not intended for extended use because, as the battery ran down, less power would get to the transmitter and the transmission frequency would drift. The addition of a small solar panel to continuously recharge the battery to extend its life, allowing the transmitter to be left on 24 hour per day. Although not strictly necessary for a microwatt transmitter, the antenna vastly increases range. You can use any kind of shielded wire for the antenna, but it must be cut to the proper length for the frequency you wish to use and placed as high as possible. To calculate the length of antenna, use the following formula:

- length = 300 / (frequency x 1/4)

For example, if you planned on broadcasting at 100 MHz (in the heart of the FM range), length = 300 / (100 x 1/4) = 75 cm.

Cut the alligator clips off the solar panel's power cord, leaving a length of 12-18." Using the extra cord you cut from the solar panel, cut a piece about 6" long. Clip the plastic between the black and red ends of the cord enough that you can grasp the sides and pull them completely apart. Using just a small amount of solder, tack the exposed red wire to the metal circle where the battery clip's positive (red) wire is connected.

Push the wire back into the jack's black plastic casing and screw the metal barrel in place. Tin the exposed tips and solder the red wire to the pad shown in the circuit diagram and the black wire to the ground.

V. Attaching the Antenna and setting the frequency.

Although not strictly necessary for a microwatt transmitter, the antenna vastly increases range. You can use any kind of shielded wire for the antenna, but it must be cut to the proper length for the frequency you wish to use and placed as high as possible. To calculate the length of antenna, use the following formula:

- length = 300 / (frequency x 1/4)

For example, if you planned on broadcasting at 100 MHz (in the heart of the FM range), length = 300 / (100 x 1/4) = 75 cm.

Once you have determined the length of your antenna, cut the antenna from either speaker wire or leftover cord from the solar panel. Cap one end in a little electrical tape to keep the wire from getting wet. Separate the strip, and tin the opposite ends of the wire, and solder the red side to the pad indicated in the circuit drawing and the black side to the wire to the shown in the circuit diagram and the black wire to the ground.

VI. Building the box.

First, drill holes in the box to accommodate your in and output ports. You will need a 5/8" hole and a solid side on top, place the transistor board on the bottom of the box. Using a permanent marker, mark on the exterior sides of the box the approximate place where the solar panel power wires, the antenna, and the audio in jack will lie. Getting the layout on paper is the most important thing, as it provides the least room for error. Remove the transmitter from the box.

Drill a 5/8" hole for the audio in jack. If you have machine oil, oil the end of your drill bit before insertion. You want an exact 5/8" hole, so go slowly but steadily. The resultant hole will be quite rough, and you can file it down a little after wiping off the oil.

Double-check your markings for power and antenna now that the jack hole is cut. Drill those with a 3/8" bit, wipe, and file. Place the rubber grommets on the holes. You should also drill holes for the solar panel mount.

Prior to attaching the solar panel, run the solar panel's power cord through the hole on the top of the box that you drilled for it. Connect the solar panel to the voltage regulator by soldering the red wire to the top right pad shared with IC1 and black to ground. Mount the solar panel to the top of the circuit box and screw in place.

Place the transmitter back into the circuit box and carefully position the audio jack in the grommet. It should fit snugly. Run the antenna through the hole on the side, and make sure your mark is on the exterior sides of the box, not the interior. The transmitter board to the base of the circuit box or raise it with spacers, but you don't really need to. It's not too difficult to get the box sturdy. Re-attach the front of the box.

VII. Using the transmitter.

Your transmitter is now ready for use. It will constantly broadcast a "carrier signal" on the frequency you selected when in the sun or attached to a battery. It is designed for outdoor applications in remote areas where it is not necessary to broadcast a message constantly or to act as a node in a network of informal transmitters just waiting to be found by the audio pirates. It should be attached to a utility pole or building at the right height for people to plug in to and transmit. The transmit signal would be raised and secured as strictly as possible.
II. Preparing the board.

First, mark 1 cm off one edge of the copper plate and score deeply with the utility knife. Place the board on the edge of your worktable and bend the score against the corner until the board snaps. Cut the smaller portion of board in a similar fashion into a square somewhere between 3 x 3 and 4 x 4 inches. This board will be the ground for your transmitter. Mark the 1 cm strip of copper board into 1 cm squares and score deeply with the knife. You will need a total of 7 squares. Holding the strip with the needle-nose pliers, use the wire cutters to cut through the board along the scores. These squares (which may be quite uneven) will be the pads for the current in your transmitter.

Glue the pads to the plate using sponge-machine oil. The arrangement shown in the circuit drawing. Four pads should be in a line with about 1/2 cm spacing between them. Another pad should be 1 cm above the second pad from the left, while the final two pads are placed on 2 cm above the third and fourth pads in the first row (refer to above image.)

Hose up your soldering iron, moisten the sponge, and unscrew a 4" length of solder. Hold the tip of the soldering iron on one of the pads for a couple of seconds and push the solder into the hot tip. It should pool slightly on the pad. Remove both solder and ironquickly. The pool of solder should harden and fill the hole. Before you begin soldering iron quickly. The pool of solder should harden and fill the hole. Before you begin soldering the remaining resistors in place.

To solder the resistors in place, hold them with the needle-nose pliers. Heat up the solder on the appropriate pad until it melts slightly and push the foot of the resistor into the melted solder. Remove the iron and hold the resistor in place for a few seconds until the solder hardens.

Only one foot of the resistor is attached to a pad. The other foot is soldered to the copper plate or ground. To solder the resistor to the ground, touch the soldering iron to the ground and touch the tip with solder until it melts and pools slightly around the component. Remove the iron and touch the foot of the resistor to the soldering iron quickly. The pool of solder should harden as it is being held in place by the resistor.

Solder the remaining resistors in place.

1. Heat, prepare the capacitors for soldering. To preheat them, grasp the lead just below it bends slightly after emerging from the cap with the needle-nose pliers and bend them sharply outward. Out, leaving about 3 mm for feet.

The transmitter has three ceramic capacitors, abbreviated on the drawing as C plus a number. Capacitors (abbreviated as C) store small amounts of current that help smooth out disruptions in a circuit. Their capacity is measured in units called farads, abbreviated with an F. Farads are really large units, so most caps in electronics are measured either in microfarads (µF) or picofarads (pF). Because this component is extremely tiny, take care to keep your caps labeled, as it can be difficult to identify them if you get them mixed up.

C1 = 1µF
C2 = 0.01µF
C3 = 0.1µF

Solder these capacitors in place as you did with the resistors.

2. You probably noticed two other capacitors (C2 and C3) in the drawing. These are special capacitors. C2 is a 10-µpF trimmer capacitor that is used for tuning the transmitter; it stores a different amount of electricity depending on the frequency you would like your transmitter to use. If yours didn’t already come with feet, bend feet and solder in place in the main drawing.

C3 is a 1µF polarized electrolytic capacitor. This means that lead one is positive and one is negative. The negative lead is marked with a band on the side of the cap that, appropriately enough, has a minus sign on it (refer to this component as marked on the drawing, with the negative lead on the pad furthest to the left.

Although the transmitter is relatively inconspicuous, especially when mounted near a building’s junction box or ed near a building’s junction box or installed at the base of an ordinary circuit box, it is given the pervasive atmosphere of fear and vigilance against anything out of the ordinary in the urban environment. Anyone who builds and deploys this transmitter should be prepared to answer some very serious questions. Sorry to break it to you, but there it is.

Additionally, this transmitter is best suited for experimental and artistic uses because it doesn’t have a very stable frequency and is subject to interference from other electrical fields and devices. The frequency is more stable in the short term with steady voltage from a new or fully charged battery. Rather than looking at this instability as a drawback, however, builders are encouraged to think of creative and subversive applications that resist the dominant desire for a Clear Channel.

Sarah Kanouse 2007