An Effective Multi-band Aerial of Simple Construction

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IMMEDIATELY after the war the writer was stationed in North Buckinghamshire until demobilized at the end of 1946 and when amateur transmitting licences were restored in February of that year, had already designed and erected a multi-band aerial in preparation for the word "*GO!*" Since only an average size back garden was available it was not deemed worth while to construct a beam for the DX bands. Operation on 1·8 and 3·5 Mc/s was an important requisite, but efficient operation on 7, 14 and 28 Mc/s. was also desired. The aerial to be described was evolved and proved to work splendidly from 1·8 to 28 Mc/s. Two versions of it were tested; one using open-wire tuned feeders and the other using a 34 ft. open-wire stub fed at its base by either 72 ohm co-ax or 72 ohm twin-lead. As an alternative to using an open-wire stub, 300 ohm ribbon feeder could be used but would, of course, introduce a certain amount of loss since, on all bands except 1·8 Mc/s, there is a large amplitude standing wave on the stub. The system proved so successful that the writer continued to use it even after his return to Chelmsford where ample space was available for a number of different arrays. It was, in fact, in regular use right up to the summer of 1955 when G5RV departed for Venezuela. Many fellow amateurs who have copied the design are using it with considerable success.

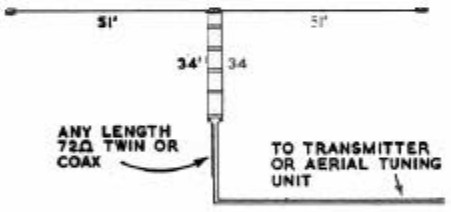

Fig. 1. Construction of the multiband aerial described in the text.

Construction

The aerial consists essentially of a 102 ft. flat-top split in the centre where a Pyrex type insulator is inserted, a 34 ft. long open-wire stub (spacing is unimportant) and sufficient length of 72 ohm co-ax or twin-lead feeder to reach the transmitter. Alternatively, open-wire feeder may be employed from the centre of the aerial right back to the transmitter output or a.t.u. The aerial should be supported at the optimum height for the band which is considered most important for DX working; that is, a half or full wavelength above ground. It is perhaps better to arrange this for 14 Mc/s at which frequency the aerial is designed to present a fairly close impedance match to 72 ohm co-ax or twin-lead via the 34 ft. stub which, in this case, acts as a one-to-one impedance transformer, i.e. a half-wave line. Details may be seen in Fig. 1 and Fig. 2.

Operation

On 1·8 Mc/s the transmitter end of the feeder (whatever type is used) is jumpered (i.e. the two feeder wires are connected together or the inner and outer of the co-ax joined, and the top plus "feeder" is used as a Marconi aerial with a series-tuned coupling circuit and a good earth connection. Despite its relatively small effective height at this frequency, the aerial performs remarkably well and with 10 watts all the British Isles and several European countries were worked regularly.

On the 3·5 Mc/s band, the electrical centre of the aerial commences at about 15 ft. down the centre stub (in other words, the middle 30 ft. of the dipole is folded up). Despite the fact that the remaining 15 ft. length of stub presents a reactive termination to the 72 ohm feeder, no difficulty was found in loading the system easily on this band and results were most satisfactory. WAC was made on 3·5 Mc/s c.w. with 75 watts input while phone contacts were made with many European countries.

The aerial functions as two half-waves in phase on 7 Mc/s with a portion "folded" at the centre. Again, although the 72 ohm feeder sees a somewhat reactive termination it loads perfectly satisfactorily and the system radiates most effectively.

At 14 Mc/s the aerial really comes into its own. On this band it functions as a three half-wavelength aerial with a very effective all-round low-angle polar diagram which is excellent for DX. Since the impedance at the centre is about 100 ohms, a satisfactory match to the 72 ohm feeder is obtained via the 34 ft. of half-wave stub. The DX results obtained on this band particularly, surpassed the results obtained with most normal 14 Mc/s radiators except, of course, a rotary beam. Between 1946 and 1955 the writer amassed a total of 227 countries worked, mostly on 14 Mc/s, mostly with the aerial described here. By making the height a half-wave or a full wave above ground at 14 Mc/s and then raising and lowering the aerial a bit at a time while observing the standing-wave ratio on the 72 ohm twin-lead or co-ax feeder by means of a s.w.r. bridge, an excellent impedance match may be obtained on this band.

On 21 Mc/s, the aerial works as a slightly extended two-wavelength system or, more properly speaking, two full waves in phase and is capable of good results, especially when using tuned feeders thus avoiding any mis-match loss. On 28 Mc/s it consists of two one-and-a-half wavelength in-line aerials fed in phase. Here again, results are better with a tuned feeder to minimize losses although it works satisfactorily with the 34 ft. stub and 72 ohm feeder.

When using tuned feeders, it is recommended that a suitable aerial tuning unit be employed as shown in Fig. 2. The feeder taps should be adjusted experimentally to obtain

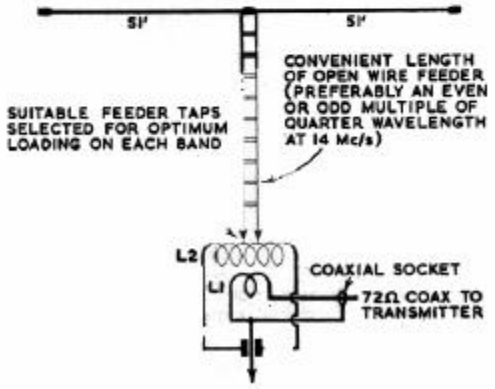

Fig. 2. Multiband aerial with tuned feeders.

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optimum loading on each band using separate plug-in or switched coils. Connection from the a.t.u. to the transmitter should be made with 72 ohm co-ax in which a suitable TVI suppression (low pass) filter may be inserted.

However, as already stated, this does not prevent the aerial loading well on all bands and it is considered that any mismatch loss occasioned by this fact is made up for by the versatility and proved excellent radiating properties.

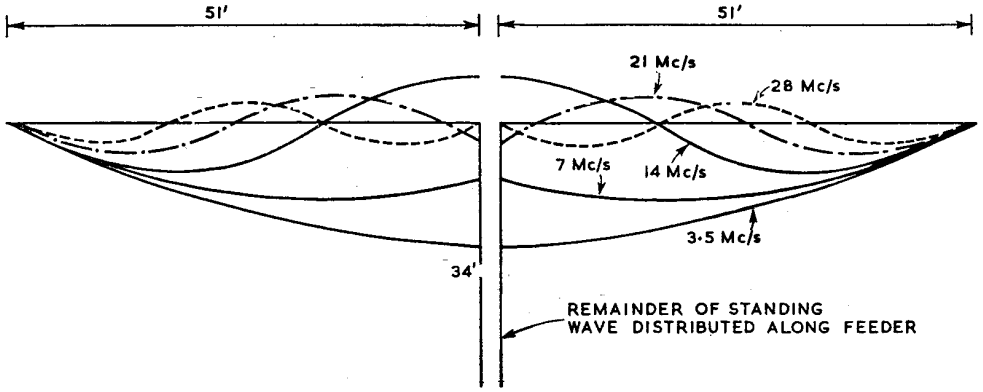

Fig. 3. Standing wave distribution at various frequencies (wave amplitudes not to scale).

Fig. 3 shows, diagrammatically, the standing wave distribution on the flat-top for the various bands except 1·8 Mc/s where the aerial plus feeder functions as a capacity top loaded semi-vertical wire. It will be noted that on all bands except 14 and 28 Mc/s the lower end of the 34 ft. stub will present a reactive impedance to the 72 ohm line or co-ax feeder.

Conclusion

The writer has often described this array on the air to other amateurs and it is known that many have used it with considerable success. Amongst others known to have used it are G2AJF (now VE3EHR), G3ACC, G4OT and the late G2SA and G6LB.