Colin Redwood's

what next?

Colin G6MXL looks at a number of antennas to help readers take advantage of the improving h.f. band conditions.

Antennas for the higher h.f. bands

In case you haven't noticed, in recent months propagation on the higher high frequency (h.f.) bands has started to improve. The main reason for this improvement is the re-appearance of sun spots. These sun spots appear as dark spots on the surface of the sun, **Fig. 1. Note: never – please – try to look directly at the sun.** High numbers of sunspots are indicative of higher levels of radiation causing ionisation in the ionosphere that surrounds the earth.

When ionised, the ionosphere refracts (bends) h.f. signals back to earth rather than letting them pass through the ionosphere and out in to space, **Fig. 2**. The numbers of sunspots follows an approximate 11 year cycle, see **Fig. 3**. We appear to be at the start of a new cycle, with the number of sunspots expected to increase for several years which will result in improving h.f. propagation.

With the increased number of sunspots, plus the normal improvements to propagation associated with the summer, propagation on the h.f. bands above 14MHz (20m) is certainly better than it has been for the last few years. If you haven't tried any of the bands above 14MHz in the last six months or so, then you have been missing out on some good contacts!

With the number of sunspots finally starting to increase from a prolonged minimum, I thought it would be a good idea to look at some simple antenna designs to make good use of the higher h.f. bands. For the purposes of this article, I'm going to consider the h.f. bands above 14MHz (20m). So this means the 18MHz (17m), 21MHz (15m), 24MHz (12m) and 28MHz (10m) bands.

Please note, that I'm not claiming any originality in any of the designs presented here – quite the contrary – they're all well tried designs that have been used by numerous Amateurs over the years. However, I'm conscious that many newcomers to the hobby will not have experienced a sunspot maximum, and I think it is a good idea to be prepared so that the opportunities

Fig. 1: The sun with many sun spots visible but please DO NOT look at the sun directly!

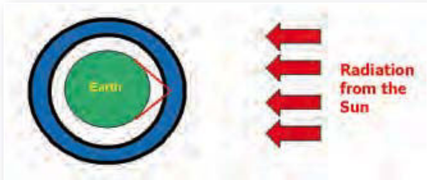

Fig. 2: Sunspots cause higher levels of ionisation in the ionosphere (shown in blue) which refracts h.f. radio signals back to earth.

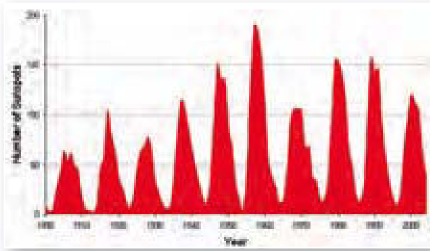

Fig. 3: Graph showing the approximately 11 year sunspot cycles over the last century.

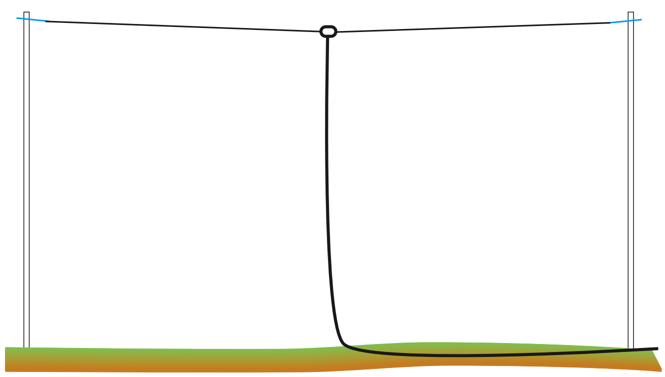

Fig. 4: Horizontal dipole. Note the insulators at the end of each leg. The centre can either be fed by twin feeder, or using coaxial feeder with a balun.

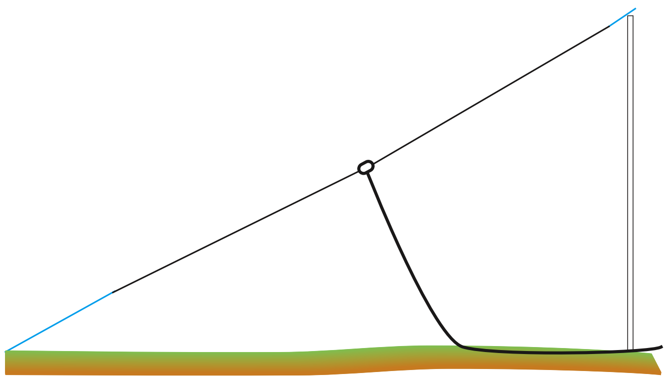

Fig. 5: Sloper dipole – this is just a dipole that slopes. If using coaxial feeder, the braid (outer) should be connected to the lower leg.

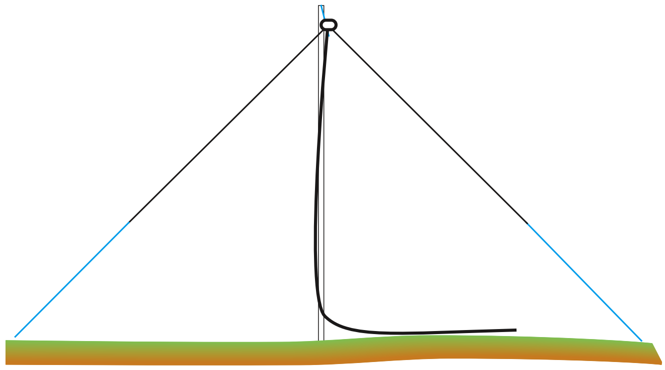

Fig. 6: Inverted V dipole.

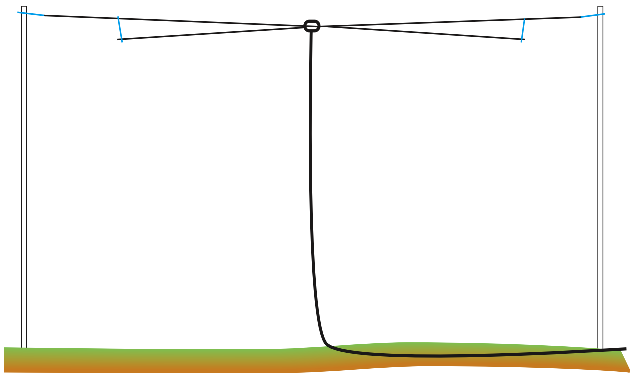

Fig. 7: A multi-band dipole

Colin Redwood G6MXL
PW Publishing Ltd.,
Arrowsmith Court,
Station Approach,
Broadstone,
Dorset BH18 8PW
E-mail: what.next@pwpublishing.ltd.uk

to work stations on the higher h.f. bands are not missed.

Some of the designs require two high-level supports, others just one high-level support. Many of the designs can be easily made by readers, but they're all available commercially if you prefer. I'm hoping that from the designs presented, that you will all be able to find one or more, that suits your particular location so, that you can get on the air and make some contacts on the higher h.f. bands.

The Popular Dipole

I'm going starting with the ever-popular dipole. When operated horizontally, this antenna ideally needs two high-level supports as in **Fig. 4**. I've used dipoles where one end and the centre are high and the other end is somewhat lower. Being a balanced antenna, the centre can either be fed by twin feeder, or using coaxial cable feeder with a balun. The list shown in **Table 1** presents some suggested dimensions for each 'leg' of a dipole, for each of the bands.

For the somewhat wider bands, I've offered dimensions at several points in the band, just in case you are planning to use the antenna for a specific purpose. You may need to cut up to 50mm off each leg to get the antenna to resonate in the part of the band you wish to operate. However, I suggest cutting off no more than 10-20mm at a time.

Sloper Dipole

A 'sloper dipole' is simply a dipole that slopes. One end might be fixed to the top of a building, mast or tree and the other will be close to ground level, **Fig. 5**. So a sloper can be quite useful if you only have one high-level support.

The dimensions are the same as a normal horizontal dipole. Unlike a normal dipole, the direction of maximum radiation is in the opposite direction from the feeder 'side'.

Ideally the feeder should come away from the centre at right-angles from the dipole itself for at least one-quarter wavelength. If using coaxial feeder, the braid (outer) should be connected to the lower leg. Ideally the end of the lower leg should be at least one-sixth of a wavelength off the ground.

Inverted V Dipole

If your location only permits a high support in the centre of the antenna, fear not there's a design that might suit! An inverted V dipole is an excellent antenna, **Fig. 6**, in this situation. It also has the small advantage that the length of the legs can be up to 5% shorter than a standard dipole. Again I am offering lengths to suit three parts of some wider bands.

Two For The Price of One

If you are attracted by the 'two-for-the-price-of-one' offers at the supermarket, here's a similar bargain for Radio

Band	Frequency (MHz)	Length of Leg (m)
18MHz (17m)	18.10	4.14
21MHz (15m CW)	21.10	3.55
21MHz (15m SSB)	21.30	3.52
24MHz (12m)	24.94	3.01
28MHz (10m CW)	28.10	2.6
28MHz (10m SSB)	28.20	2.6
28MHz (10m FM)	29.00	2.59
28MHz (10m Satellite)	29.50	2.54

Table 1: Suggested starting lengths for Dipole Antenna for various h.f. bands.

Band	Frequency (MHz)	Length of Leg (m)
18MHz (17m)	18.10	7.69
21MHz (15m)	21.20	6.41
24MHz (12m)	24.94	5.45
28MHz (10m)	28.20	4.82
28MHz (10m FM)	29.20	4.65

Table 2: Suggested starting lengths for Inverted V Dipole Antennas for various h.f. bands.

Amateurs with a 7MHz (40m) dipole (including a sloper and inverted V). You may be pleasantly surprised to find that a 7MHz dipole will also be quite effective on the 21MHz (15m) band.

Multi-Band Dipole

Taking the any of the designs above it's possible to combine one or more of the bands above into a multi-band antenna. The design is simply a set of dipoles, slopers or inverted V dipoles wired in parallel, so that all the bands share a common feed point, **Fig. 7**.

At first you might think that this will be difficult to match. Fortunately the lengths not being used on any particular band present a higher impedance and so can effectively be ignored, as the signal will in effect 'seek out' the antenna with the lowest impedance.

I built such an antenna for 7MHz (40m) and 24MHz (12m) a few years ago and was very pleased with the results on 24MHz. I have seen such antennas built using ribbon cable, although I'm a little sceptical about the long-term viability of an antenna using such thin wire.

Trapped Dipole

A trapped dipole is a multi-band antenna and the 'traps' (that give it the name) are in each leg are tuned circuits that present a low impedance to frequencies below their resonance point. So, on the lower band, the full length of the wire appears as the antenna, **Fig. 8**. But on the higher band the trap's high impedance effectively shuts off the outer section of wire from the signal. When buying or building traps, it's important to chose traps of the correct frequency, **Fig. 9**. It's possible to install more than one trap in each leg, and thus get an antenna that is resonant on several bands.

One nice by-product of the traps, is that the wire that makes up the inductor in the trap, effectively reduce the overall length of the antenna. So, if you are in a situation where you can't quite make a particular dipole fit, using a trapped version of your antenna might make the difference and you'll get an additional band as well!

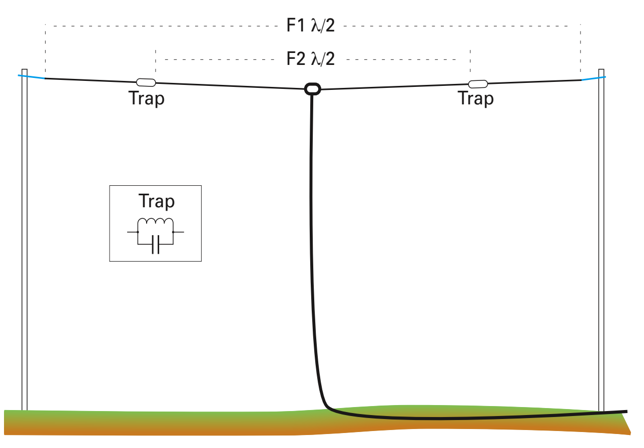

Fig. 8: Trapped Dipole: Showing the role of the traps. F1, the lower frequency makes use of the blue, the trap shown in red (which presents a low impedance) and black parts of the antenna. F2, the higher frequency uses the blue part of the antenna, whilst the trap presents a high impedance preventing most of the higher frequency r.f. from reaching the black part of the antenna. Both frequencies 'see' a resonant antenna. The feeder is shown in brown.

Fig. 9: A trap is just a parallel tuned circuit, however it's created.

Trapped V Dipole

Over the years, commercial antenna manufacturers have come up with numerous antenna designs. The Comet H422 trapped dipole uses three traps in each leg of a 'V'-shaped dipole, made from aluminium, to give 7, 14, 21 and 28MHz coverage in a surprisingly compact antenna, **Fig. 10**.

Fig. 10: The Comet H422 rotary trapped dipole (used in a V form in this photograph) antenna for 7, 14, 21 and 28MHz. It can be used either 'flat' ordinary dipole form) or in the V form as shown.

End-Fed Vertical

If you're really restricted for space, then a bottom-fed vertical can be a good choice. I have been very impressed with the performance of the **Snowdon Radio Company**'s (SRC) X80 Vertical Multi-Band antenna, **Fig. 11**. At the base a 9:1 ratio unbalanced to unbalanced (Un-Un) transformer is used to bring the high impedances to a more acceptable level, **Fig. 12**.

I've used the SRC X80 on 7, 10MHz (30m), 14, 18MHz (17m) and 21MHz (15m) with success with a 100W transceiver with a built-in antenna tuning unit (a.t.u.). In a few weeks I worked five continents, and 39 countries as far apart as Uruguay, Kazakhstan, Iceland and Martinique using a mixture of upper sideband (u.s.b.), PSK31 and RTTY. The data mode QSOs were made with less than 50W.

At a price of just £47 plus £6 for UK postage and packing, I can't help feeling that this is one of the best bargains to be had in Amateur Radio. Cheerio until next month! ●

Fig. 11: The Snowdon Radio Company's X80 Vertical Multi-Band antenna.

Fig. 12: The 9:1 ratio UnUn transformer on the X80 antenna.

Some interesting websites you might like to look at:

www.burtonarc.co.uk/dipole.htm
www.hamuniverse.com/dipivcal.html
www.angelfire.com/mb/amandx/dipole.html