“Hands on to *RADIO WAVES*” - Constructing Hardware Items

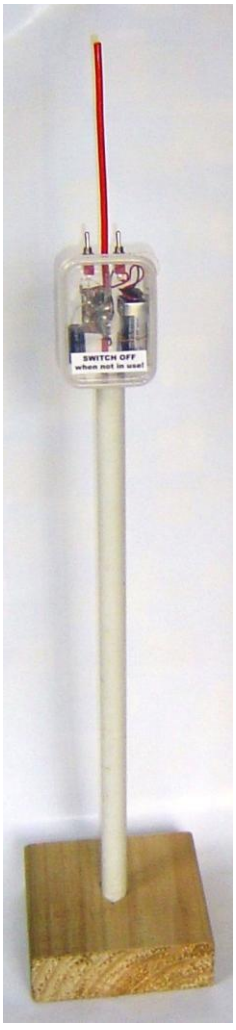
Simple *Support Stands* to hold the Transmitter and Receiver units

These are easily made!

Two pieces of bamboo, or two pieces of 20mm plastic tube, are required, i.e. one for each unit. Plastic water-pipe or plastic electrical conduit can be used. About 450mm over-all length makes a suitable stand for table-top use.

Select a suitable 2m bamboo garden stake at a garden centre. Cut out a 450mm length. You may get the two pieces out of one 2m stake! Cut the stake so that a long "pipe" of bamboo is available to take the whole lower aerial element of the transmitter and receiver units as seen in the pictures. The hole in the pipe must be of diameter large enough to take an aerial element.

A piece of scrap timber, about 140mm square and 50mm thick makes a suitable base. Drill a hole of the size to take the vertical support – a tight "push-fit". Drill the hole after you have selected and prepared the support pipe!



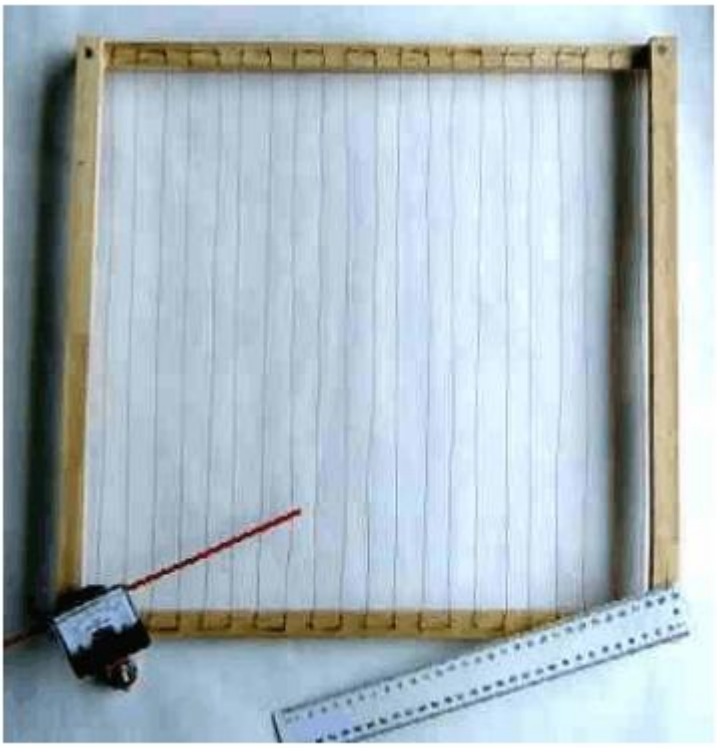
The Transmitter Unit on its stand
(using plastic pipe)

The Receiver Unit on its stand
(using bamboo)

Making a "*Polarisation Grating*"!

Is our signal vertically or horizontally polarised?

This is a grid of fine wires through which we intend our signal to pass. We can hold this grid between our transmitter and our receiver and rotate it to make the wires horizontal or vertical. It is not critical and two versions are given here.



Will our signal pass through a grid? Let's build a grid and try it!

First Version:

Wooden garden stakes, about 25mm square in cross-section, are obtained from a "garden centre". Select stakes with minimum knots. A good rubbing with sandpaper may be needed to remove roughness. The stakes are cut into lengths about 500mm long. Four such lengths are required. They are glued and nailed/screwed to form an open frame.

When the glue has set, small nails are tacked at 20 or 30 mm intervals along two opposite sides of the frame as shown in the photograph.

Fine wire is laced across the frame to form a grid of parallel wires. Any gauge of wire is suitable and it may be insulated or bare. Try what you have available. You can calculate the total length needed – and it need not be in one complete length. Individual grid wires can be used if only short lengths of wire are available.

Copper wire is prone to stretching, fine steel wire is preferred. The wires should be parallel, their number and spacing are not critical.

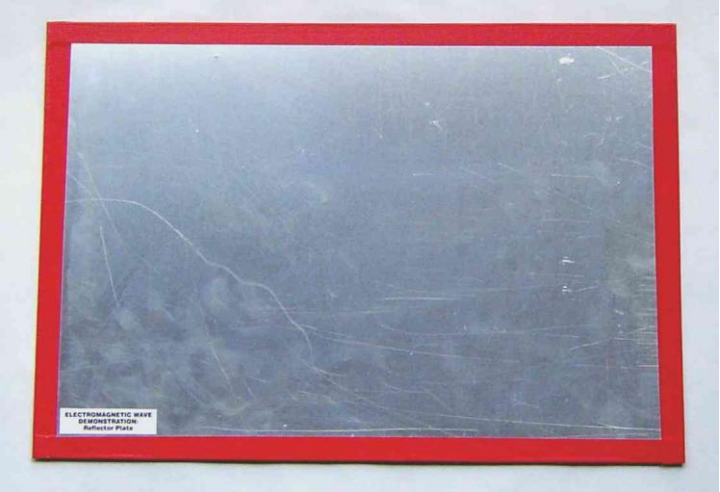
Second Version:

A piece of clear "perspex" about 450mm by 310mm has short hacksaw saw-cuts spaced at intervals across each end. A long length of wire is wound in a progressive fashion to form a parallel grid. The perspex plays no part in wave propagation, it is just a support for the wire.

Making a "*Reflector Plate*"!

This is a flat metal sheet about 450 by 310mm. The material is aluminium or steel, the size and the thickness are not critical but it must be rigid and could be made from hardboard with aluminium foil glued to it.

Sticky tape is folded over its edges for safety – to make handling comfortable and to remove any sharp cutting edges.



Attach sticky labels to these items to be sure that their purpose is recognised should they become displaced from the other apparatus, e.g.

Electromagnetic Wave
Demonstration
REFLECTOR PLATE

Electromagnetic Wave
Demonstration
POLARISATION GRATING

A "Square-Corner Reflector"!

Increasing the directivity of our signal

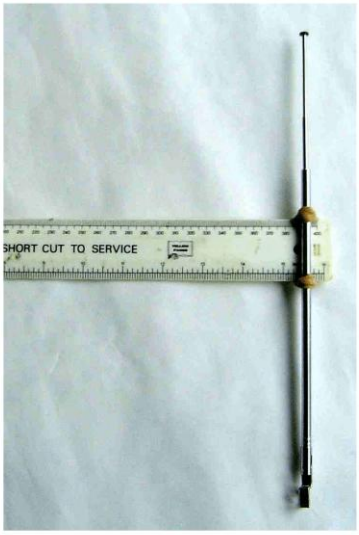
Two pieces of hardboard about 700mm by 500mm are held together by a hinge made of wide sticky plastic tape. The two pieces of hardboard must be kept about 2mm or 3mm apart when applying the tape to allow for easy folding. The tape is applied to both sides of the hardboard. The "fold" is along the 700mm dimension. One whole face of the two boards including the fold is then covered with aluminium foil, glued on.

The foil is obtained in rolls as "kitchen foil" from a supermarket and glued on in overlapping strips.

A wooden batten, about 1-metre-long, 25mm by 20 mm, i.e. a wooden garden stake obtained from a "garden centre", is placed across the open reflector as shown in the photograph to support the transmitter unit on a string.

Select a stake with minimum knots. A good rubbing with sandpaper may be needed to remove roughness.

A useful *Adjustable Parasitic Element*



For testing Parasitic Director and Reflector lengths and positions

A telescopic aerial element taken from a discarded transistor radio makes a useful device for acting as a demonstration parasitic Director or parasitic Reflector.

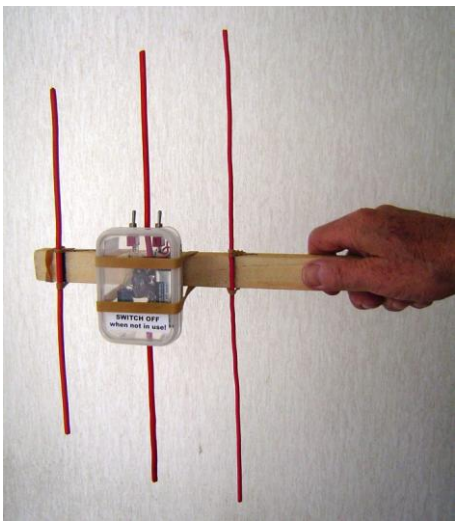
Adjust it to be longer (or shorter) than the transmitter aerial and position it behind (or in front of) the radiating transmitter aerial, or similarly position it behind or in front of the receiving aerial.

The telescopic element is attached to a wooden or plastic boom by rubber bands so the arm and presence of the operator is distanced to prevent disturbance of the fields.

The telescopic element can be placed within the induction field of the respective aerial and the change in the reading on the field-strength meter noted.

A Yagi-Uda Antenna

Reflector and director elements can be easily fitted to a receiver or transmitter unit to form a Yagi antenna to demonstrate directivity. Start with a "director" and a "reflector" with the dimensions suggested below. Cut additional elements 10mm longer and 10mm shorter to use as test replacements.

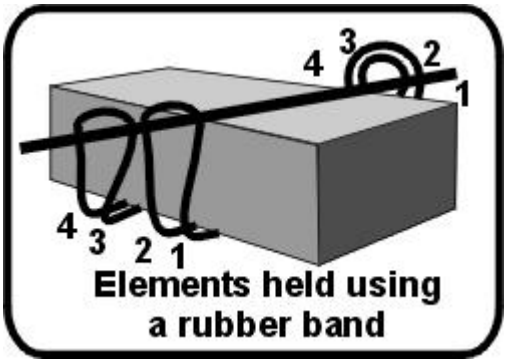


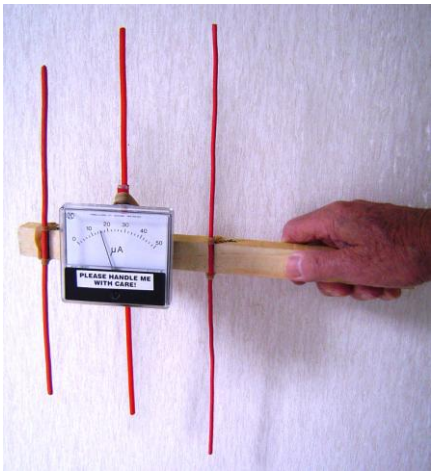
The boom can be made from a half-metre-long, 25mm by 20 mm, wooden garden stake obtained from a "garden centre". Select one with minimum knots. A good rubbing with sandpaper may be needed to remove roughness.

Use rubber bands (from a stationers) to hold the elements, as shown in the diagram.

A Yagi antenna can be used for receiving and transmitting so the "driven element" can be either a diode receiver or a transmitter unit as shown in these two pictures.

A performance comparison can be easily made between transmitting aerials using the Yagi and the square-corner reflector. Another director could be added too.





Suggested starting dimensions:

Reflector: 370 mm long, 65 mm behind the radiator.
Director: 290 mm long, 75 mm in front of the radiator.

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