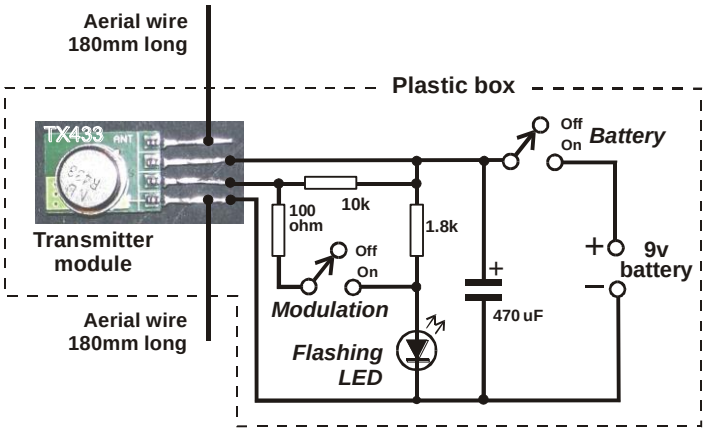
“Hands on to *RADIO WAVES*”

Constructing the Transmitter Unit

Our source of RADIO WAVES



This “test transmitter” is our source of radio frequency energy. It uses a transmitter module smaller than a postage-stamp. These are inexpensive and can be obtained by on-line buying on the internet.

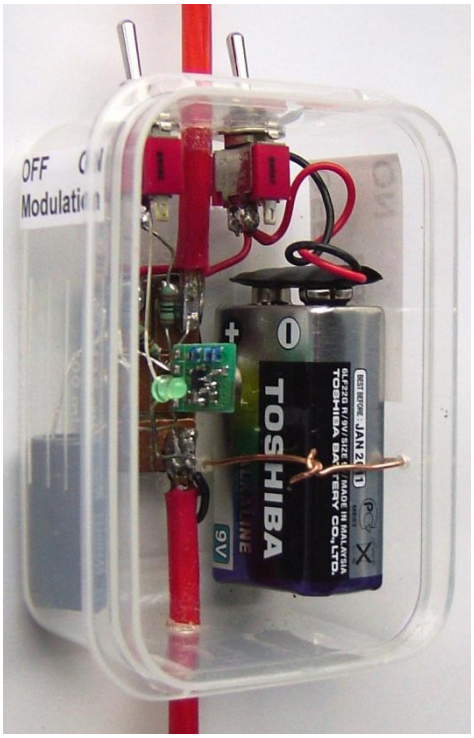
Module type TX433 is used here. Type “TX433” into Google.

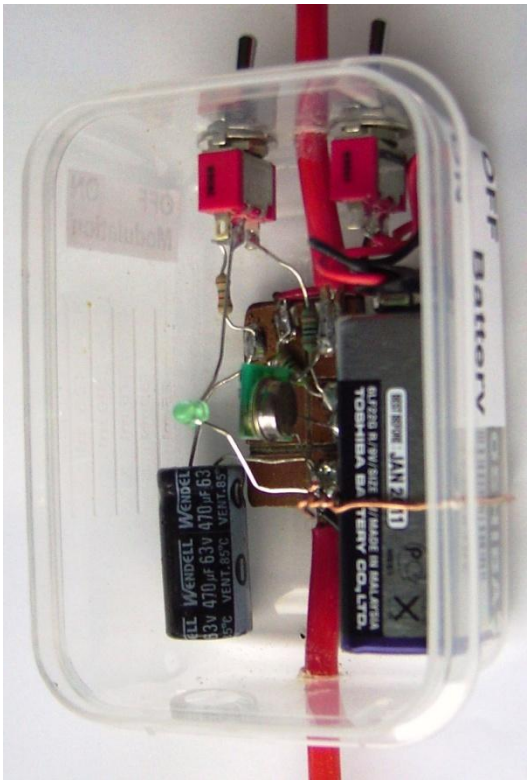
A 9-volt battery with a "snap" connector and some other common components are needed. These can be obtained from electronics shops.

A small plastic box houses the unit. A box about 90mm by 65mm by 45mm high, is suitable. These are often sold as a “Snack Box” in supermarkets and labelled "125 ml". Size is not critical and many available boxes are suitable - but don’t try to make your unit too small. Trying to fit things into a confined space can be very frustrating and damage to components can result.

It is very important that the battery polarity is strictly observed (red for the positive lead and black for negative). The red lead (+ve) in the "snap"-type battery connector is cut at a suitable point and the switch inserted.

A piece of printed-circuit board stock from an electronics shop is cut to 30mm by 20mm and the copper surface scored to make six “lands” for soldering. This holds the components in place. The board itself is held in place in the box by one self-tapping screw.





The wires of the transmitter module are splayed out and soldered to the various "lands" in accordance with the circuit diagram.

Scrap stiff insulated hook-up wire is used for the aerial elements. Some "6-mil" wire off-cuts can usually be obtained from a friendly electrician. The insulation plays no part in the operation of the unit. Red insulation gives good visibility in the classroom.

Tight holes for the aerial wire elements to pass through are drilled in the ends of the case.

The battery is held in place by a strand of scrap wire passed through two holes drilled in the box.

Holes are drilled in suitable positions on the box for the two toggle switches.

Check all the wiring very carefully before connecting the battery and before switching the assembly on.

Being battery-operated, the signal from this transmitter unit will eventually self-extinguish if inadvertently left switched on. You will then need a new battery. *The discipline of "Turn OFF after use" should be encouraged and observed.* With care, a long battery life can be expected.

"On/Off" labels and a "Switch off when not in use" warning label should be affixed to the box.

The switches should be separately identified with labels: "Battery" and "Modulation".

The 3mm flashing LED warns when the battery switch is ON. (A green flashing LED is preferred in this application. Red could imply danger – but there is no hazard from this unit.)

The same flashing LED also acts as a very simple modulator to key the transmitter on and off at the flashing rate. This causes a slow waggle in the meter at the receiver. This remote waggle can be controlled by the "Modulation" On/Off switch at the transmitter.

The meter is a remote indicator of the state of the positions of the switches at the transmitter (i.e. no signal, unmodulated carrier, or modulated carrier). Topic for discussion: information-transfer! What would happen if the flashing rate were to change?

NOTE: The TX433 transmitter module used here is rated at 10mW peak output. Be aware that *substitute devices may not have adequate power output* and hence may not produce a workable deflection on the receiver field-strength meter used in these experiments.

Care when using hand-tools, especially a hot soldering iron, is expected at all times.

Additional Notes:

1. The operating frequency of the TX433 unit as quoted on the data-sheet is 433.92 MHz. In practice, devices have been found to operate at this frequency with some at higher and some at lower frequencies but all are still within the spread of the ISM / SRD (Industrial Scientific and Medical / Short Range Devices) band 433.05 to 434.79 MHz.
2. You may wish to prune the aerial element lengths of your transmitter to seek a more optimal performance – but you will find that the element lengths for these devices are not critical! To provide for the added dielectric which surrounds the lower element when it is inserted in the pipe of the support stand, prune the top element to extend to 160mm above the centre-line of the circuit board, and the lower element to extend 145mm below the centre-line of the board, i.e. an overall antenna length of 305mm.

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Appendix

Building Radio Gear … Handy Hints

Take time to prepare and to thoroughly check your equipment and you will achieve success.

Tools

You will need pliers for working with copper wire: heavy pliers for the heavier wire and long-nose pliers for working with finer wires and electronic components.

Side-cutters for clipping off long leads and some small screwdrivers are needed too.

A soldering iron rated at around 25 watt with a pointed tip should be suitable. Working with heavy wires may require a larger iron.

Use only fine resin-cored solder sold for electronics use. Don't use acid-core solder.

Soldering

Poor soldering is a major cause of failure. Take time to clean and to prepare each joint. Practice on some unwanted items first before attempting your real project.

Make good mechanical contact of the conductors making up the joint. Clean all connecting parts. Don't finger cleaned leads. Hands, even clean washed hands, are greasy!

Heat the joint not the solder. When pre-heated, apply the solder to the joint. The solder should free-run when the joint is hot enough. Remove the iron and allow time for the joint to cool before moving anything. Yes, we know you need more hands!

The connection should be shiny. If it appears rough, it will probably be "dry" and must be re-done. Re-heat and apply some more solder.

Be sparing with the solder. Don't over-apply and don't over-heat. Don't prolong the heating. Keep the hot iron away from plastic!

Inspect each joint after completion. Look for solder-bridges that may make unwanted connections to other conductors and remove them.

Keep your soldering iron clean. Wipe its tip with a clean rag before making each joint. Take care! It is HOT! Make and use a suitable stand to support the hot iron when it is not in use.

Soldering requirements – lead-free solder

In Europe there is a perceived need for better management of "hazardous" municipal waste destined for incineration or landfills. On January 27, 2003, The European Parliament and the Council of the European Union adopted the two Directives 2002/95/EC (RoHS – restrictions on hazardous substances) and 2002/96/EC (WEEE – waste electrical and electronic equipment). The compliance due date is July 1, 2006. These two Directives are easily found on the internet. Both are aimed principally at the production consumer market and landfills. It is not made clear if our home-constructed educational equipment is classified as consumer equipment or if it falls somewhere in the many listed exemptions. Lead-free solder is to be used in goods mass-produced for the consumer market but the use of conventional solder will remain with us for many years for the maintenance of existing equipment. Working with lead-free solder requires different techniques. It requires hotter temperatures, has different "wetting" characteristics, is considered more difficult to work with and has a reputation for being less reliable. Its use should not be mixed with conventional soldering.

For our purposes, use whatever soldering facilities you have available.

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