TECHNICAL TOPICS

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HOME-BREW END-FED ANTENNAS FOR HANDHELDS

TT, SEPTEMBER 1990 p31, DREW attention to a South African review of the AEA 'Hot Rod' 144MHz, end-fed, half-wave antenna which plugs into hand-held transceivers in place of the usual short helically-wound 'rubber-duck' antenna. ZS6GM reported a very noticeable improvement in performance, although his review gave no information on the matching section used by AEA to permit end feeding from the transceiver socket (it has been pointed out to me that some CB antennas are end-fed dipoles).

The item has resulted in useful comment from Hans-Joachim Brandt, DJ1ZB, who sent along a copy of a 1985 article he wrote for the German magazine *Funk* describing a home-brew half-wave 144MHz dipole that gave markedly superior results to rubber-duck antennas. He writes:

"In the February 1985 issue of *Funk* I presented a concept for home-brewing a 144MHz end-fed half-wave antenna with an LC matching section in a small plastic box, a telescopic antenna of rather random length (80cm to 133cm) and a flange BNC plug (or similar): **Fig 1**. The trimmers were 7pF air-dielectric made by Tronser. Starting values for the coil are 5 turns, inner diameter 5mm, total length 8mm. The coil may be varied if the setting of capacitor C2 is at an extreme end (when the section is being aligned using a VHF SWR meter). The plastic box is superior to a metal box in two aspects: it is easier to isolate the telescopic antenna; and there is no difference in tuning with the box open or closed.

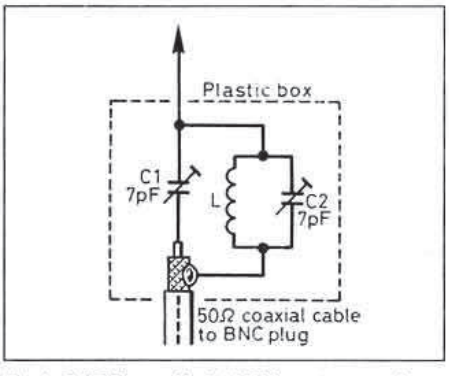

Fig 1. DJ1ZB's end-fed 144MHz antenna using a telescopic rod (80cm to 133cm) with matching network enclosed in plastic box (57mm x 28mm x 28mm). When the box is fitted with a flange-type BNC plug the antenna can be plugged directly into a hand-held transceiver or mounted separately and connected to the transceiver by length of 50Ω low-loss cable.

"Simple comparisons between a rubber duck and this telescopic antenna were conducted from the flat roof of a city building in Munich. With the rubber duck and 2.5W, the Austrian repeaters OE2XSL and OE7XKI could just be opened, but the German repeater DB0XF north of Munich could not be opened. With the telescopic antenna, all three repeaters could be opened easily with the low power option of 0.3W of this hand-held, indicating an improvement of at least (10log 2.5/0.3) equal to 9dB.

"Other comparisons were done as follows: An aluminium plate 20cm by 20cm was placed as a ground-plane on the roof of a car having a sliding opening in the roof, with the test antenna mounted on this. The feeder cable was routed into the interior of the car to the handheld receiver via a variable step attenuator. Either a fixed S-meter reading or the closing of the squelch was used as the input voltage reference. With each antenna, the attenuator was adjusted so that this condition was met. With a telescopic length of 90cm an improvement over the rubber-duck of 7 - 11dB was noted; with a length of 116cm the improvement was 11 to 15dB.

"Another type of matching section for this type of antenna employs a parallel resonant circuit, with a tap on the coil for the 50 ohm input (as often used on HF for voltage-fed antennas - G3VA). Such an antenna is being marketed in Germany by Bensch. This saves the use of a second high-grade trimmer but I would guess that the matching transformation cannot be as accurate as when using two continuously variable trimmers. I am also using this type of matching section for an 'under the roof' fixed vertical antenna for local FM working. In this case two quarter-wave radials are used as a counterpoise (see *Sprat*, Autumn 1981 'QRP via repeaters')."

DJ1ZB also mentions that his matching section arrangement with the two trimmers appears in the latest edition (11th edition) of *Antennenbuch* by K Rothammel, Y21BK, the most popular antenna book in the German language. Y21BK died a few years ago, but his widow hopes to recruit a group of competent antenna specialists to continue to update this most useful book. A copy of the first edition (1961) is still in use at G3VA, the many illustrations and tables overcoming the language barrier!

Rubber-duck antennas can, of course, be replaced by home-made quarter-wave systems without the use of matching networks. J M Osborne, G3HMO, writes: "I recently acquired a dual-band handheld (IC24FT) with the usual rubber-duck antenna. I had decided to use this for mobile operation during my summer holiday but two days before leaving had got only as far as reading the literature on mobile antennas. The shortage of time forced an empirical, but in the event entirely satisfactory, KISS solution.

"I extracted a telescopic antenna from a scrap transistor radio and fixed it to a piece of plastic channelling. An odd length of coaxial cable (about 2m long) with a BNC connector was also secured to the plastic, the inner being connected to the telescopic rod and the outer to a screw through the plastic channelling. The whole was fixed with insulating tape to the integral roof rack (Passat estate) so as to earth the coax outer to the roof rack via the screw. The lead was brought through a rear door to the handheld on a front seat through an SWR/power meter. The telescopic rod length was then adjusted for best compromise SWR on both 70cm and 2m bands (about 1.3:1 SWR on both). This proved to be with about a 54cm extension of the rod (roughly quarter-wave on 2m and 3/4-wave on 70cm). No coils were used for loading or matching and the antenna connected to the handheld via the meter or direct.

"My excuse for bringing this simple system to your attention is that the results were most satisfactory. From South Devon, I worked stations from Dorset to Cornwall (and in France) via a Brittany repeater on 144MHz during a lift, and routinely simplex as well as many other repeaters en route. On 70cm, results were equally good; during my return trip, I raised G0AKN (Twickenham) via the Farnham (UHF) repeater to give my ETA while on a high spot on Salisbury Plain (about 36 miles from the repeater). The handheld was producing about 5 watts on the power meter when running off the cigar lighter 12V supply.

"Once the optimum setting had been ascertained, the segments of the antenna were taped to fix the length. Mechanical performance was (unexpectedly) good. Once the contraption was dislodged by a branch in a Devon lane, but a spare reel of tape quickly restored it. Three months later the system still functions normally."

HF/VHF SCATTER COMMUNICATIONS

WHILE WE NORMALLY THINK OF radio signals being propagated to long distances by being reflected (refracted) from conductive surfaces (ionised layers or ground/sea surfaces), they can also be propagated by the scattering which occurs when radio signals pass through the layer or are reflected from the ground. Scattering normally implies only very weak signals, but since the effect occurs with signals passing *through* ionised layers it is not limited to frequencies below the MUF.

It is worth recalling that one of the pioneers of VHF scatter communications, shortly after the end of the second world war, was the same Dr E C S Megaw (G6MU) who, as noted previously in *TT*, played an important role in the 1940 development of the cavity magnetron, was a former Council member of the Society and several times described his microwave experiments in the *T&R Bulletin [another note for newer members; this was the fore-runner of the* RSGB Bulletin *- Ed]* in the 1930s. In the USA, the prime movers were H G Booker and W E Gordon, whose studies led to a major investigation of scatter propagation on a frequency just below 50MHz in conjunction with the US Bureau of Standards, Collins Radio and a large number of American amateurs. These studies showed that with very high-power transmitters using frequencies well above the MUF, weak signals could be received consistently far beyond the horizon due to incoherent scattering caused by random fluctuations in the refractive index in the troposphere or the lower ionosphere (primarily the E-layer). This work led directly to the development for commercial and military communications of troposcatter (and some ionospheric-scatter) systems, often using enormous 'billboard' antennas and multiple-diversity systems, although relatively low power systems can be used for narrow-band communications in conjunction with high-gain antennas.

A survey of the various forms of scatter