A BEAM IN THE LOFT

WHAT DO YOU RECOMMEND for a beginner's indoor 2-element beam for 50MHz, preferably something that could be fixed in the loft?

IN A NORMAL LOFT you can hardly fit in a 2-element Yagi for 50MHz. The element length is about 3m and the boom length might be about 1.2m, so you'd be lucky to be able to mount the beam anywhere without serious detuning by nearby objects. It is also very important to keep loft-mounted antennas as high as possible, not only to radiate a better signal but also to avoid coupling with the mains wiring (bedroom lights) and the telephone wires. To give you all the bad news at the outset, you can't expect wonderful performance from indoor antennas because they are always relatively low down and screened by the roof. But don't give up – with a little luck and a lot of patience, people have worked the world with simple antennas in the loft. Here are a few ideas, particularly for VHF, taking maximum advantage of the fact that you don't need to bother about the wind and weather.

Why bother with a fixed beam if you could rotate it? Signals can arrive from many directions, and there's no point in having to dismantle your beam in order to aim it where you want. A good first move would be to fix yourself up with a rotating mast in the loft. The mast can be nothing more than a straight length of wood located at the centre of the loft-space. The foot of the mast can be supported on a small board between the ceiling rafters and pivoted on a dowel (**Fig 1**). The top can be steadied by a loose conduit clamp screwed to the ridge-board. To work on the antennas, move the bottom of the mast away to one side and let the top slip out of its bearing. Take extra care when working inside the loft – make sure you have enough light, and lay down some boarding over the whole of area where you will work. Many DIY stores sell chipboard in long, narrow sizes especially for this purpose. You don't need a motorized rotator for the mast; there's nothing wrong with scooting up the loft-ladder and doing it by hand. If you can reach from the hatchway, well and good. If not, rig up something at the bottom of the mast with cross-pieces and lengths of string. You now have a good basis for an indoor VHF antenna farm.

The simplest rotatable antenna suitable for loft mounting is a quad loop (**Fig 2**). Although it is bidirectional, the diamond configuration fits nicely into a loft and a loop has the major advantage of being compact and relatively immune to detuning by nearby objects. All you need is a wooden crosspiece attached to your mast and you can rig up a wire loop on drawing-pins, without any special insulators. Use a small terminal block to connect the coax. Since the feedpoint impedance of the loop will be about 125Ω you will need a transformer to match 50Ω feedline. This can take the form of an electrical quarter-wavelength of 75Ω cable such as 980mm of URM70 or RG59. The theoretical VSWR on your 50Ω feedline would be about 1.1, though you may have to adjust the length of the loop for the lowest VSWR in your particular loft environment.

With any indoor antenna you need to take strong precautions against RF on the feedline.

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Wind the 75Ω cable into a ten-turn choke, about 100mm diameter, as close as possible to the antenna feedpoint. You may also need to use ferrite rings and/or linear-resonator traps further down the feedline. Try to use low-loss cable such as UR67 for the main feedline. You've already sacrificed a lot by mounting the antennas indoors and relatively low down, and if you make yet more compromises you cannot expect any success at all.

To graduate to a 2-element beam, one option would be to add a quad reflector, again

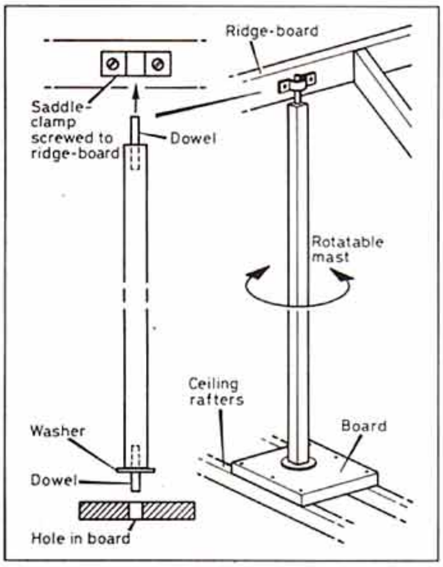

Fig 1: Ideas for a rotatable mast inside the loft.

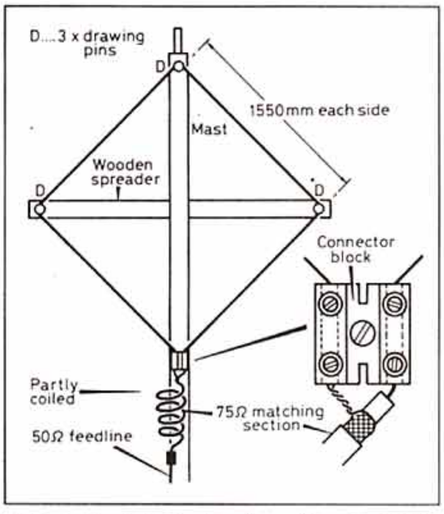

Fig 2: A simple bidirectional quad loop for 50MHz (not to scale). The impedance matching section is 980mm of URM70 or RG59 coax (75Ω). Coil some of the matching section into a choke just below the feedpoint and run the feedline straight downwards as far as possible.

retaining the diamond configuration. Since this involves considerable extra carpentry and the whole antenna must be further down the mast in order to rotate freely, possibly a better shape for a very compact rotatable beam would be the VK2ABQ. This is a quad loop turned on its side and divided by insulators into a driven element and a reflector (**Fig 3**). You will need two spreaders at right-angles, and you may actually be able to get a VK2ABQ higher up in the roof-space than you could manage with the diamond quad. Two lightweight insulators are required, which can be plastic coat buttons, and you will need to support the feedline to prevent it from dragging down on the driven element. The feedpoint impedance of a VK2ABQ is around 50Ω at resonance so you can connect the coax cable directly to the wire element. If the VSWR is too high for your taste, you may have to alter the lengths of the elements slightly. The drawing pin supports can be repositioned if necessary. Use a feedline choke if there is an indication of antenna currents on the transmission line.

This has assumed horizontal polarization. If you're thinking of something vertically polarized, eg for packet, you could try either of the above antennas turned on its side – but forget about rotation. You will need to take the cable horizontally away from the antenna as far as possible before running it down the rafters, and you may also need additional cable chokes to avoid inducing currents on the feeder. Please note that the dimensions given above are all carefully computer-optimized but I haven't been able to try them out – our loft is already too full! To make the antennas work in your situation, you may have to experiment with the wire lengths and perhaps also the matching methods. The delight of loft antennas is that they're so easy to play around with, in all weathers. Just mind where you're putting your feet!

WHICH LOW-LOSS COAX?

I HAVE BEEN RECOMMENDED two types of low-loss coax for 70cm. One is 'H100' and the other is RG213. My local dealer has the RG213 and assures me there is very little, if anything, to choose between them. What is the difference between the two types? Is it worth paying the extra for the H100, and where could I get it?

YOUR DEALER IS BEING 'economical with the truth'. For 10W into a 10m length of cable at 432MHz, RG213 will lose 3W while a lower-loss semi-airspaced cable such as H100 or W103 will lose only 1.5–2W. In terms of transmitted signal strength, the difference is 0.6 – 0.8dB; this doesn't matter if signals are already several dB above the background noise, but it might make all the difference between success and failure with a weak DX station.

The lower loss of H100 cable came from a combination of design features: a large solid-copper inner conductor, the relative absence of lossy dielectric material between the inner and outer conductors (unlike RG213 which uses solid polyethylene). H100 also has an RF-tight outer conductor consisting of solid copper foil covered by a light woven braid. Being originally manufactured for use in un-

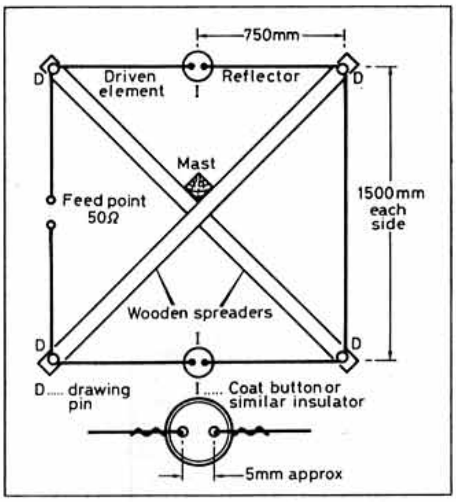

Fig 3: VK2ABQ 2-element beam for 50MHz (top view, not to scale). See text for matching suggestions.

derground cable TV systems, H100 had a thick heavy black polyethylene sheath. Unfortunately this proved its downfall for amateur applications: it was very difficult to fit connectors securely to this slippery sheathing material, which also had a smaller outside diameter than the RG213 cable for which ordinary connectors are designed. Thus water tended to leak in, and would run unobstructed down the inside of the cable and into the shack, promoting the scurrilous rumour that the 'H' in 'H100' meant 'hosepipe'. Also, the inner conductor was not restrained inside the cable and tended to shift, both sideways and lengthways. At the shack end of a long vertical run of cable this could result in the inner pin being pushed out of the plug, while the corresponding pin up at the mast-head became totally disconnected — and I still have a burnt-out connector to prove that! In its heyday, many VHF/UHF DXers came to love H100 for its low loss and low cost, but cursed almost everything else about it.

The good news is that H100 is no longer available in the UK, having been replaced by the much better designed Westflex 103 from the same dealer, W H Westlake (0409-253758, or see *RadCom* adverts). W103 has slightly lower loss even than H100, and is much better designed mechanically. The outer sheath is PVC, and has the same diameter as RG213 (10.3mm – hence the name '103') so N-plugs fit easily and remain watertight, and the inner conductor stays in place. When fitting a standard plug the only special thing you need to do is to file down the diameter of the inner conductor a little, though Westlake can supply a special N-connector if that seems too demanding. Even for high-power VHF/UHF stations which use semi-rigid coax for the main feeder run, I can recommend W103 as a flexible link around the rotator. However, you still need to take care to avoid all the bending force concentrating in one place, because that will tear apart the coil shielding, leaving only the thin braid.

Loss, dB/100m

	144MHz	432MHz
RG213	8.4	15.5
H100	5.5	9.8
W103	4.5	7.5

AUTOTRANSFORMER OR NOT?

AT A RALLY OR a junk sale, how do I tell an autotransformer from one that provides safety isolation from the mains?

LOOK AT THE MAINS TERMINALS. There will always be one set marked something like 0-110-115-120-200-220-230-240, but any transformer that does not have another winding with a completely separate set of terminals marked in a similar way is not 'double-wound' and will not provide safety isolation. Of course, the only way to make absolutely certain is to test the windings with an ohmmeter. If you're going to rallies or junk sales with major purchases in mind, slip a small multimeter in your pocket (a quick-change screwdriver set can be handy too). Nobody selling surplus transformers should object to your asking to test them with an ohmmeter. If they do object, don't buy from them – some rally traders need to be taught a few hard lessons about customer relations, don't they?

LOOSE ENDS

HOW DO I CUT and finish the ends of synthetic-fibre rope?

THE PROFESSIONAL METHOD is to use an electrically-heated knife, to melt the fibres together and stop them fraying. Alternatives for amateurs include the barrel of a soldering iron, or a carefully-applied flame from a cigarette lighter. Although this doesn't always prevent loose strands from escaping, nowadays you don't need to back-splice the loose ends or 'whip' them with twine. A short length of heat-shrink tubing does the job perfectly.

By the way, don't take the photographs of knots in the June column too literally – leave a much longer free end than shown, in case the knot slips a little. When tying-off to a guy stake, always bring the free end back to the stake and secure it with a couple more half-hitches. Remember that knots can reduce the effective strength of a rope by 40-60%, and rate your guys accordingly. I'll have more to say about that in a future column.

VARYING VSWR READINGS

MY VSWR SEEMS TO IMPROVE at low power levels. How can this be?

VSWR IS TOTALLY INDEPENDENT of the RF power involved (at least up to the power levels where your feedline arcs over!). Trust this as a fact, and look for explanations elsewhere. The explanation is actually quite simple, and lies in the detectors used in all VSWR meters to measure the 'forward' and 'reflected' signals.

These are simply diode rectifiers (**Fig 4**), and any normal diode shows a threshold RF voltage below which no detected DC flows. It isn't a sharp threshold; rather the rectified current begins to flow a little with any applied RF voltage and the threshold region is where it increases towards the direct proportionality that you see at higher RF voltages. The threshold voltage is typically about 0.6V for ordinary silicon signal diodes (1N914 etc.) and rather lower (0.4V) for Schottky-barrier diodes (HP5082-2800, BAT85 etc.). So-called 'zero-bias' Schottky diodes are available but are too expensive for ordinary amateur VSWR meters.

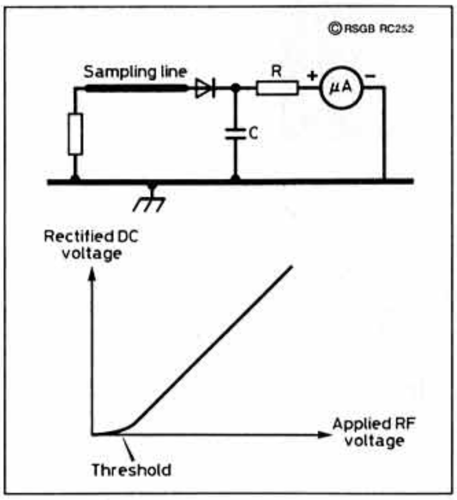

Fig 4: Typical diode detector in a VSWR meter or wattmeter. At low signal levels, particularly when reading reflected power, the diode's threshold voltage makes the meter read low

The RF voltage sampled by the VSWR meter and detected by the 'forward' sensor diode can be as much as 10V, which is well above the threshold; but in a well-matched system the 'reflected' signal could be only a fraction of a volt, so the threshold effect in the diode is very noticeable. Hence the 'reflected' reading may be substantially low and the meter underestimates the VSWR. If you increase the overall RF power level, the 'reflected' signal increases beyond the threshold region so you see a truer VSWR reading.

Unfortunately this goes against all the good advice about only using low power for antenna tests. There's no way around this unless you use a VSWR meter that is specially designed for low-power work, an impedance bridge in conjunction with a low-level detector, or a noise bridge in conjunction with the receiver.

TIP – The Electromail catalogue – all three volumes totalling well over 2000 pages – is on offer for £2.95 (inclusive) until 31 October. This is the same as the professional RS Components catalogue except for the cover pages. Whether or not you choose to buy anything, the catalogue itself represents magnificent value as a data book covering almost everything electronic and a great deal more besides. Order from Electromail, PO Box 33, Corby NN17 9EL (0536 204555).

IF YOU HAVE NEW QUESTIONS, or any comments to add to this month's column, I'd be very pleased to hear from you by mail or by packet (see head of column). But please remember that I can **only** answer questions through this column, so they need to be on topics of **general** interest.