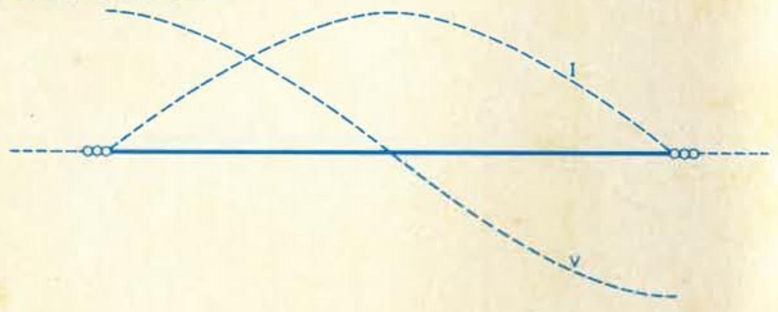
PRACTICAL AERIAL DATA CHART

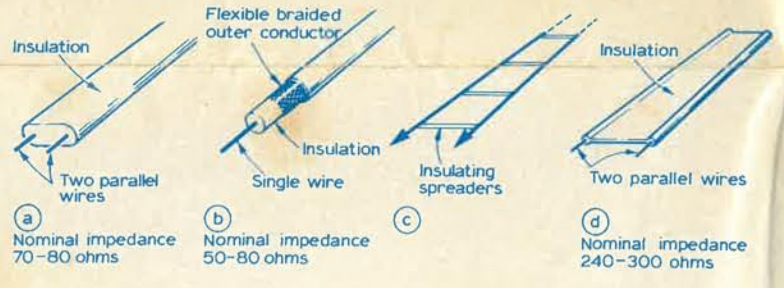
PRESENTED FREE WITH PRACTICAL WIRELESS OCTOBER 1972

BASICS



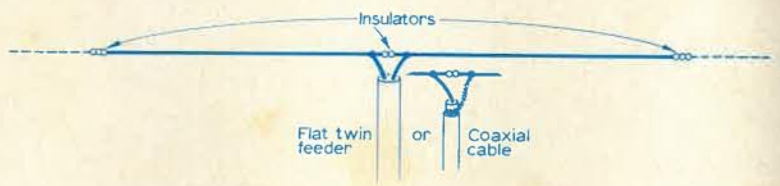
The basic horizontal half wave aerial (½λ). In practice, the physical length required for resonance is reduced by a factor of 0·95 (0·95 x ½λ) due to the effect of insulators and nearby objects. A simple formula for the practical half wave aerial is 468/F(MHz) feet. At resonance the induced voltage V will be maximum at the ends of the aerial (high impedance) while the current I will be maximum at the centre.

FEEDERS



Since the aerial should be located in the clear and generally as high as possible to produce maximum signal strength it is necessary to use a feeder to connect the aerial to the receiver. Low impedance feeders may be flat twin (a), coaxial (b) or flat ribbon (d). High impedance feeders consist of two wires spaced apart by insulators every foot or so (c).

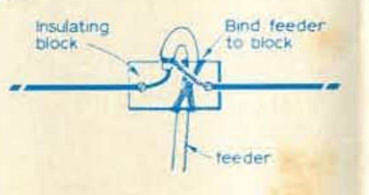
HALF WAVE DIPOLE



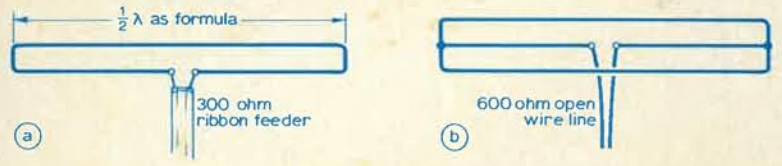
As the impedance at the centre of a half wave aerial is approximately 70 ohms feeders (a) or (b) will provide a good impedance match to the aerial ensuring maximum signal transference. The aerial, length calculated from the formula given, is cut at the centre and an insulator inserted, the wires of the feeder being connected either side of the insulator.

CONSTRUCTION

A practical method of feeding the aerial with low impedance feeder. The loop in the top of the feeder is essential to prevent the ingress of rain and dirt. The end of coaxial cable can be sealed with plastic insulating tape or compound.

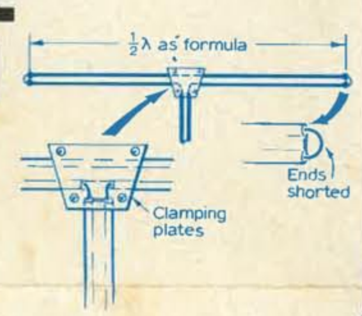


FOLDED DIPOLE



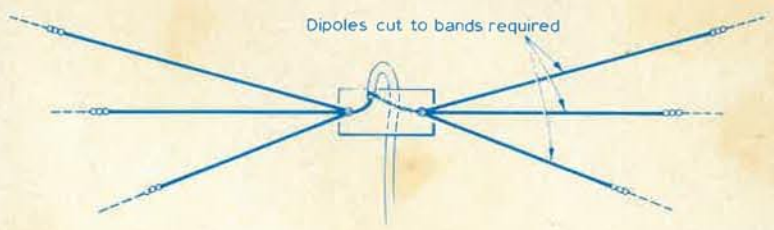
The folded dipole (a) will transform the input impedance by a factor of 2^2 or 4 x 70 = 280 ohms so that it can be fed with a flat ribbon feeder of 300 ohms impedance, provided the wires forming the folded dipole are the same diameter. If a three fold dipole is used the input impedance will be 70 x 3^2 = 630 ohms which will provide a good match to an open line feeder.

FOLDED DIPOLE CONSTRUCTION



A practical folded dipole using 300 ohm ribbon feeder for both the aerial and the feeder. One conductor only of the aerial is cut at the centre and the feeder inserted and the joints soldered. The junction should be clamped between pieces of insulating material and properly waterproofed.

MULTIBAND DIPOLE



If dipoles are required for optimum performance on several frequency bands they can be connected in parallel at their centres, and fed with a common feeder thus providing multiband facilities in a minimum of space. The ends of the dipoles may be tied off to any convenient supports and the dipoles need not all be in the same plane. Note that a dipole cut for, say, the 7MHz amateur band, will be three half waves on the 21MHz amateur band thus eliminating the need for a separate aerial for that band.

DIPOLE DIMENSIONS

The table gives the length of a half wave aerial in the various HF amateur and broadcast bands.

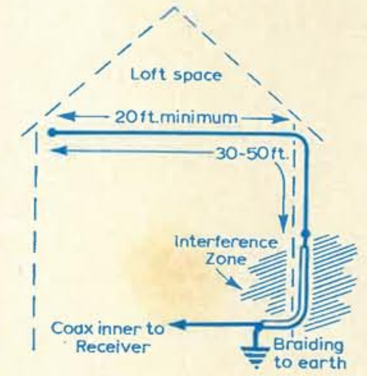
Broadcast		Amateur	
Band	Length	Band	Length
11m	18ft 2in	160m	256ft
13m	21ft 7in	80m	128ft
16m	26ft	40m	66ft
19m	30ft	20m	33ft
25m	39ft 4in	15m	22ft
31m	48ft	10m	16ft
41m	65ft		
49m	76ft		

LONG WIRE

A long length of copper wire, with one end connected to the receiver, is probably the most commonly used aerial. This is often fitted onto a picture rail and even quite a small room will enable a 40ft. length to be used. One convenient form of aerial can be obtained by using the coaxial cable of a TV aerial, the outer braiding being connected to the aerial socket of the receiver. Important! disconnect the TV aerial from the TV set before using it in this form. Probably the best and only *true* long wire aerial is the Beveridge. This is used by many major monitoring stations. It comprises a straight wire about a mile long mounted on short poles over the ground. One end goes to the receiver and the other to earth via a resistor. It is very directional and provides excellent reception but there are few who have sufficiently long back gardens to accommodate this one!

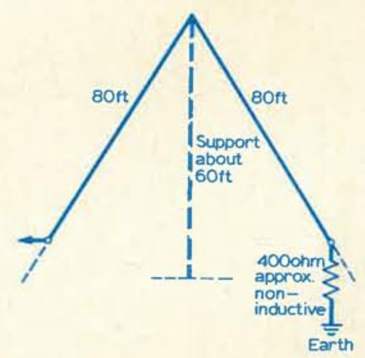
INVERTED L

A simple, general purpose aerial which, when connected to an ATU, will give good results. The length should be between 30ft and 50ft. of which the horizontal part should be at least 20ft. A wire across the loft and running down the outside of the house is a simple method of arranging this. In areas of high local interference the vertical portion can be screened using coaxial cable, the outer braid being taken to the earth terminal on the receiver and thence to an outside earth.



INVERTED V

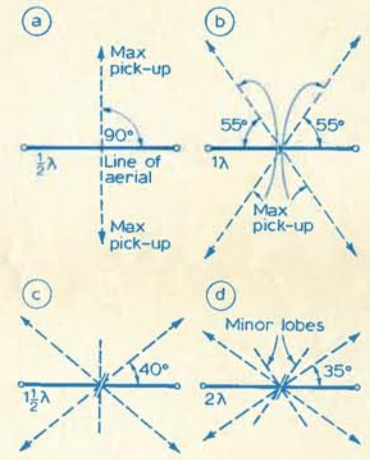
With only a single support required this form of "Inverted Vee" can be very effective. The 400 ohm resistor renders the system aperiodic i.e. not resonant at any particular frequency. It will be useful over most of the HF bands favouring signals in the plane of the aerial.



DIRECTIVITY

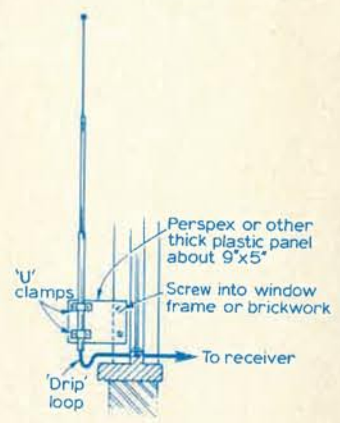
Signal pick-up of a half wave aerial is maximum at right angles to the line of the wire (a). If the wire is one wavelength long maximum pick-up is from four directions (b). By choosing the right length of aerial and adjusting its orientation the maximum pick-up lobes can be made to cover all the land areas of the world.

Longer aerials result in the appearance of minor lobes (c) and (d) which reduce directivity and improve all round coverage. With an aerial many wavelengths long maximum reception is along the line of the wire.



WHIP TYPES

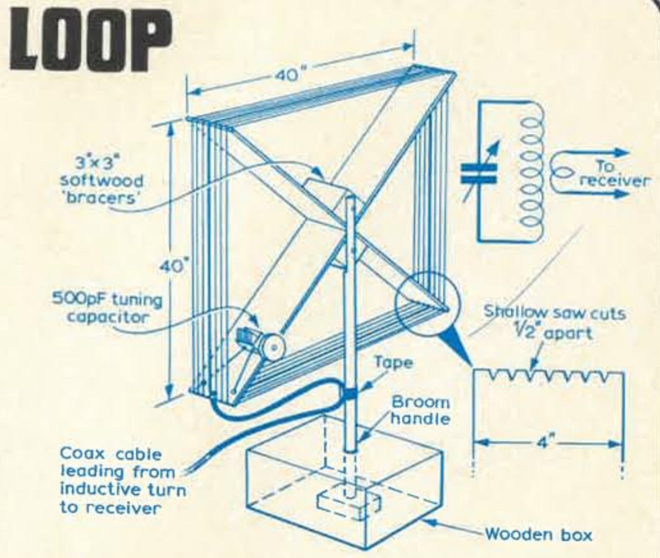
Whip aerials come in a variety of forms, many being ex-Government and very cheap. They can be telescopic, lengths of rod which screw into each other or several tubular sections with a single wire running through them which holds the sections rigid when tightened. In certain locations a whip aerial is about the only practical type since it can simply be mounted outside a window, as shown. The whip should be as long as possible, but very tall ones present mounting problems due to wind pressure. Generally a whip aerial will be non-resonant on the HF bands and should, ideally, be connected to an ATU. If not it may be connected to the aerial terminal directly or via a variable capacitor.



TV AERIALS

It is hardly worth making a TV aerial since commercial ones generally cost much less than the materials would cost to buy. Band I aerials (Channels 1-5) are nearly always cut for an individual channel and take the form of a simple dipole or an H or X arrangement. Band III aerials are available for individual channels, semi-broad-band encompassing three channels or broad-band (Channels 6-13). These aerials are generally more elaborate than Band I types due to the poorer propagation at these frequencies and incorporate one or more directors. The UHF frequencies (Channels 21-68) are divided into groups for aerial purposes: A, B, C, D and E and the correct type must be used in a particular area. Broadband UHF aerials, usually log-periodic, are also available but their gain is rather less than with conventional types. UHF aerials are much smaller than VHF types and usually incorporate from 3 to 19 directors plus a reflector in order to increase the gain. The dimensions are fairly critical and this, together with the low cost of the commercial product, makes home construction an unrealistic proposition.

MW LOOP



For frequencies between 500kHz and 2MHz the loop aerial takes a lot of beating. It consists of 7 turns of wire (5 or 6 turns for higher frequencies) around a wooden framework as illustrated. The ends of the wire connect to a 500pF tuning capacitor. A second wire, wound around the centre turn connects to a coax cable which goes to the aerial and earth sockets on the receiver or preferably to a balanced input.

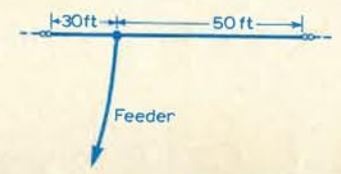
The loop forms a tuned circuit in conjunction with the capacitor with the inductive loop providing a low impedance feed to the receiver. The capacitor has to be tuned for each frequency and the selectivity is excellent. The loop is highly directional and by rotating it, interfering stations can be virtually eliminated. The tuning is very sharp and it is advantageous to fit either a slow motion drive to the capacitor or to wire a small value variable trimmer in parallel with it (10pF to 20pF).

The gain is not as high as that of a long wire aerial but this is more than outweighed by the much improved signal-to-noise ratio and the directional characteristics. The direction of a station can be determined within a few degrees by nulling it out to take its bearing. The broom-handle can be fitted into a box as shown with the bottom fitting into a recessed slot to prevent it slipping.

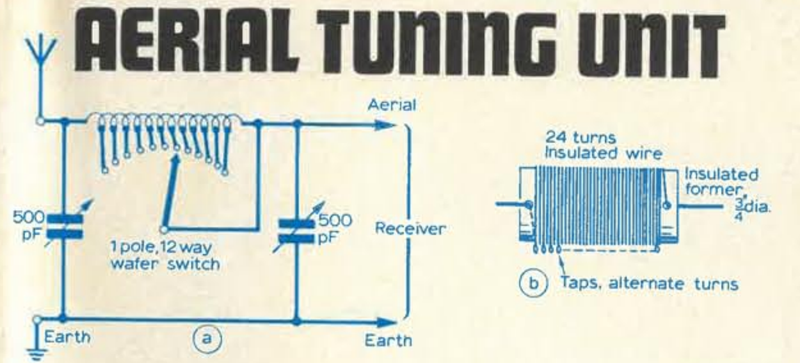
The main frame can be made of 6mm (¼in.) plywood or softwood. The wires should be wound very tight and should be kept that way (under tension the wire tends to stretch slightly). The softwood blocks merely act as bracers and as supports for the broom handle.

WINDOM

A useful general coverage aerial for the HF bands is the Windom which uses a single wire feeder tapped on to the horizontal wire. An aerial length of about 80 feet will work especially well on the 13, 25 and 49 metre bands.

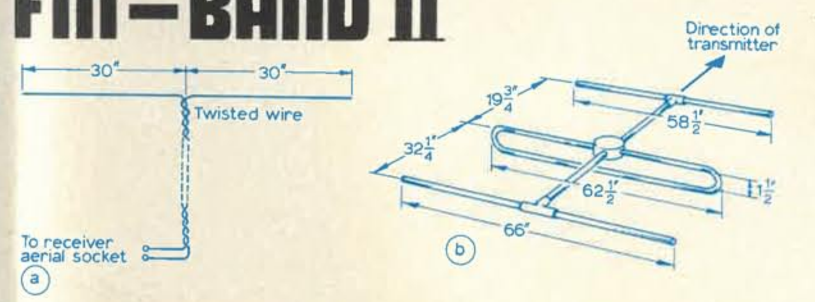


AERIAL TUNING UNIT



For best results an end fed wire aerial or rod aerial should be matched to the receiver input circuit with an Aerial Tuning Unit (a). The inductor (b) is wound making a loop every other turn, the loops then being soldered to the switch tags. Fit each tuning capacitor with a calibrated knob or dial and number the switch positions. Adjust the capacitors and switch position for maximum signal strength noting that the three adjustments are very much interdependent. Log dial and switch readings for future reference.

FM—BAND II



The signal strength of FM broadcasting stations is quite high over most of the country and elaborate aerials are rarely necessary. Many receivers are now fitted with telescopic aerials for FM but these will be poor in some areas. A very simple FM aerial can be made from ordinary twisted bell-wire, as shown. One end should be unwound and pinned along a picture rail to form a dipole. The dimensions given are for 95MHz. If within range of a BBC local radio station, the dipole should be modified to resonate at the frequency of this station as the signal strength is likely to be comparatively low. Length of each leg in inches = 2808 /Frequency in MHz. For DX FM reception or in difficult areas, more elaborate roof or loft mounted arrays should be used. Dimensions of a typical array are given although these aerials usually are cheaper to buy ready made.