HAM RADIO TODAY

AN ARGUS SPECIALIST PUBLICATION

DECEMBER '83

90p

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HAM RADIO TODAY

VOLUME ONE NO. 12 DECEMBER 1983

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Amateur Radio – "from a dynamo of inventiveness and improvisation to a machine of sterility and tediousness". So said Frank Ogden in his farewell editorial in these very pages two months ago. The new editorial staff say "not so – but complacency could be dangerous". It will not be the off-the-shelf syndrome that will kill our hobby (as Tony Bailey points out in this issue, commercial ready-made amateur radio equipment has been available for a very long time), nor will it be the multiple choice RAE examination. No, the danger is from the lack of awareness that exists between the two groups of radio amateurs – those, usually of long standing, with a 'traditional' point of view, and the newer amateurs, often with a very sharply contrasting viewpoint.

Let us first address ourselves to the problems facing the newly licenced amateur in getting 'on the air' and making contacts. The complexity of knob-twiddling needed to operate the average 2m multimode (let alone an FT726!) is something that G3ZZD would not take lightly. He writes: The commercial ex-public service and home-brew gear available when I was licenced , some 12 years ago, was certainly simpler to operate (and maintain) than many 'black boxes' of today. I am not ashamed to admit that it took me at least a month to make a successful contact using the second-hand home-made gear I first got 'on the air' with (let he or she who is without sin cast the first stone . . .). Without the advice and assistance of the other more experienced enthusiasts, in particular those in the local radio club, I would probably have given up the hobby quite quickly. 'Am I tuned up? Is my SWR OK? Am I on frequency?' – and all this without worrying what to say to the person at the other end, even, in my case, after two years as an SWL. New licencees have always been afraid of calling CQ, Frank.

In those days, though, the amount of newcomers was due to a small but steady trickle. Largely, but not entirely through the interest in radio communication generated by CB, this has become a flood and the time honoured fraternal spirit of amateur radio is in danger of drowning. The danger, we believe, stems not simply from the sheer increase in numbers, but from the resulting tendancy of the new and old radio enthusiasts to form into separate camps. Long standing licenced amateurs can appear rather smug and safe in their technical know-how and societies to a newcomer. Fairly recently, we heard of a group of CBers who visited their local radio society and demanded that an RAE class be run for them. Clearly, one set of attitudes feeds the other – so let us all beware of intolerance and try to see the aspirations and needs of all other amateurs, no matter how different from our own they may be.

As Frank said in his very first editorial, amateur radio is a broad-based hobby and "means different things to different people and those people will themselves be different".

The new editorial staff at HRT will continue to lead the magazine in the direction established by our predecessors – the magazine's identity transcends the editorship. We shall continue to cater for all kinds of interest and all degrees of expertise. We shall continue to publish the best equipment reviews and the best constructional articles. Rather than sweeping changes, we shall be reforming and refining the magazine in its original form – and to this end, the comments we receive from you are invaluable.

One very definite change that we can make, and that we think will be very popular, is the introduction from next month of a free readers' classified ad. service.

And finally, we haven't forgotten that amateur radio is a hobby, and people do it for the enjoyment.

73

Dave Bradshaw
Steve Ireland, G3ZZD

LETTERS

POLITICAL STATEMENTS

Sir, I read with interest Brian Ewing's letter in October's HRT, and noted with disgust the manner in which he tried to trivialise the point I originally made. These days, if one is to believe letters, editorial etc, in radio magazines, much thought is given to protecting the image of amateur radio. It is therefore dangerous for someone who is openly connected with the hobby, or who holds a position in a national body connected with it, to make political statements. These may be taken to represent the opinions of amateurs in general. The nuclear balance is an issue of world-wide importance, and is currently good news value for the media, unlike Mr. Ewing's "free range eggs" or "gay lib", and in a sense the Patron of the RSGB would have been just as unwise to express opinions *against* nuclear weapons. It is not at all relevant whether that agrees with my own supposed political "bias", although I doubt whether Mr. Ewing would have liked it and he would probably have been the first to complain!

To be fair to HRH Prince Philip, by the way, I have made a point of obtaining a copy of his speech. I note that the nuclear issue was only touched upon in passing. Perhaps I have done him an injustice, but not half as much as the media who focussed on that small part of the speech and gave it prominence.

Mr. Ewing accuses me unjustifiably of writing letters only tenuously connected with amateur radio. Not so. The public behaviour of prominent members of the RSGB, and their treatment by the media, is of direct concern to us.

P. Thompson

I take your point Peter, but I do feel that we should all be free to make political statements – although the more reponsible the position we hold in society the more careful we should be of making the point that it is our own personal view that is being stated, and not necessarily that of the organisation or body we represent. . . which neatly brings to the next body of letters. . .

BACKWARD BABOONS – FAIR COMMENT?

Sir, As one of the "backward baboons" who passed the RAE multiple choice examination a few years ago (it was the first such RAE), may I be permitted to grunt a few comments on the astonishing outburst of invective which appeared in your October 1983 issue – written it seems by one "the honourable – I passed the written exam" – Frank Ogden, G4JST.

I agree with Frank that our ranks are now filled with undesirable types who are a disgrace to the much-vaunted "spirit of amateur radio". A few years ago one expected fellow amateurs to be polite, courteous, helpful and tolerant individuals who would do anything to help a fellow amateur. Yet, what do we find but a vociferous group of trumpet-blowing egoists whose arrogance almost takes one's breath away? Yes, Frank, the attitude of some amateurs has indeed changed regardless of their self-proclaimed technical expertise.

I first studied for the RAE thinking that I would be attempting the old-style format which was identical to various school/university exams which I had taken twenty years ago and which by "question-shooting" (and luck!), one could pass by mugging up 30 to 40% of the topics.

Let's face it, the old style exam was also a "piece of cake" and the *percentage* of candidates who passed it was no lower than with the current multi-choice type which can at least cover the entire syllabus. The real difference between the last of the old type RAEs and the new type is that in 1983 there are thousands of new people aware of amateur radio instead of hundreds in, say, 1973. We all have an elitist streak in us but it is no use trying to put back the clock. The days when the "real amateurs" using a hammer and a screwdriver could knock up a one-valve CW rig with massive point-to-point wiring is gone for ever.

I look forward to *Ham Radio Today* moving forward under the guidance of someone "of a higher calibre". Best of luck.

Arthur Tait, GM4LBE
(Hon Sec Lerwick Radion Club, GM3ZET)
PS. If I were not such a "backward baboon", I might have signed the letter with my other "written exam" qualifications: Arthur Tait, BSc., C.Eng., MICE, MIWES, MIPHE, (GM4LBE)

Sir, I just had to write about Frank Ogden's "Comment" in this month's (October) issue. It was outrageous to say the least; for someone in his position to make such a remarks is beyond me.

Peter Stonell (G4TLB) sums up my comments in his letter (*OTT* in the same issue) when he said "You are far too out of touch to be the Editor of this magazine". He is right, and I for one am very glad that Frank Ogden is going.

I cannot understand why the magazine printed it knowing the harm it would do to our hobby and I am sure you will lose many readers over this article.

There is only one "backward baboon" and it must be Frank Ogden.

V H Dann, G4PPD

Sirs, The bigoted and unjustified views of the current state of Amateur Radio expressed in Frank Ogden's editorial (HRT October) cannot pass unchallenged.

In the gospel according to Frank, a radio amateur is a person with considerable technical knowledge who constructs his own equipment, which is fine for Frank because he has and he does. But there are many amateurs making valuable contributions to the hobby whose interests do not lie in construction. These folk may organise and participate in contests, work with Raynet, organise DF hunts or edit their local club's magazine. According to Frank they are not radio amateurs.

With regard to the RAE, I would agree that, as with many examinations, there is room for improvement in the syllabus. Did not the City and Guilds of London Institute recently invite comments and suggestions on the syllabus? (In my view there should be a separate paper devoted to operating practices and procedures.) In HRT it is reported that 2226 people failed the RAE all of whom, together with those that passed but obtained "only" pass grades or "only" one credit are "backward baboons" according to the Editor. How dare Frank use such insulting language about people who may have spent many months studying for an examination in which they may have had little previous knowledge.

Frank mentions interesting conversations he has had with unlicenced pirates. Let us hope that Frank values his licence at least to the extent that these conversations took place face to face and not over the air.

I wish you well in your new publishing venture Frank, but hope that the next Editor of HRT at least believes in the future of the subject about which he writes.

D W Green, G40TV

Sir, Frank Ogden leaves HRT and takes a swipe at amateur radio enthusiasts. Where does he and other biased people get the idea that only "real" hams spend all their time building bits and

pieces and not actually talking on radio? Should a motorist spend his time stripping car engines then rebuilding? Should an angler first dig a pond? I could go on all day.

Some time ago I joined a camera club, but soon left – why? Well, the old-time bods would never accept that the 35mm camera was capable of decent picture-making. In every hobby there are at least two factions: those who know it as it was and the newcomers.

Back to radio; neither I nor any other licenced operator I know would advocate that everyone should transmit rather than build, so why should Frank Ogden rather than any other person complain about the actions of other people who are not interfering in any way with the way in which other stations conduct themselves.

Most of the new boys are ex-CBers – AM, SSB, FM, it makes no odds: most did not tinker with electrical bits before they found their new hobby gave them the knowledge, albeit pretty basic, to meddle and build bits like ATUs and aerials; few would contemplate building a transceiver and why should they if they can afford to buy one? The Russian amateurs build their own equipment because they do not have an alternative and every day their signals can be heard 'splattering' all over the place – is that what Mr Ogden wants? Or, better still, let's all go back to AM – would you believe that when single side-band transmitters first appeared, a lot of the "OMs" decried it?

Mr Ogden makes comments like "2 metres is un-naturally quiet". He obviously lives 50 miles from any reasonably large town or city. Within a 20 mile radius of Manchester there is queue for vacant frequencies. His comment refers to "killing the hobby" – surely this cannot be the case, there are more amateurs than ever, enough, in fact, to warrant the publication of *Ham Radio Today* – which is read by backward baboons.

Mr Ogden, could it be that you and a lot like you thought that you belonged to an exclusive club; the remnants of which can now be heard on 80 metres claiming to have exclusive use of a certain frequency for 30 years until these upstarts appeared? I note that your opinions were not expressed in the first issue – I wonder why?

To the new editor, I say welcome, let's hope that you are not as biassed as your predecessor.

One last question for Mr Ogden: if, as you imply, home construction is virtually dead, why does HRT publish all those projects?

A Whittam, G4TOJ

Sir, As one of Frank Ogden's "backward baboons", I must reply to his final "Comment" in the October edition. In his vitriolic condemnation of new radio amateurs and their commitment to the hobby, he is missing a very important point.

Passing the RAE is only a beginning, it always was so, even in the halycon days of the written examination. Good amateurs are not so because they passed the old-style exam, and, of course, there is a lot wrong with the current one, but that is another subject. Amateurs become "good" by being taught and "shown the ropes" by more experienced operators.

Could the truth be that there is a school within the hobby that has chosen to ignore the new amateurs as ex-CBers and legalised pirates, which has produced the standards of which Frank complains? If so, one is entitled to ask just whose commitment to the hobby is in question?

Speaking personally, I have been most impressed by the example of personal enthusiasm of my tutor at the local college of further education whilst studying for the RAE last year. Also, the help offered and given by local amateurs in setting up a good station and advice on construction problems has been most helpful. Perhaps if those established amateurs actively helped their local "new boys" instead of belly-aching about them, then perhaps Frank would be somewhat more optimistic of the future.

A. David Whiteman, G1ADW

The above is typical of the majority of the many letters we have received on Frank's parting remarks. However, there is another point of view. . . .

Sir, May I say how much I enjoyed *Ham Radio Today* whilst Frank was at the helm. I especially enjoyed, as I'm sure others did, his *Technicalities* column – I personally devoured their contents with relish, even though sometimes the prose was reminiscent of that esoteric publication, *Wireless World*. His (G4JST) equipment reviews were seized upon with salivating interest none of this touching-the-forlock attitude that is all too prevalent in some other mags. Subservient bowing-down to advertising revenue – Ugh! (What's wrong with advertising revenue? – G4NXV)

I hope that the present editorial team at *Ham Radio Today* will continue to publish the above, with just a little of the previous editor's inimitable style. May I just say in ending how much I wholeheartedly agree with Frank's goodbye "Comment" in the October edition.

R J Howes, G40WY

Unless a reader writes to use with a viewpoint that is substantially different from those expressed above, we will not be publishing any further letters on this topic.

FT200 UP–DATE

Sir, Further to Gordon Crowhurst's letter in the October issue.

I have owned an FT200 for about four years and have had no trouble at all with it (I do my own servicing). It makes a change to hear someone else asking for an up-date on this rig instead of the infamous FT101. I would eagerly look forward to such an article.

I have a regular order for your magazine every month and think it is very good value for money.

B. Tranter, G4FBT

Is there anyone out there who is interested in writing an FT200 up-date?
— Ed.

AMTOR UNIT

Sir, On reading the prinout of my article "The AMT-1 reviewed" I see that unfortunately you have made a mistake in the captioning of a 'hard copy' QSO I sent you.

You will see on page 29 of the September issue that you have titled the copy of the QSO 'Typical AMTOR copy'. This is not so. The copy was of a CW QSO which I had with the Russian station, and which was mentioned as 'Figure 2' in the second half of the article which you did not publish.

I have had my attention drawn to this as first of all one *never* sends callsigns twice in AMTOR. There is no need as one gets 100 percent perfect copy, and so there would not be any errors in the text. Secondly, to my knowlege, no Russian station is in possession of AMTOR gear.

Can you please publish a correction of this at your convenience so as to remove any misconceptions about the efficiency of the note.

Ken Michaelson G3RDG

RAYNET

Sir, I have bought your magazine since its first issue (in Dec. 82) and must encourage you to keep up the good work.

However, like everyone, I have a complaint, though you will be pleased to hear it is not about *HRT*.

After reading an article in the April 83 issue of your magazine by Cyril Young (G8KHH) titled *This is Raynet*, I decided to make enquiries about joining, despite not yet being licensed. (I am in that long wait between RAE results and receiving my ticket.) I wrote to the RSGB, who, with their normal efficiency wrote back very quickly sending me an address to write to. I have since written to this address twice and, despite enclosing a stamped addressed envelope each time, have received no reply.

So, "This is Raynet", a service which lives could depend on. Do they want volunteers or not?

S M Richards

ANCIENT PHONETICA

Sir, Reading G4UBV's letter re Phonetics brought to mind my service

days, which began as a PBI(TA) signaller in 1939. The equipment we had was of 1918 (or before), vintage. The phonetic alphabet was Ack-Beer-Charlie-Donald-Edward-Freddie-George-Harry-Ink-Johnny-King-London-Monkey-Nuts-Orange-Pip-Queen-Roger-Sugar-Toc-Uniform-Victor-William-Xray-York-Zebra.

We had radio for the first time in mid 1940 – WS18 sets. The HT batteries were the wrong type and would not fit inside the 18 sets. I was ordered to "make the damn thing fit," so two rows of cells were removed from the end of each battery, laid alongside and tied up with string. Melted candle wax was then poured over the joints. Yes, it was messy, but the operation was successful!

M. Hughes, GW3VFZ

Sir, viz Peter Murray's request for the vintage phonetic alphabet (sic), which one would you like? I have only ever used the standard NATO code as I'm a mere youngster. However, deep down in the junk box, I've an old publication from what I think is the war years.

It is "The New Morse Code Manual. 5th. Edition", and the author is listed as Flying Officer A W Eley, RAFVR. It is priced 1 shilling and three pence and was published as a guide to Service students learning the Morse code. I assume it's from the war years as the inside cover has the sentence, "Photographic reproductions in this Manual are by permission of The Ministry of Information" (when did that Ministry disappear?).

The Manual, as I said, has two phonetic codes and these are shown below:

Military exercises	Inter-Services use
A Ack	**A** Able
B Beer	**B** Baker
C Charlie	**C** Charlie
D Don	**D** Dog
E Edward	**E** Easy
F Freddie	**F** Fox
G George	**G** George
H Harry	**H** How
I Ink	**I** Item
J Johnnie	**J** Jig
K King	**K** King
L London	**L** Love
M Monkey	**M** Mike
N Nuts	**N** Nan
O Orange	**O** Oboe
P Pip	**P** Peter
Q Queen	**Q** Queen
R Robert	**R** Roger
S Sugar	**S** Sugar
T Toc	**T** Tare
U Uncle	**U** Uncle
V Vic	**V** Victor
W William	**W** William
X X-ray	**X** X-ray
Y Yorker	**Y** Yoke
Z Zebra	**Z** Zebra

Anyway there's two codes for you; in the back of the manual it has the printer down as "John Reader, 117, Asfordby Street. Leicester". It'll be fun to see how many other codes turn up.

Basil Spencer, G6VAN

2m PREAMPS

Mr. Ogden, Thank you for your letter regarding the supply of sample 144MHz band preamplifiers for review. We hadn't forgotten you! However, we are in an overload state and obviously our customers need satisfying before we are in a position to supply review samples – not that we're blind to the advantages of editorial review! You'll also appreciate that the last few weeks have included the Dayton Hamvention which has not helped with our production headaches!

We expect to be in a position to supply samples of our SLNA 144s, SLNA 145sb and GFBA 144e preamplifiers by your deadline, although as I mentioned on the telephone the latter item will be a prototype as our next production batch is not due for completion until around 23-24 May. If you'd like to look at a standard production unit after this time there should be no problems.

I remain a little concerned about your test procedures – in fact I can't see any point in your second method! If you are trying to examine the dependence of noise figure on source immitance, then surely it would be better to do it formally by rotating the phase of (say) a 2:1 source vswr around 360° and incrementally recording the noise figure. By using random cables you're likely to see all sorts of strange effects which have no bearing whatsoever on the performance that you're trying to measure and I'd hate to do a proper error analysis! The measurement of very low noise figures is an absolute minefield and you would do well to look very carefully indeed at your error budget. Unfortunately even comparative 'measurements' are subject to quite large random errors. As in so many other aspects of radiofrequency measurement accurate results can't be obtained simply by 'plugging in' to the first piece of noise figure instrumentation that you come across!

I hope also that you won't simply try to measure noise figure – and that when you do you'll also present the results in a meaningful way. We would expect, as a minimum, any competent review to contain the following data: noise figure (corrected for second stage noise contribution), transducer gain, input 1dB compression point, input 2nd and 3rd order intercepts, frequency amplitude response (probably over 0 - 1GHz), input and output return-loss, and supply voltage sensitivity. Obviously the equipment used should also be listed, and as a company we would also wish to know which laboratory was responsible for performing the tests. I'd suggest it would be fruitful to include some discussion on the use of preamplifiers at vhf as it's a subject which is little understood. We'd suggest that a careful perusal of Julian Gannaway's articles in Radcom (November/December 1981 – I think) would also be in order – it's one of the few competent articles on noise figure to appear in the amateur radio press of recent years.

Perhaps we should also comment that we have no fears regarding competent review of our products (although I have nightmares about the self-opinionated quasi-engineering seen in some sections of the amateur radio and hobby electronics press). Modern devices have made it easy for any fool to obtain a low noise figure at vhf – what matters now is attention to good engineering, both in its systems and circuit design senses and any review should take this into account.

Of course, if you're merely sponsoring a noise figure contest we'll respond accordingly!

C.P. Bartram
Managing Director
muTek limited

Please address correspondence to:
Ham Radio Today,
145 Charing Cross Road,
LONDON WC2 0EE

"Did you know that it isn't raining in Cape Town?"

RADIO TODAY

Pilgrim Fathers Celebration

A special-event station in Massachusetts, WA1NPO, will be operating on Thanksgiving Day, Thursday November 24th, from a site overlooking a replica of the Mayflower at Plimoth Plantation, which is a living history museum depicting life as it was in the early days of America's history. On the UK side, a complementary station, GB2PRC will be operated by Plymouth Radio Club from Plymouth Hoe in Devon, from which the original Mayflower sailed in 1620. The operating schedule at WAINPO will be:

20 metres: 14180 or 14255 from 1300 to 1600,
14355 from 1600 to 2000
15 metres: 21260 from 1300 to 1430
21385 from 1730 to 2000. All times GMT.

WAINPO will welcome contacts with any UK station, and an attractive certificate featuring the Mayflower and suitable for framing, is available.

Amateur Radio will link Plymouth Devon and Plymouth Massachusetts on Thanksgiving Day, Thursday November 24th when WAINPO and GB2PRC will be in contact during the day on 14180, 14255 & 14355 between 1300 and 1600, and on 21260 from 1300 to 1430, and 21385 from 1730 to 2000, GMT.

The US Station will be located at Plimoth Plantation. a living museum devoted to re-creating the lifestyle of the early New England settlers, and will be alongside a fullsize replica of the Mayflower; GB2PRC will be on Plymouth Hoe from which the original Mayflower sailed in 1620.

WA1NPO welcomes contacts with any UK station, and an attractive certificate, suitable for framing, is available.

Tuned Feed Without Tears

300 ohm ribbon cable makes a very convenient feeder for multi-band tuned-fed antennas, such as the G5RV dipole. However, moisture, laying along the cable can cause severe variations in the SWR of the antenna. The only way to cambat this problem was to cut slots in the feeder — usually with a pair of scissors — a laborious and often painful process.

Now, W.H. Westlake of Holsworthy, Devon, have managed to track down a slotted ribbon cable from a manufacturer in Sweden — and sore fingers will now be a thing of the past. The Bofa GMP-6 is claimed as "being superior to existing closed gap types and not affected by rain or dampness of the feeder" ...although..."a little more expensive".

Electrical Characteristics are claimed as follows

Impedance	300 ohms
Capacitance	11pF/m

Attenuation at 20C

50 MHz	2.1dB/100m
200 MHZ	4.6dB/100m
500 MHz	8.0dB/100m

The cable is available from W.H. Westlake at West Park, Clawton Holsworthy, Devon EX22 6QN and is priced at 20p per metre (postage 3p a metre).

Stolen Yacht Located by Radio Amateurs

There are many Amateur Radio Maritime networks round the world. One of the oldest, the UK Maritime net, recently received a report from a sailing 'ham' in Alicante that the 40ft ketch 'Frizzelle' had been stolen. Such reports are repeated twice a day at our regular Net times, 0800 and 1800 GMT on 14.303 and the news spreads worldwide via other 'relay' stations in a remarkably short time. About two weeks later an alert member of the network in the Canary Islands spotted what looked like 'Frizzelle' entering Arrecife in Lanzarote. Registration and engine serial numbers were obtained and identified her as the stolen yacht, no doubt on its way to South America, where, incidentally, other sailing 'hams' had already been alerted.

While these nets are basically for the informal exchange of positions, weather and harbour information, some dramatic rescues have been assisted by Amateur Radio, not least Richard Broadhead's remarkable rescue of his fellow competitor, Jacques de Roux sinking in the South Pacific in the Whitbread Round the World Race. Initially alerted by the French boat's 'Panic button' on his satellite-tracking transponder, Newport R.I's Ham relay station alerted the U.K. Maritime net who passed the message to our New Zealand counterpart who was in touch with Richard, the nearest boat (300 miles away) in that remote part. Jacques had just inches of freeboard left when he was taken off.

When can we have out telly back, Dad?

G4DHF Transverter on 160, 80 and 40m.

In the August issue, David Johnson described a unique Transverter — one which enabled you to turn your 2 metre multimode into an HF Transceiver running on 20, 15 and 10 metres. This of course is the opposite way round to most Transverter designs — you normally find them taking 10 metres up to 2 metres.

In the August issue, we described a natty little transverter to effectively turn your 2 metre multimode into an HF transceiver. Due to many requests, here is a modified version which will get you an 160, 80, and 40 metres at considerably lower cost than buying an HF rig! It is useable on SSB, CW and even FM is you want. Modification by Tony Bailey, G3WPO.

This article has raised a lot of interest, together with many requests for a version which covers the lower frequency bands.

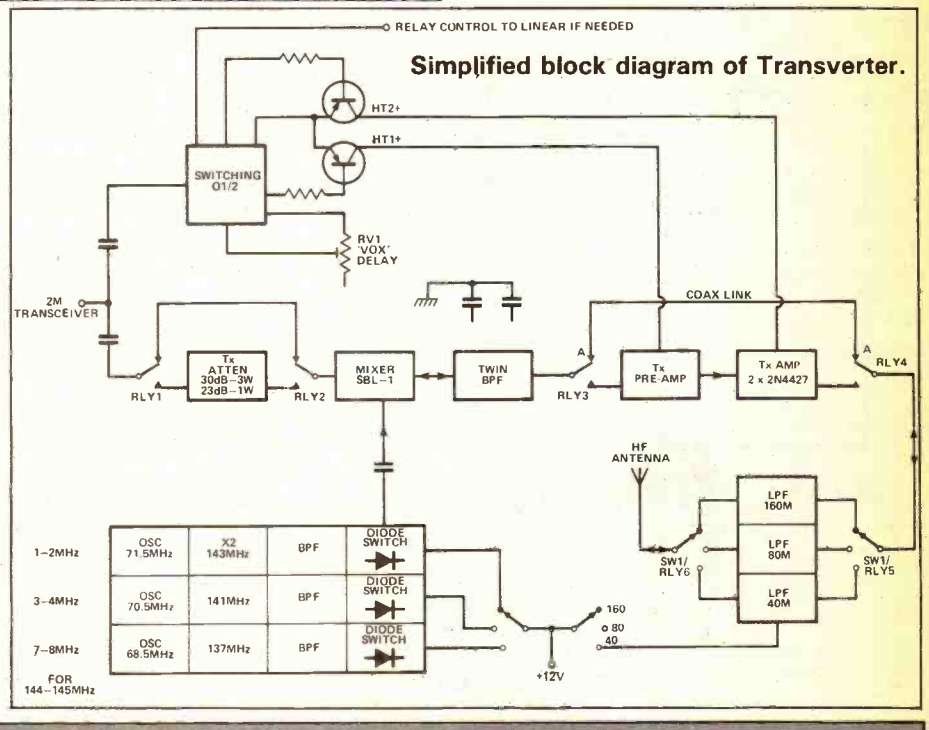
With David's permission, a modified version is to be described which enables coverage of these three lower bands. Reference should be made to the original article in the August issue for the main circuit details although a precis is given here for those without the original. The modified circuit diagram and pcb layouts are reproduced here together with full constructional details for constructors convience.

Circuit

The transverter is designed around an SBL-1 bi-directional mixer, with the VHF signal on 2 metres mixing both transmit and receive with a diode switched local oscillator which produces the required output frequency. It is important that the mixer is driven with the correct power level of around 5mW, and is terminated in a 50 ohm load. Higher powers will cause saturation of the diodes and lots of spurious products.

A pair of relays switch in an attenuator pad, which is selected to reduce the output power of the 2 metre rig down to the MW level on transmit only. In the original a 30dB pad was used for a 3 watt input — it is possible to use almost any input power down to the actual 5mW by selection of the appropriate resistor values in the pad.

The three diode switched oscillators are identical in design, except for some inductor values, and produce stable, low-noise, low harmonic outputs of approx 0.7V RMS correctly terminated at the mixer. For the lower frequency bands in question (taking 80 metres as an example), an input of 144.000MHz requires an injection frequency of 141.000MHz to produce a 3.0MHz output. The 2 metre rig then tunes 144.5 —



Simplified block diagram of Transverter.

145.800 to cover the amateur 80 metre band of 3.500 – 3.800MHz. Similarly, 160m tunes 144.800 – 145.000MHz, and 40 metres 144.000MHz – 144.100MHz.

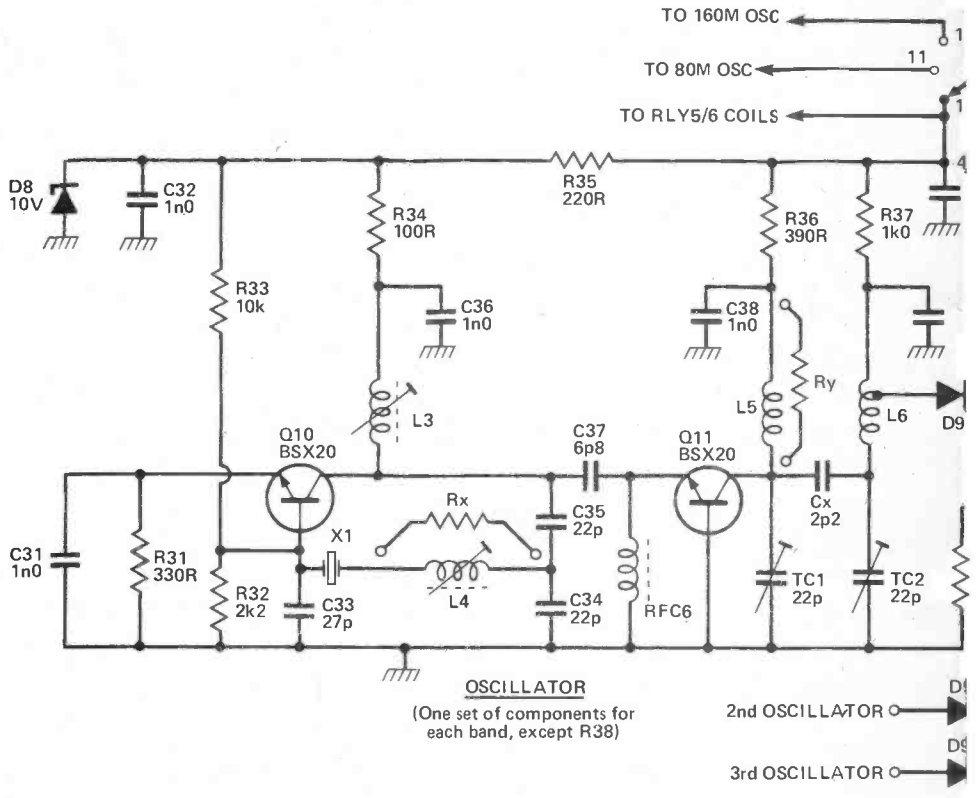
The oscillators use an overtone circuit (Q10) running at half the output frequency (70.5MHz for 80 metres) which is then doubled by Q11 and filtered through L5 and L6. The outputs are diode switched via D9, to give a low imepedance output to the mixer.

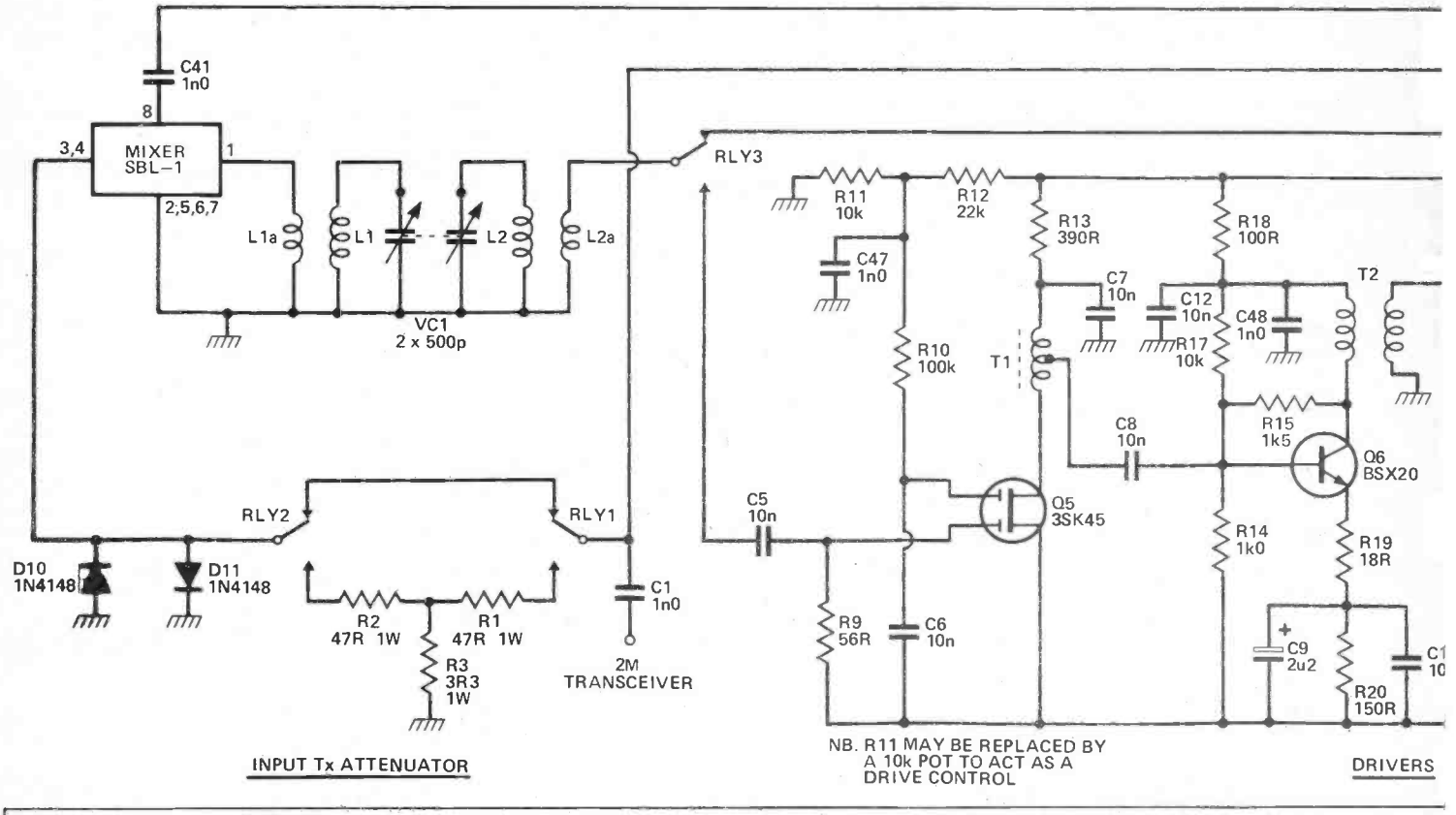
The mixer output will contain sum and difference frequencies, and the correct one is selected by the preselector L1/2 and VC1. In the original, a dual gang 250pF capacitor was used, but a 450/500pF max version is required here to achieve the frequency coverage, together with a higher value for the torodial inductors. The preselector is active in both transmit and receive modes.

On receive, signals are routed through RLY3, and low pass filters, to the mixer, then up-converted to appear at 2 metres. No preamplification is required – the basic sensitivity of this transverter is that of your 2 metre rig less the conversion loss of the mixer (7dB). Thus sensitivities of around 0.3 – 0.4 uV can be expected which are entirely adequate for the LF bands.

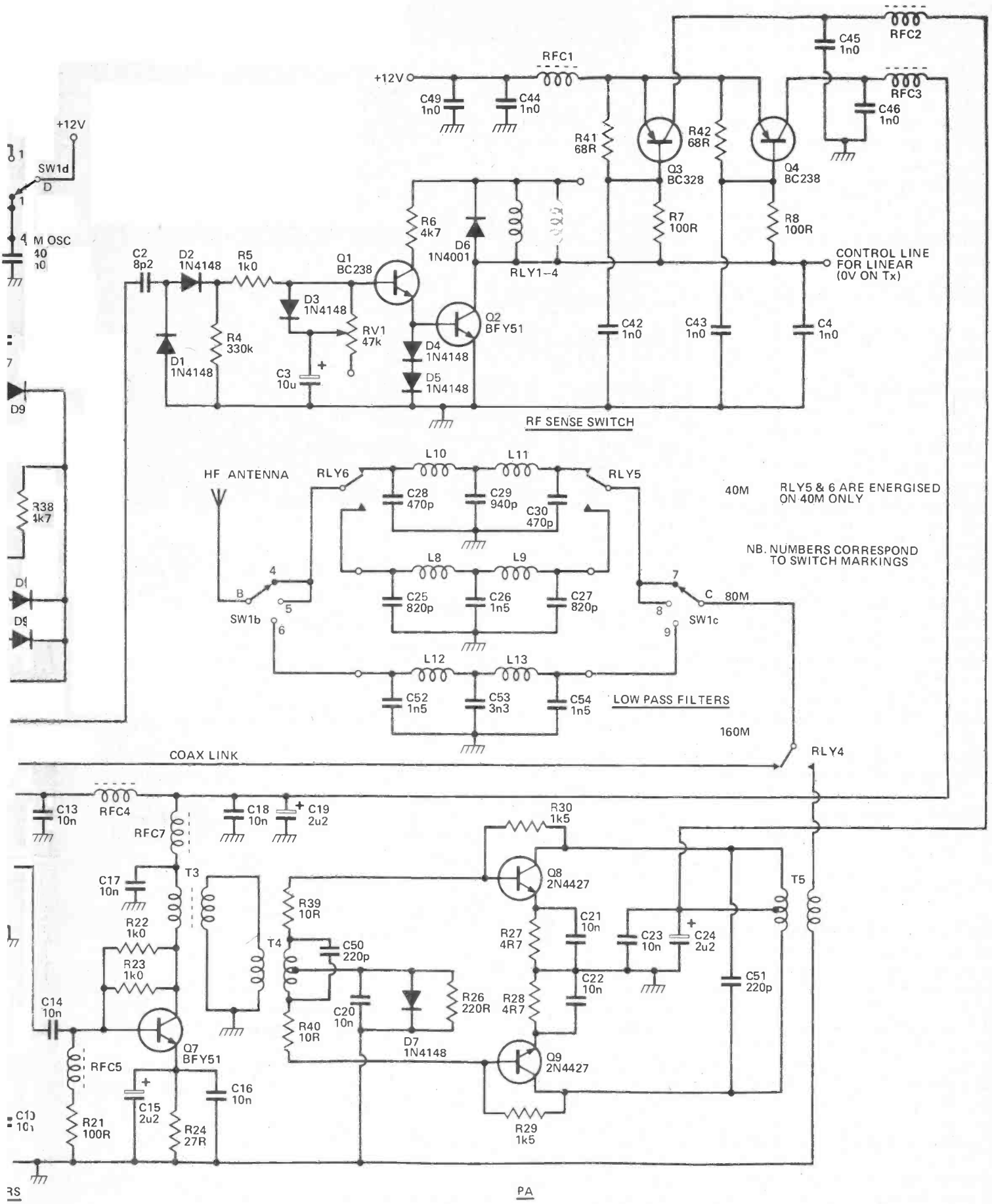
On transmit, signals are amplified up to a level of around 2-3 watts by the broadband amplifier chain Q5,6,7 and Q8/9.

This section of the circuit is much the same as the original, with a few component value changes. The Driver transistor Q7 has been changed from a 2N3553 to a BFY51, and the value of the compensation capacitors C50,51 increased.





Complete circuit diagram of Transverter.



Output Filters

It is necessary to have suitable low-pass filters on the output of the PA to reduce harmonic output. Here lies the only slight problem in the conversion from the three higher frequency bands.

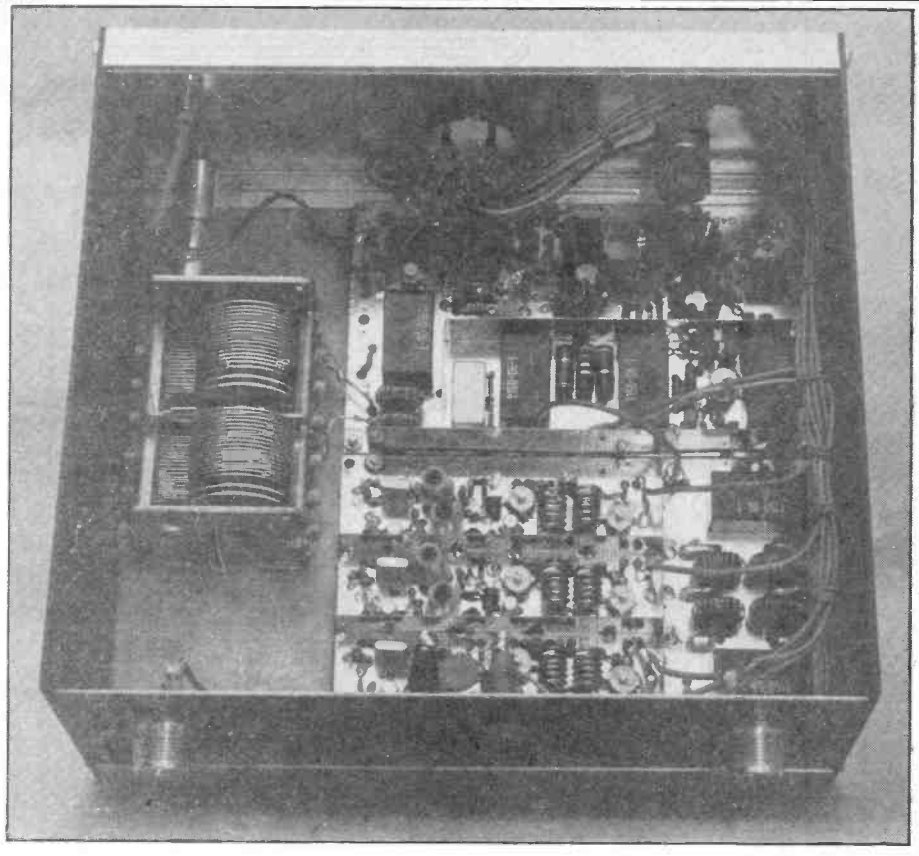
The original circuit needed only two low-pass filters to cover the three bands, as it is possible to use the same 30MHz cut-off filter for both 21 and 28MHz.

One 160, 80 and 40 metres, three filters are needed, one for each band, but space for only two is provided on the PCB. To avoid changing the PCB layout, the extra filter has been accomodated on the three-way switch used for band-changing, with suitable connections to bypass the relays when required. The PCB filters are used for 80 and 40 metres (switched by RLY5/6) and the 160 metre filter is wired on the switch.

In order to avoid having to use a number of connections to the 2-metre rig, RF-sensed switching is used to get from receive to transmit. A small amount of transmit power is fed to the detector circuit Q1, and used to switch the relays over via Q2. Adjustable hang time is provided by RV1 to avoid relay chatter on SSB. If preferred, it is possible to hard wire a connection from the PTT line on the microphone, or a special output if one is provided on the rig, direct to the base of Q1, via a 27k resistor, to provide 'hard' switching. If the PTT line is used, most rigs have this going to ground when activated, so a simple inverter would be required to give a positive voltage for the base of Q1.

Construction

The transverter is built on two double sided PCB's — one carried the three local oscillators and low pass filters, the other the remainder of the circuits. In the original design, the two boards were mounted on top of each other with a screen in-between, and the preselector tuning capacitor mounted on the side of the screen. If desired, the units can be mounted more conventionally in a case as shown in the photograph. If this is done, it is essential that a screen is made of to fit between the two boards so that the oscillator circuits cannot "see" the other board.



Procede with the construction as follows:

1. Start construction by inserting 1mm PCB connection pins at the points denoted in the layout drawings.
2. Next, taking the main PCB, assemble the components located between RLY4 and RLY1, starting at the top edge of the board and working down as far as Q4 and the 1n capacitors. It is important that the bodies of vertically mounted components are in the positions shown on the drawings. Keep all leads as short as possible. Transistors should sit in the PCB with their undersides about 4-5mm above the PCB surface. Be careful that the orientation of polarised capacitors is as shown — tantalum capacitors do not take kindly to being reversed!

Q2 has its emitter lead soldered directly to the top foil, and R40/41 are mounted under the PCB directly across the pads (they are *not* shown on the overlay).

3. Continue working around the board until all components except the transformers are inserted. Pin 1 of the SBL-1 is at the end of the package which has the letter "M" of the "MCL...." legend stamped on it.

Transformers

The block toroids used in the design are surplus types, and come with windings already on them. These must be removed — they cannot be used as they are!

When winding the transformers, one turn is defined as a wire passed through one hole and out of the other. Therefore for those transformers with primaries and secondaries, one pair of wires will emerge from one end of the core, and another pair from the other end. The tapped windings are probably easiest made using two lengths of wire twisted together with the join as the tap. The space within the cores is fairly limited so keep the windings neat and tight, but avoid stripping the insulation in the process.

The centre tapped 8 turn winding requires two lengths of wire each of 15cm, four turns about 15cm, and two turns 9cm of wire to wind. The 5 turn chokes use 10cm of wire. Make sure you know which end is which after winding (mark a P on the primary end).

Note that Q5 has one lead soldered to the top foil, and the same is soldered to the underside as well.

Q7/8/9 should each be mounted so that the underside of the case is no more than 3mm above the PCB to avoid instability. Each of these transistors must have a heatsink (TO5 push on type). L1 & L2 are made as per the drawings. Once wound and in place, and after correct operation has been vertified, the cores are held fast using epoxy adhesive with a seperation between the cores of 5mm. The 53 turn windings need 82cm of wire each, and the 3 turn windings 9cm.

A tinplate screen should be fitted last (or use double sided PCB), 15mm high to isolate the input and output signals from each other. Don't forget to solder in the coax link (use miniature cable) between the two points both marked A on the layout (or you won't receive any signals).

Oscillator/LPF PCB

The oscillator section is identical to the HF version (except for crystal frequencies), and the low pass filters are similar in layout but with changed values. Also, the cores used for the latter are a different grade for the lower frequencies.

1. The PCB is not difficult to assemble — start by inserting the connection pins. Then commence with the top oscillator section; all the three sections are identical, with the exception of the 160M oscillator where L3 has a lower inductance (blue coil — the others are white) and the two air spaced inductors (L5/6) have one turn less than the others. Again keep leads as short as possible and orientate leads of vertical resistors in the positions shown.

It is important that when winding L5 and L6 (two for each oscillator) the winding direction must be correct if the tap is to end in the right place. Each soil is wound by taking a 15cm (14cm for 160m) length of 19swg (1.25mm) enamelled copper wire, and winding around a 7/32" drill so that the winding progresss anticlockwise from left to right. If you start the winding by having the wire under the drill, and then bring it up over the back towards you, continuing to wind to the right, you will get it right.

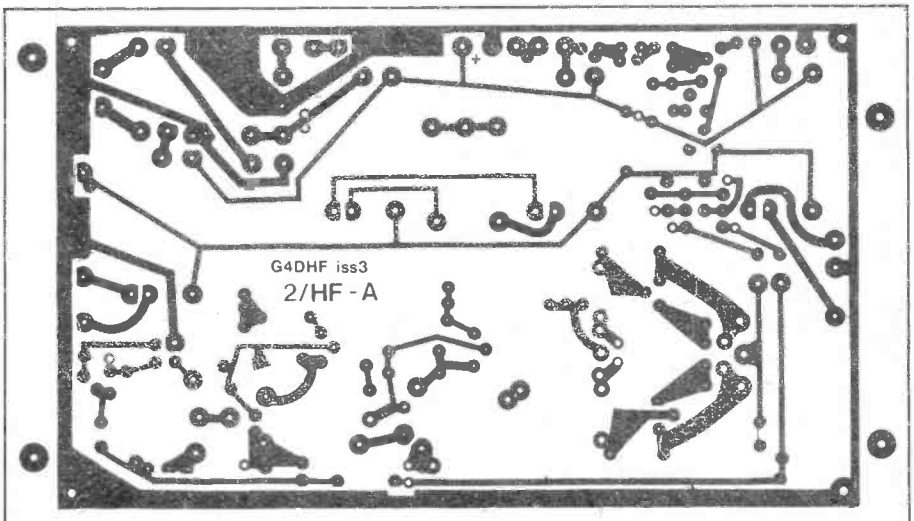
Four of the six-turn coils, and two five-turn coils are required if you are running all three bands, with the insulation scraped off at 1.25 turns from the end nearest the 1nF decoupling capacitors. Tin the exposed copper before putting the coil into place with its underside about 2mm above the PCB. Then solder the diode into place, with the banded (yellow or black) end against the PCB (it won't work if they are the wrong way round). The other end can then be clipped off just at the point where it meets the tap made earlier, and then soldered.

Low Pass Filters

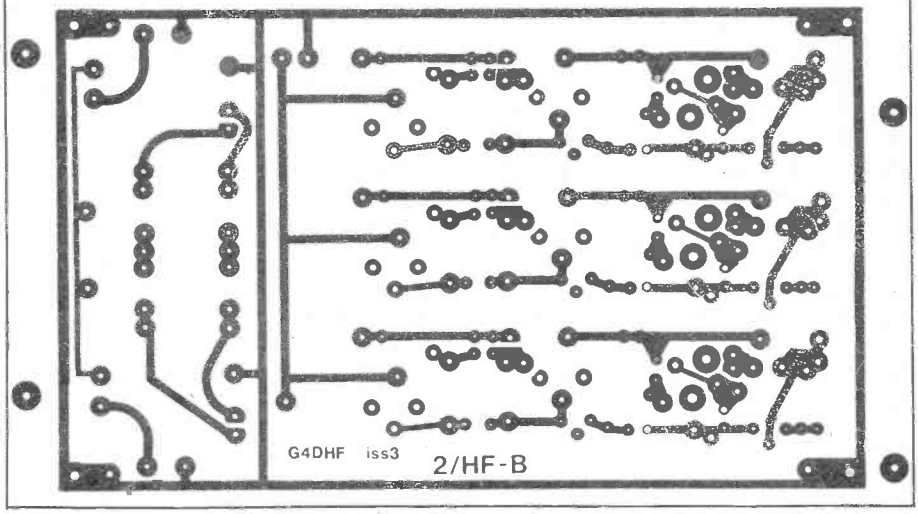
These are wound on T50-2 (red) toroids)rather than T50-6). L8 and 9 (80 metres) need 36cm of wire for winding, and L10 and 11 (40 metres) need 26cm. The 160 metre inductors (L12 & L13) are wired directly across the bandswitch (see diagram). They require 50cm of wire each for winding. Note that C29 comprises two capacitors wired in parallel to get the correct value. Polystyrene capacitors are used in this version of the transverter.

Screens are required between the oscillator sections as shown, again 15mm high.

If the transverter is constructed as the original, an 18swg aluminium screening plate cut to the same size as the PCB's is required between them — this is sandwiched between the two PCB's as shown in the drawings. In the prototype VC1 was also mounted on this screen, using an additional sidepiece which had been bent at right angels to the main screen — whether this can be done depends on the type of capacitor used. If the leads from the capacitor to the preselector



Foil Patterns — Please note they are 75% full-size.



connections are more than a few centimetres long, then a screen will need to be fitted so that the two leads cannot "see" each other, and spoil the preselector rejection.

The leads feeding +12V to each oscillator need to be run in screened audio cable, and short lengths of miniatur coaxial cable should be used for the inter-PCB wiring.

Alignment

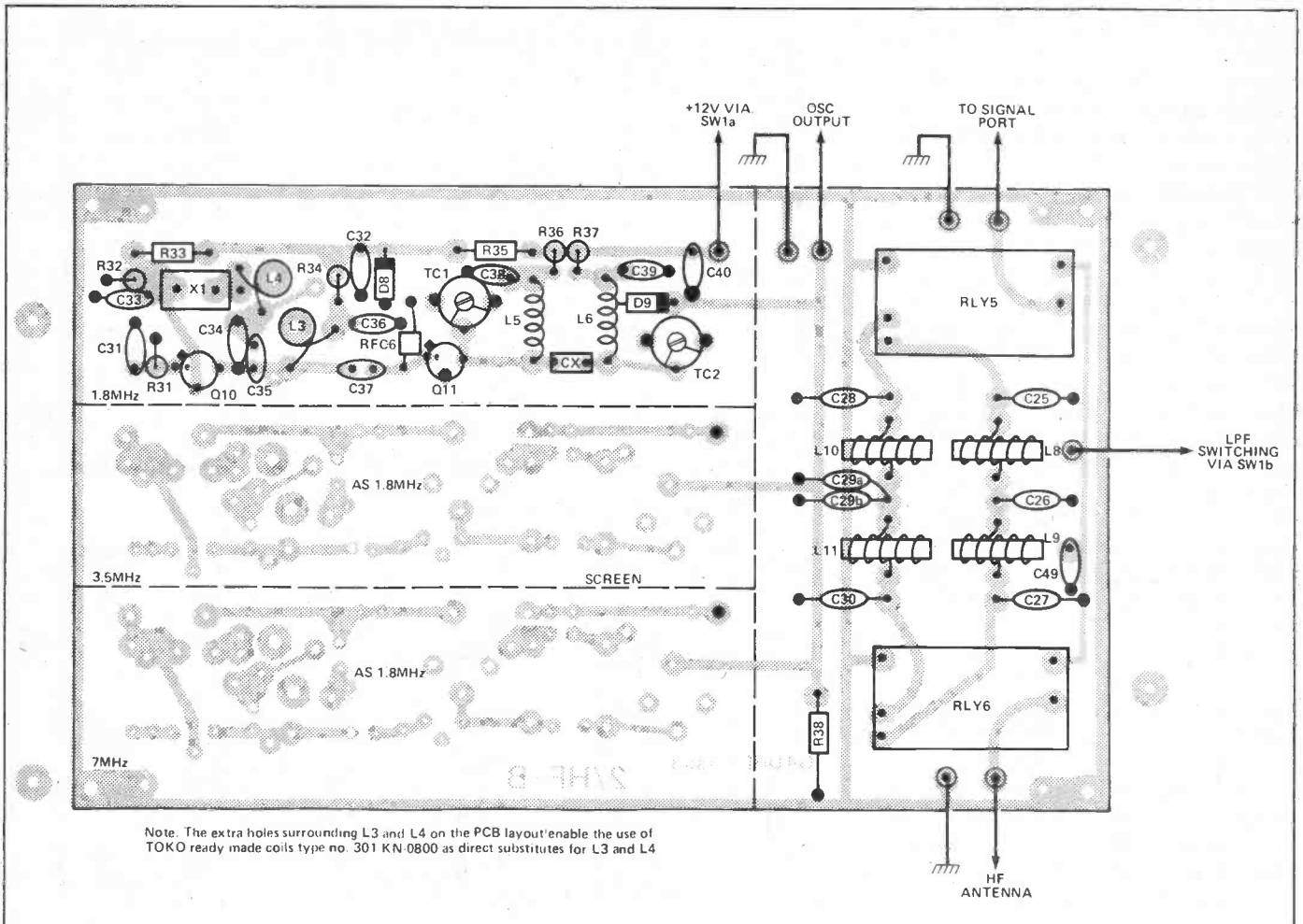
There are two ways of aligning the unit. The first, if you haven't any test equipment, is purely to tune up for best received signal. The better way is to firstly adjust L3 until oscillation occurs (monitor the current taken by the +12V line for a sudden peak), then back the core off slightly so that the oscillator fires reliably when switched on and off. With a diode probe connected ro the oscillator output, adjust TC1 and TC2 for maximum reading (the trimmers will be near minimum

COMPONENT LISTING

RESISTORS

All resistors 0.25W 5% carbon film unless noted otherwise.

R1,2	47R 1 watt
R3	3R3 1 watt
R4	330k
R5,14,22,23,37*	1k
R6,38	4k7
R7,8,18,21,34*	100R
R9	56R
R10	100K
R11,17,33	10K
R12	22K
R13,36*	390R
R15,29,30	1K5
R16	not used
R19	18R
R20	150R
R24	27R
R25	27R
R26,35*	220R
R27,28	4R7
R31*	330R
R32*	2k2
R39,40	10R
R41,42	68R



Note. The extra holes surrounding L3 and L4 on the PCB layout enable the use of TOKO ready made coils type no. 301 KN-0800 as direct substitutes for L3 and L4

capacity). L4 controls the oscillator frequency and should be adjusted for the correct output frequency.

If the oscillators tend to self-oscillate, resistors Rx and Ry should be added, using the highest values which will cure the problem — too low a value will reduce the drive to the PA chain.

On transmit, the only adjustment needed is to the delay of the RF sensing circuit, and VR1 should be set to give a comfortable delay when talking normally.

Power Inputs

A note of caution which equally applies to the 20/15/10m version. Most rigs have a means of reducing power down to 1 watt or so, and this is the preferred sort of level for driving the attenuator. However, not all rigs reduce power in all modes when this option is selected. The FT-480R is a case in point, and does not reduce power on SSB. This will result in considerable overdriving of the balanced mixer, and consequential splattering.

So, check that your output power DOES reduce when you select low power. Also rigs give more output power than their specifications would indicate, so an

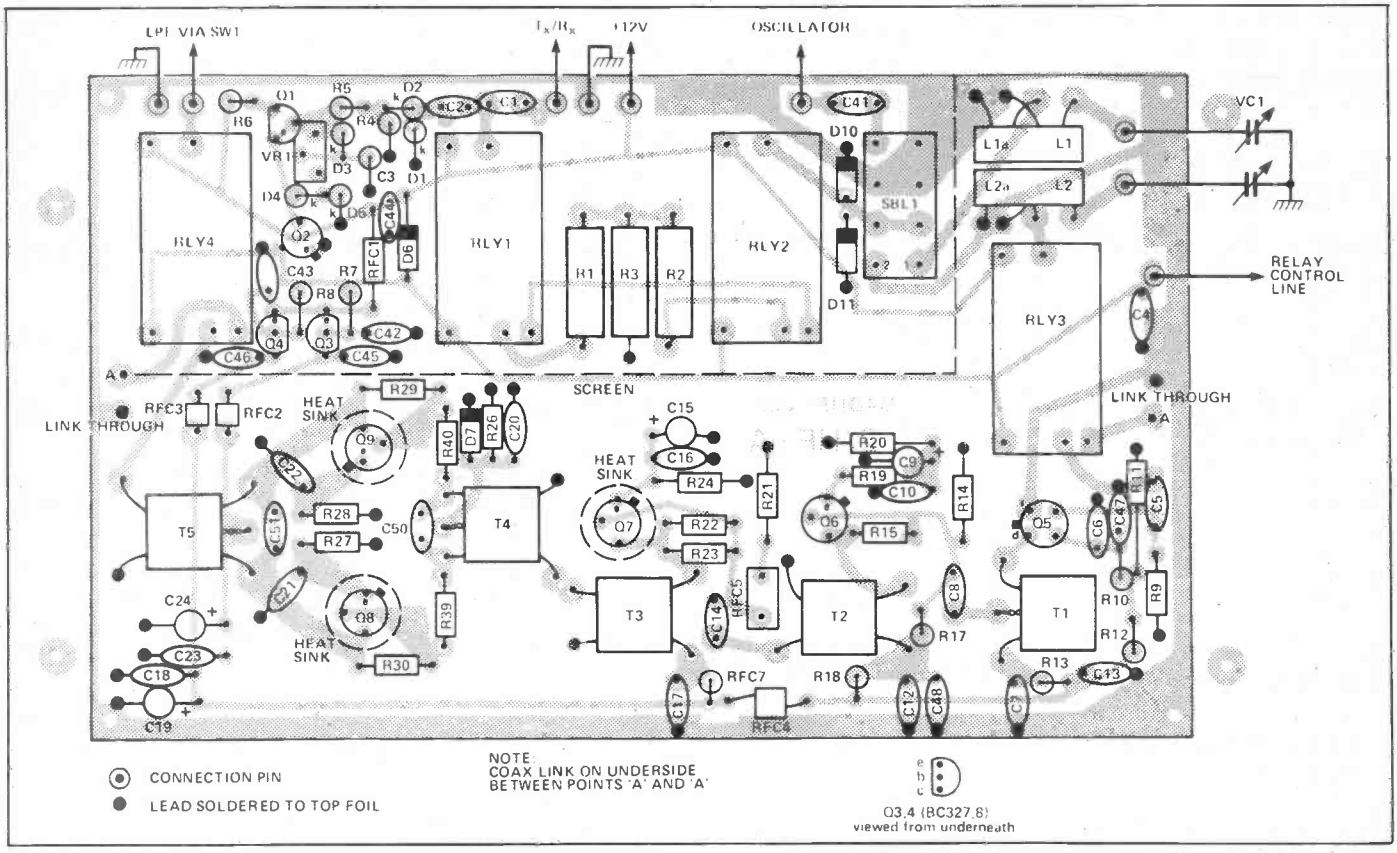
Rx	22k (mounted underside across L4)
Ry	10k or lower (see text-mounted underside L5, see text)
VR1	47 or 100k preset, vertical mounting

CAPACITORS

C1,4,31*,32*,36*,38*,39-*,40*, 41-49	1n0 ceramic
C2	8p2
C3	10u/16v min tant
C5,6,7,8,10,12,13,14,16,-17,18,20,21,22,23	10n ceramic
C9,15,19,24	2.2u/16v min tant
C25,27	820p polystyrene
C26,52,54	1n5 polystyrene
C28,30	470p polystyrene in parallel
C33*	27p ceramic
C34*,35*	22p ceramic
C37*	6p8
C50,51	220p ceramic
C52	3n3 polystyrene
Cx*	2p2 ceramic
TC1*,2*	2 to 22 or 36pF trimmers
VC1	dual 450/500pF max air spaced

CHOKES

RFC1	4u7 or 10uH axial type
RFC2,3,4,-6*,7	5 turns 0.25mm of Cu wire through ferrite bead.
RFC5	10uH TOKO type 7BA or BS



attenuator of slightly greater value than theoretically required is a good idea. The values given on the circuit diagram are for an actual drive level of 2-3 watts.

If you find it necessary to use 10 watts to drive the transverter, then the PCB will not accomodate the high wattage resistors needed to attenuate this to the correct level. In this case, take two lengths of coaxial cable from the input and output of the attenuator on the PCB, and amount the resistors externally in the case. Information on attentuator values and computer program for determining them can be found in Radio Communication, November 1982, page 1046.

Drive Control

A drive control to vary the output power can be added by changing R11 to a 10k potentiometer mounted on the front panel. Note that this in no way compensates for too much drive reaching the mixer. The connections to the PCB should be made using screened audio cable.

KITS

A complete kit of parts for this project is obtainable from WPO Communications for £74.00 including three crystals (£61 ex crystals). The kit includes all components for three bands, wire, switch, air-spaced, capacitor, connectors, but no screens or case. Individual crystals are £5 each.

The HF version (20/15/10) is still available at £72.75 complete with three crystals or £61 without. Individual crystals are £5 each for 20 & 15 metres, and £3.71 for 10M. All prices include VAT & p&p.

SEMICONDUCTORS

Q1	BC238 or 239
Q2,7	BFY51
Q3,4	BC237 or 238
Q5	3SK34 or 3SK51
Q6,10*,11*	BSX20 or 2N2369A
Q8,9	2N4427
D1,2,3,4,-5,7,9*,10,11	1N4148
D6	1N4001
D8*	10V 400mW Zener

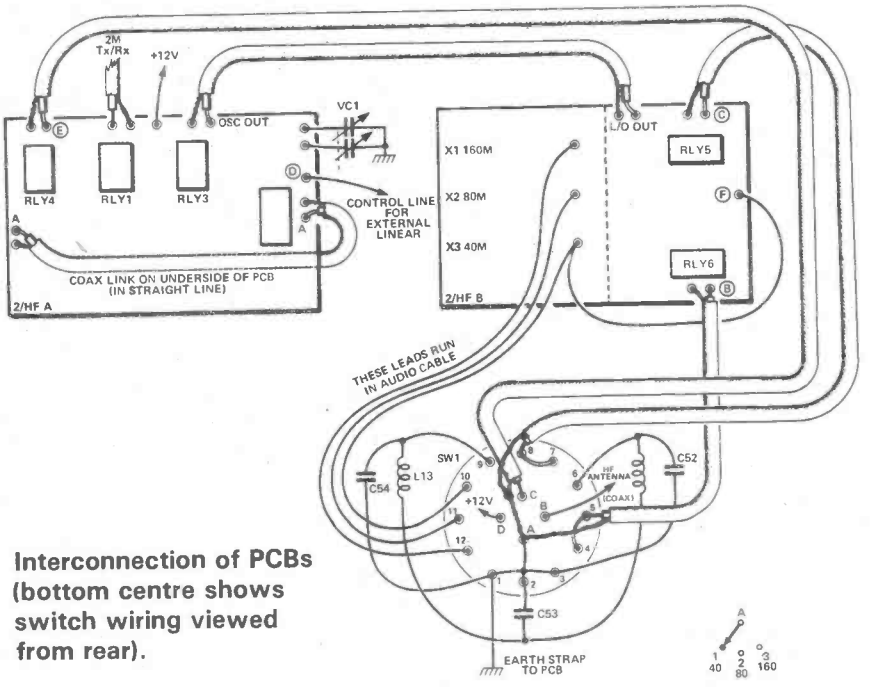
MISCELLANEOUS

Crystals:	160m (tuning 144.8 — 145.0MHz) 71.500MHz 80m (tuning 144.5 — 144.8MHz) 70.500 MHz 40M (tuning 144.0 — 144.1MHz) 68.500MHz

All HC18/U types, series resonance 5th overtone.

RLY1-6	type 1150-060-1 ex J Birkett
T1-T5	wound on 10mm square block ferrite toroids (see text)

8 off Amidon T50-2 toroids; SBL1 balanced mixer; Switch 3 pole 4 way rotary; PCB connection pins; miniature coaxial cable (50 ohm).



Interconnection of PCBs (bottom centre shows switch wiring viewed from rear).

COIL DATA

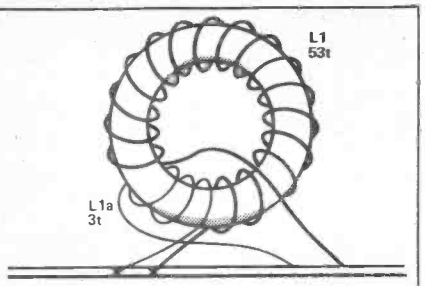
L1,2
53 turns of 0.25mm dia en Cu wire wound on T50-2 core.

L1a, L2a
Wound on the main toroid next to L1/2. Three turns 0.25mm wire.

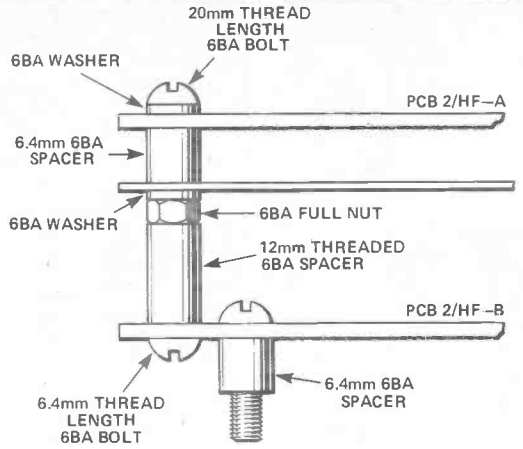
L3,4
For 160mm L3 & L4 are TOKO type 301-KN-0600 (Ambit part No 35-10603)
For 80/40m, L3 & L4 are 301-KN-0800. (Ambit 35-10803)

L5,6 (80 and 40 metres)
Six turns of 18swg (1.25mm) en Cu wire wound on a)16" drill. Self supporting approx 1cm long. Diode tap on L6 1.25 turns from earthy end.

L5,6 (160M)
Five turns as above.



WINDING LAYOUT FOR L1 & 2



Original method of mounting Transverter PCBs.

T1 to T5
All wound using 1cm square ferrite toroid with 0.25mm wire. The wire is passed through the holes in the manner of a conventional transformer.

T1	Eight turns centre tapped
T2	Four turn primary, two turn secondary
T3	As T2
T4	Four turn primary, four turn centre tapped secondary
T5	Four turn primary centre tapped, four turn secon-
L8,9	20 turns 0.56mm en Cu wire on T50-2 core.
L10,11	14 turns en Cu wire on T50-2 core.
L12,12	26 turns 0.56mm en Cu wire om T50-2 core.

(L12 & L13 are mounted directly across the band-s w i t c h .)

Additional Attenuator Pad Details

For 100mW O/P, R1, 2 = 33R, R3 = 22R, all 0.25 watt.
For 300mW o/p rig, R1, 2 = 39R, R3 = 10R, all 0.5 watt.

Note that all the components marked with a * are for just *thv* oscillator, and you will need to order three of each of these (you will also need to make three each of L5 and L6).

GB2BP on Magnus

The idea of an amateur radio station operating from the biggest steel structure in the North Sea may seem incongruous. Luckily, 'the powers that be' agreed to my request – what better time could be chosen for such a station than the date of the inauguration of the Magnus Field by the Prime Minister on 14th September 1983?

Stan Crabtree, GM3OXC, samples Amateur Radio on Magnus – "the biggest steel structure in the North Sea".

The writer had twice previously operated a similar station in the Forties Oilfield in 1975 and 1978. A 150 foot long wire, suspended from the helideck and weighted with a piece of metal, had performed very well on all bands. However, this time it was not so easy. Whereas Forties had started up with communications on the marine bands, Magnus was implemented using sophisticated data communications circuits and multi-channel links to the shore by tropospheric scatter. Probably the lowest frequency in general use on Magnus was the marine VHF band around 160 MHz. On top of this the accommodation was pressurised and there was no question of simply drilling a hole through a bulkhead for an HF antenna entry. Eventually, it was decided to use a spare, fibreglass marine communcations whip aerial about 30 feet long and protruding out from the structure about half way up. This was mounted on the south west side of the platform and good for UK contacts – the prinicpal aim of the operation.

A few accessories were sent ahead but the station transceiver, a Yaesu FT101B was hand-carried by the writer on Tuesday 13th September, the day before the inauguration ceremony. GM4FFG was fortunately the resident radio operator on the platform at the time and had everything generally ready by the time I arrived. Frank spent some time using the rig on CW when the writer decided to relax in the cinema!

Due to the lack of other available space and the position of the antenna feed point, it had been agreed that the operating position should be in a corner of the radio room. This was situated on the 7th level of the 9 storeyed structure.

Licensing as a special event station had been effectively processed by RSGB head quarters and the requested call, GB2BP, was issued for the third time. On previous occasions of operation from a platform we had gone after DX. As well as the vertical top fed wire, a 14AVQ had been mounted on a high spot and resulted in many long distance QSO's on 21MHz and 28MHz. However, this time, we realised we were limited because of the positioning of the antenna. Our idea was to work as many UK stations as possible on CW and SSB and treat any DX contacts as a bonus. Again, because of antenna restrictions, top band (1.8MHz) would not be used.

On the air

The station was fired up on 40 metres just after noon on the 13th September and the first contact, after a brief CQ call, was with GM3TCW, Lanarkshire with a promising 5 and 9 both ways. After just three more contacts disaster struck. The Yaesu was muted on all but the 'TUNE' position and would not transmit on CW or phone. We reasoned it to be a relay but the main send/receive unit appeared OK. With the help of Bob, one of the platform technicians, we turned the set on its side and removed the holding screws of the bottom. As the last came out, the set burst into life! It seemed a group of leads had somehow become jammed between the bottom panel and the case and had temporarily short circuited. Anyway, we were back in business and the rig performed marvellously for the rest of the sortie.

A marvellous run then developed on 14MHz CW of 87 stations in 2 hours. Unfortunately, this was the only time DX was easily available. The unusual call sign – at least on the higher bands – undoubtedly had something to do with our popularity. We didn't try to explain our locations in much detail as it seemed to prove confusing! Good conditions on 20 metres did not reappear during the rest of the operation and only two QSOs were made on 15 metres. After a spell on 40 again in the late afternoon we returned to 20 metres and packed in when the band folded at 2130 hours.

On Wednesday a few CW QSOs were achieved on 80 metres around 0630 hours local time but after half an hour we switched to 40 metres and remained there until 1330 on both phone and CW. Moving to 20 metres we managed a few JAs and Europeans. We remained on this band except for a brief look at 40m around 1530 hours until 'twenty' folded at 2200. Nothing very exotic in the way of contacts, VEs (Canadian stations) and the odd W. It was strange to hear Gs at good strength and without their characteristic 'watery' signals on this band. But, of course, we were over 500 miles from the centre of the UK.

Our bread-and-butter band was

undoubtedly 40 metres. Using CW and SSB over 600 contacts were logged on this band. Best DX was ZL4AW on CW at 0730 hours local time. From Saturday afternoon the Scandinavian activity contest (SAC) meant CW was out but we were happy – if a little breathless – to continue piling up sideband contacts.

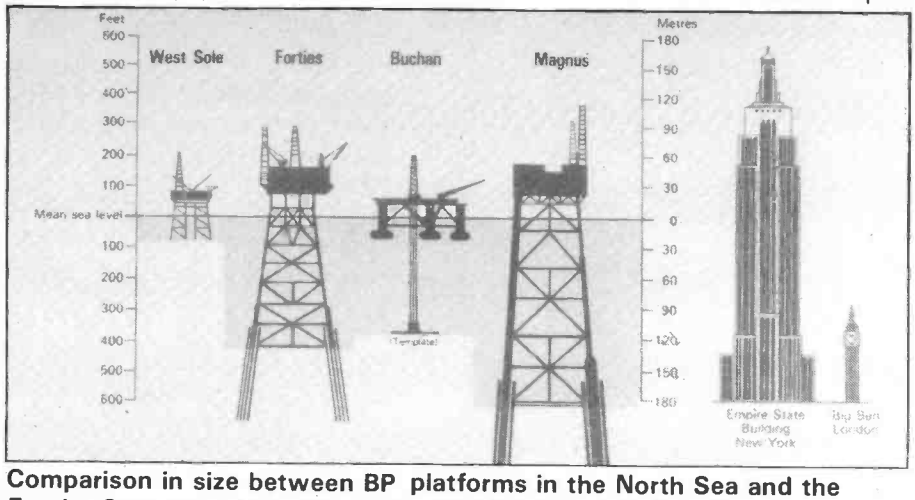
After the inauguration was shown on the TV news, stations worked appeared more readily to understand our location – on the most northerly of the fixed platforms, some 125 miles north east of the Shetland Isles. Congratulations and good wishes were offered to all on the platform and some sympathies for enduring bad weather conditions. Everyone seems to think that it is permanently blowing a gale at this latitude and yet I have known it as calm as the most sheltered, inland lake. One woman operator contacted thought we were lonely, but I had to tell her there were over 1000 men of various trades putting the finishing touches to the platform.

DJs (Germany) and LAs (Norway) were coming in with the same strength of signals as the Gs. The standard of operating was extremely courteous – almost too much so at times. I had expected 'tail-enders' but where more than one station called, the unsuccessful challengers seemed to quickly give up and disappear which meant more 'CQ FORTY METRES' calls from me. Contacts were necessarily short. After a name and location had been passed, it was on to the next one but, where good strong signals were available, we gave out details of the station and equipment.

Magnus production platform (right) with accommodation vessel Polycastle, 110 miles NE of Shetland. Photograph courtesy of BP.

About half way through the event more trouble came to light. We seemed to be breaking through onto the platform's 'Order Wire' communication system. An ATU was in circuit, providing an apparently perfect match to the aerial on all bands, and the FT101B seemed to be working correctly. What could be causing the iterference? GM4BDC, another platform technician, suggested removing the ATU from the circuit – a further length of coaxial cable had been added between the aerial and the ATU output in order for an easy connection between the two. Could something be amiss here? The ATU was removed from the circuit and the FT101B fed straight to the antenna via a low pass filter. Result? No more interference!

The SWR must have been quite high after this change but it seemed to have little effect on our signal – GM4BDC, Trevor, further distinguished himself by contacting an old friend VP2VD, in the British Virgin Islands, on 20 metres whilst was viewing the platform video!



Comparison in size between BP platforms in the North Sea and the Empire State Building, New York, and Big Ben, London. Drawing courtesy of BP.

Signing Off

The final contact was with GM4SID, Aberdeen, on 80 metres at 0700 hours, Monday 19th September. Just over two hours later, we were in a Chinook helicopter on the way home.

In all 850 contacts had been established with 58 countries. Over 400 QSOs were with United Kingdom stations; 282 in England and 97 in Scotland. Best DX was probably 4K1GDW, the russian base on South Shetland Islands in Antarctica. Upon arrival at the office on Tuesday morning, 41 QSL's were waiting and return cards were dispatched by mail the same day. Amongst the cards were some interesting short wave listener reports and these were also acknowledged. All stations will eventually receive a QSL but cards received will be acknowledged immediately.

It is said that the BP Magnus platform is the last of the large-scale platforms to be embedded in the depths of the North Sea – thus it could well be that GB2BP will not be heard again. However, over 850 people in various parts of the world will have a special souvenir card to commemorate this occasion.

NEWCOMERS FORUM

By Tony Bailey, G3WPO

In the short time since Frank G4JST's parting 'COMMENT' in the October issue, and the deadline for this piece, I have received a number of letters mostly agreeing with his sentiments, but of course others which violently disagree. *(Readers may see that we received rather more of the latter if they care to turn to the letters page — Editor.)*

Whilst not agreeing entirely with some of his statements, I think that the underlying theme is undeniably true. The transition from the Radio Amateur who built his own gear entirely, and could place his finger on a fault within a very short length of time, to the black box appliance operator has taken place in a fairly short time. It is a consequence of modern techniques which allow mass production of consumer items, and a vastly increased amateur population providing a market which would not have been worth catering for some twenty years ago.

Coupled with an examination which is undeniably much easier to pass than the old RAE written answer technique, amateur radio has taken off to an extent which no-one could have forecast. The migration from CB is a recent phenomena which has added more acceleration to the process.

The Future

In another twenty years, some further innovations which we cannot predict will not doubt have taken place and more controversy will be raging. In the meantime, if the majority are getting what they want out of the hobby then it cannot be a bad thing. Given time, even the black box operators will find an awakening interest in the technical side of the hobby. I suspect that even in 'the good old days' there were those who bought what equipment was available rather than built it, or who scrounged second-hand home-brew gear from

others. There was commercial equipment about 50 years ago you know, as witnessed by the advert shown!

Emergencies

I added this piece because of overhearing one of those QSOs which you may at sometime be involved in yourself, and that is receiving a request from someone in a foreign country for drugs or medical assistance. You must bear in mind that not all countries are as well equipped for such events as we are, and that the local amateur in, say, a South American country may be the only quick contact with the outside world.

The correct procedure if you ever get into such a situation is NOT to get involved directly yourself. Any such requests must be passed to the Police or to the Home Office, and left at that.

The other possibility is a request for assistance by a ship or aircraft in distress — most of their equipment can be used on the amateur bands and it may be the only way of getting a quick reply. Again, don't get involved yourself directly but IMMEDIATELY contact the Coastguard (see telephone book) or Police (999). It is obviously advisable to stay in contact with the station involved in case more details are required. Your licence permits you to pass third party traffic on behalf of the user services in an emergency, and although direct contact with a non-amateur station is theoretically not allowed, the possible saving of life far outweighs this in practice.

If you do have an interest in actually being able to help during more widespread emergencies, and would like training, then you should consider joining Raynet, the amateur emergency service. This is co-ordinated by the RSGB, from whom further details may be obtained.

Working DX

When you have made your first few contacts, most likely with fairly unexotic European stations or the States, you will want to try something a bit more exciting and be looking for a DX contact. The term 'DX' is relative — on the microwave bands you may well be only a county or two away, and on 2 metres it depends where you are, even the North or South of this country may come in the category.

If you just want to get a few nice call-signs in the log, then the best way is to take a look around during one of the major contests. We are now in the contest season, and the one thing that contests do, other than annoy a lot of people, it to bring out a large number of DX stations which would be quite rare at other times of the year. They are therefore a good hunting ground for DX, although you will be limited to a very basic QSO only.

The first thing to do when trying to work anyone during a contest, assuming you aren't actually entering it, is to find out the required contest exchange. You won't be very popular if you don't know it, and it is very unlikely that anyone will stop to tell you what it is. The best place to get this information is from Radio Communication, which regularly publishes all the details for most contests. Other than the signal report, there will be some additional information, such as your zone, a contact serial number, county or what have you.

A Few Hints

Funnily enough, the best way of finding DX is to let it find you. Most DX stations seem to avoid pile-ups during contests especially if the event is one where country multipliers are involved. You stand a much better chance of working something if you find a quiet spot (if you can) and then calling CQ, working whatever comes along. By sheer virtue of statistics, the more stations you work the better your chance of something rare. Hopefully, someone may be looking for G as a multiplier, and you may be the lucky station.

If you are going to call a DX station, there are a number of vital points to bear in mind. During a phone contest, a really good operator will be working something like 300 stations an hour, and maybe 150 + on CW. That is one every 12 seconds on phone. It isn't uncommon to hear people calling this station, and by the time they have finished their call, the DX station has worked 2 other people.

Quite honestly, if you come across a big pile-up, it is better to leave well alone — the competition at this stage is very high, and the pile-up is likely to be out of control. It goes out of control quite simply. Everyone wants to be the last person calling when the DX calls QRZ? It doesn't matter if the DX station came back to someone he could hear and is working him, because 95% of the rest of the calling stations let go of the PTT switch, hear other stations still calling, and so give another call. This then carries on for a while until everyone realises there is a QSO in progress. Also, by the time this sort of pile up has been generated, half the stations don't know who they are calling anyway ('here's a pile up — lets join in'), resulting in utter chaos.

When you do hear a rare station calling CQ, net accurately, and give one clear call to him, with your call-sign once only using recognised phonetics. If he doesn't come back, by all means try but only when he asks for calls. Either you will be heard, or you won't.

If the miracle occurs, give the contest exchange once only, and confirm receipt of his details by saying 'QSL'. Don't tag on your name, the weather or half a dozen repeats of your call and his. If he isn't sure of your call he will ask for it. You may also find that he comes back to you with only your suffix, in which case you should repeat your call clearly once. QSL information can be asked for if needed, or if he is already working stations, he will give it periodically. Speed is the essence of the operation, combined with a good sense of timing.

One other point — headphones are a much better bet during contests, not the loudspeaker. Your concentration, and ability to ignore the inevitable QRM will increase dramatically with 'phones.

The secrets of the Smith chart

PART TWO.

by Alec Jones, GM8HGD

This month Alec Jones, GM8HGD, shows us how to design our own antenna systems.

Recently the aerial for the Grampian VHF repeater GB3GN was changed from a folded dipole to a Cushcraft 4D colinear. This uses four gamma-matched half-wave dipoles and a phasing harness to produce the colinear aerial. We shall be considering one element only. I took the physical dimensions from one element of the Cushcraft, and the calculation shows the electrical characteristics at a frequency of 145.5MHz.

On the Smith Chart, the total distance round the outside of the chart is half a wavelength. This is an electrical length, the result of the velocity of phase propagation (or more simply, the wave velocity) in the medium through which the energy passes. With air insulation in coaxial cables and open-wire transmission lines, the velocity of propagation can be taken as 300 000 km/sec. Hence =v/f. For dielectrics other than air, the velocity of propagation is lower, and hence the wavelength for a given frequency is lower. The factor by which the velocity is reduced is given in the tables of information for the cables. It is the square root of the dialectric constant of the medium.

We are going to use the method of calculating the gamma match given in the ARRL Antenna Book, 1974 edition, pages 119 and 120. There are several stages of calculation before the Smith Chart is used.

Firstly, we need to calculate the step-up ratio of the impedance due to the coupling between the dipole and the gamma match. **Fig. 9** shows the details. This impedance step-up is a function of the diameters of the elements and the spacing between them.

$$r = 1 + \left(\frac{\log (2S/d_1)}{\log (2S/d_2)} \right)^2$$

where d_1 is the diameter of the dipole, d_2 is the diameter of the gamma match, and S is the spacing between them. In our example we take the values: $d_1 = 1.905$, $d_2 = 0.95$, and $S = 3.57$ (all centimetres). This gives a value for r of **2.66**.

Next we calculate the characteristic impedance of the ''transmission line'' formed by the gamma match and the dipole element considered as two parallel conductors. Use the formula:

$$Z_0 = 276 \log \left(\frac{2S}{\sqrt{d_1 . d_2}} \right)$$

where the symbols have the same meaning as previous equation. Hence $Z_0 = 200$

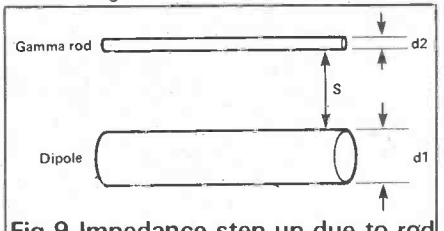


Fig.9 Impedance step-up due to rod diameter and spacing.

The lengths of the gamma rod, 17cm from dipole centre to shorting point, corresponds to a wavelength of 0.008245γ. We can express this in electrical degrees, where 1γ = 360°, and this calculates to 29°41′ (=θ).

With a gamma match, the dipole element is being driven off-centre, and hence has an increased impedance over the centre-fed dipole. The impedance at the centre of the half-wave dipole, with 3% shortening, can be taken for calculation purposes as 25−j25 ohms (Z_1). Feeding this off-centre gives the new impedance $Z_2 = Z_1/\cos^2\theta$. This calculates to 33.123−j33.123Ω. Hence the antenna impedance seen at the shortening strip end of the gamma match will be $Z_3 = r \times Z_2$, so Z_3 calculates to 88.114−j 88.114.

All these calculations to date have been done on my pocket calculator. We now have to move the impedance down the transmission line of the gamma match to reach the feedpoint where the 50 ohm cable is attached. This is where we need the Smith Chart and its peripheral scales. The ''transmission line'' has a characteristic impedance of 200 ohms, as calculated above, so we normalise our impedances for use on the Smith Chart to 200 ohms. Whence the impedance at the shorting strip becomes 0.44−j 0.44.

Plot this point on the chart as point A. We now travel down the gamma match rod towards the generator by a distance of 0.08245γ. On a single piece of paper, it is not possible to rotate the inner scales relative to the outer. Use a straight edge to go from the centre 1.0 point to the outer scales, passing through point A (**Fig. 10A**). This cuts the wavelengths towards generator scale at 0.42. We need to travel an extra 0.08245 λ. Draw a line from this point on the outer scale to the centre. Using compasses, draw an arc centred at 1.0 from point A to cut this new line at point B (=0.35+j0.005), **Fig. 10B**. We are now at the feedpoint of the gamma match and have the value of the impedance of the aerial due to the aerial alone.

In parallel with this is an induc-

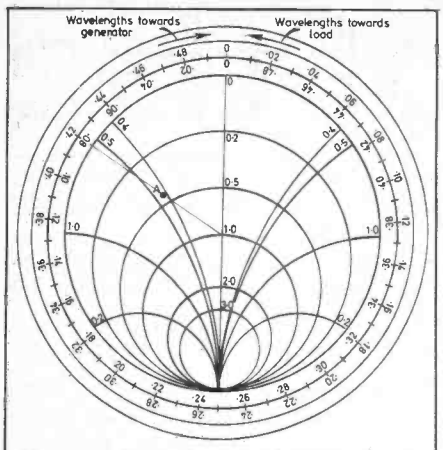


Fig. 10A Plot the start point.

tive reactance caused by the short circuit termination on the gamma "transmission line". This can be calculated as: $X_p = j.\ tan\theta$, or $B_p = -j/tan\theta$

Alternatively, we can use the Smith Chart to find the value. Using the outer scale, wavelengths towards generator, the impedance due to a short circuit *at* that short circuit is 0 + j0. Travel towards the generator down a transmission line a distance 0.08245γ, put in the line from the centre to this point C, and you will see the reactive impedance is 0.57 ohms. We know θ is 29°41', and tan θ is approximately 0.57 ohms (**Fig. 10C**).

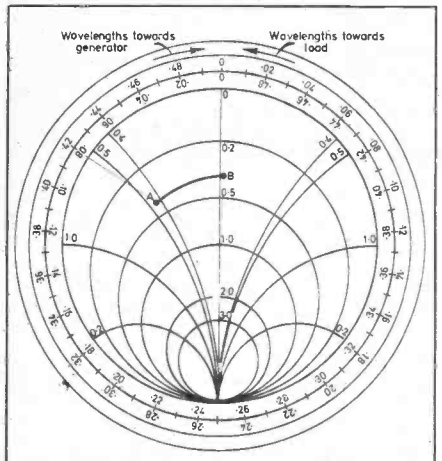


Fig. 10B Rotate through 0.08245 wavelength.

These two impedances are in parallel, so they have to be added as admittances. In the previous example of a matching network I used an overlay system, as recommended by Phillip Smith. Here is a new trick to convert impedances and admittances.

Draw a straight line through point B as a diameter. Use compasses to draw an arc centred on 1.0 through B to cut the diameter on the far side of 1.0. This is point D (2.85 – j0.005), **Fig. 10D**. Check it using a calculator and the formulae $G = R/(R^2 + X^2)$; $B = X/(R^2 + X^2)$. You will find that point D is the normalised admittance equivalent to the impedance of point B. What a way to ease the design of matching networks given earlier! Similarly convert point C to point C'. The susceptance equivalent to a reactance of 0.57 is – 1.75.

To show the composite effect of the admittance due to the aerial at the feedpoint and the susceptance due to the short circuit, we now have to travel

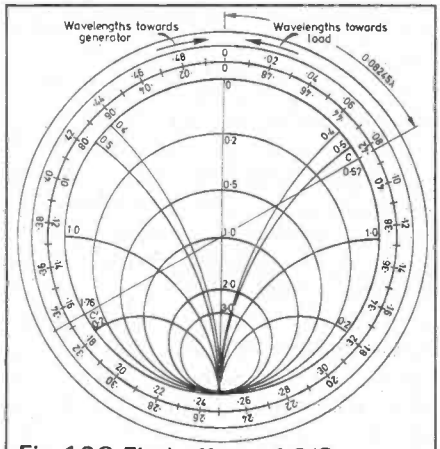


Fig. 10C Find effect of S/C.

anticlockwise on the circle of constant conductance from point D a distance of 1.75 mho to point E. This is effectively adding the two values D and C'. Anticlockwise because C' is a negative value. this value E is 2.85 – j1.76, and is the input admittance of the complete aerial at the feedpoint. **(Fig. 10E)**

We invert again using straight edge and compasses as before and get the equivalent input impedance at point F (0.254 + j0.157). **Fig. 10F**. This value is normalised to

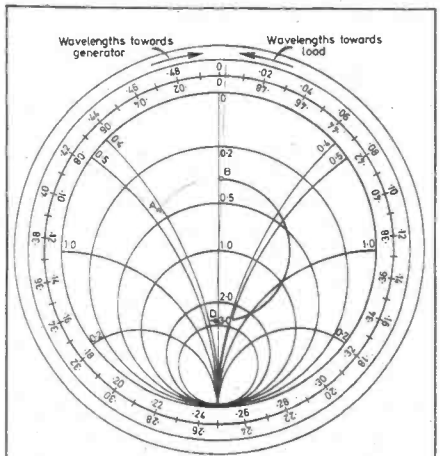


Fig. 10D Convert to admittance.

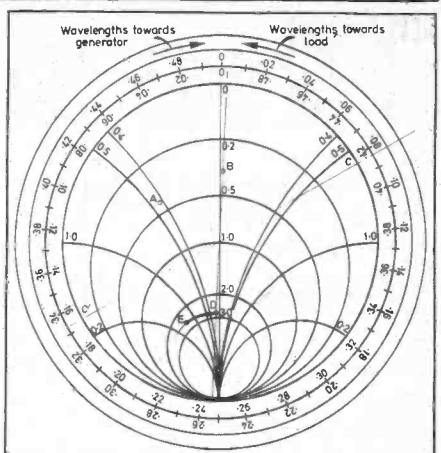


Fig. 10E Add the admittances.

200 ohms, so in real terms this is 50.8 + j031.36 ohms. Hence the aerial has an input impedance of 50.8 ohms and requires a series capacitor of reactance 31.36 ohms to tune it correctly.

The Smith Chart can be used for waveguide calculations, transmission and standing wave losses, lumped values such as those of striplines, and negative impedances as well as the comparatively simple analyses I have shown here. This article is merely an invitation for you to get your feet wet, and maybe you will be able now to follow other articles on the Smith Chart. It is a really

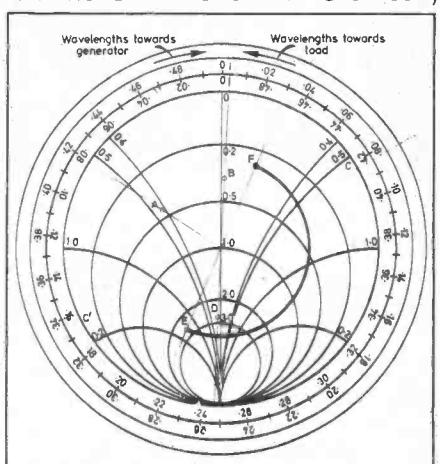


Fig. 10F Convert back to impedances.

powerful tool to aid circuit design.

For those of you who want to translate the numbers above into a practical design of a gamma match 2m dipole, here are the details.

The main element is a 1m length of ¾in diameter aluminium tubing. This is available from DIY suppliers as wardrobe railing. Where I bought it, it costs £4.65 for a 4m length. The gamma match is made from a 6in length of old TV aerial rod, one end being crimped

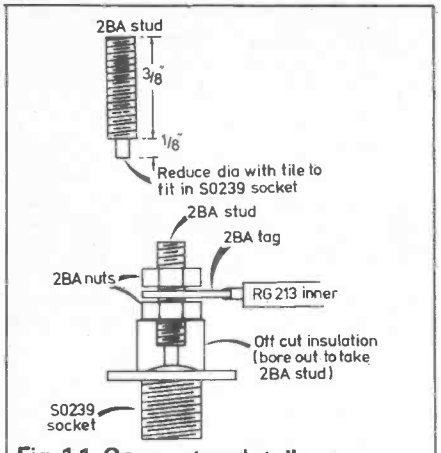


Fig. 11 Connector details.

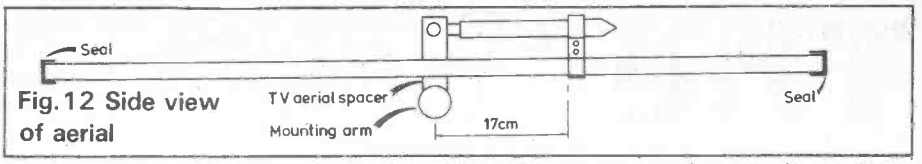


Fig. 12 Side view of aerial

closed in the vice to provide a degree of weather sealing. The rod is ⅜in diameter, and has a 5in length of RG213 inner core to produce the matching capacitor, working like a trombones line. This type of inner core slides freely inside the gamma rod. The design is for a centre frequency of 145.5 MHz with the dipole shortened by 3%. The length calculates to 99.999 cm for the dipole, which is near enough 1m. The gamma match is spaced 5cm from centre of aerial to rod, which makes the air gap between the dipole and the gamma match 3.57cm, and the shorting strip is 176cm from the mid-point of the dipole.

For the RG213 inner, take a length of 5¼in, cut off ¼in of the dielectric to make a soldering point, and solder on a 2BA tag. The cut off piece of dielectric is used to provide an insulating standoff over the point where the stud connector is soldered into the SO239 socket connector **Fig. 11** The trombone capacitor is adjusted by sliding the gamma rod in the shorting strip AND by adjusting the position of the shorting strip. In both of the prototypes I made, if 1¼in of the inner shows at the rod, and the shorting strip is 17cm as shown in **Fig. 12**, the SWR should be a reasonable value.

After all adjustments have been made to tune the aerial, all points should be sealed against the weather. A good method of doing this is to use silicon rubber sealant as used for bath grouting or car sealant. Also use rubber tape to seal the PL259 plug on the end of the coaxial feeder. If the aerial is well sealed, it should last for many years.

REFERENCES:

1) Motorola Application Note, AN-267, Matching Network Designs with Computer Solutions, by Frank David.

2) "Electronic Applications of the Smith Chart", by Phillip H. Smith pub by McGraw-Hill.

3) Radio Data Reference Book, by T.G. Giles, G4CDY and G.R. Jessop, G6JP, pub by R.S.G.B. Fourth Edition, 1977. Unfortunately, this book is dropped from their current list, and it was listed last year as being out of print.

4) ARRL Antenna Book, 1974 edition. Again there is now a newer edition of this book, and I do not know if this method of calculating the component values is retained in the newer edition.

The 'Very Highs' with a VK Accent

Visualise a nation so extensive that its eastern suburbs might be out on the borders of the Caspian Sea and its western suburbs around Dublin. Its southern suburbs would be washed by the Mediterranean and its northernmost tip would reach almost to the Arctic Circle.

This month we include a special report from our 'Metre Wave' correspondent Jack Hum, G5UM, after his recent trip to the Antipodes.

That *could* be a description of the United States. In fact it is a description of Australia. Note that it includes two keywords: "nation" and "suburbs". They are keywords for two good reasons: that Australia is a nation in its own right, and that most of its inhabitants dwell in suburbs around its great cities.

Perhaps the foregoing will disabuse any British misconception (it still lingers) that Australia is a place "somewhere down at the bottom of the map" and that its people are broad-brimmed bushwhackers. Nothing is further from the truth.

What all this means in a radio communicating context is that distances in Australia (or VK-land if you prefer) are so vast that communication across its length and its breadth must be by means of what would be regarded in the UK as a DX band – most popularly 14MHz, closely followed by 7MHz and with 3.5MHz some way behind because of its shorter haul characteristics.

Where VHF Scores

It is in the great conurbations that the metre wavelengths come into their own. Remember that over 3 million people live in Greater Sydney, almost as many in Greater Melbourne, and approaching a million each in Brisbane, Adelaide and, way out west, Perth. These people are spread out for tens of miles from the cities' centres simply because there is so much more room to move in VK-land by contrast with close-packed Britain. In other words, here is ready-made terrain for a high level of amateur transmitting operation on 'metre waves' that embrace not only the familiar 2m and 70cm bands used in Britain but, in addition, the 52MHz band, or "Six" as it is known in Australasia and the Americas, where it is an official allocation (unlike the situation in Europe).

G5UM (left) with Gordon Bracewell, VK3XX, ex-G3EGK.

A visitor contemplating the Australian life-style, as G5UM was privileged to do during a 3½ month stay earlier this year, marvels at the sophisticated and highly developed society which has been built in only a couple of hundred years. Taming such a huge land could only have been achieved by a resourceful people – and this resourcefulness is still much in evidence today, notably on the amateur radio front. Without the pioneer work done by Australia's and New Zealand's hams in the Twenties, international DX would have been a very circumscribed affair.

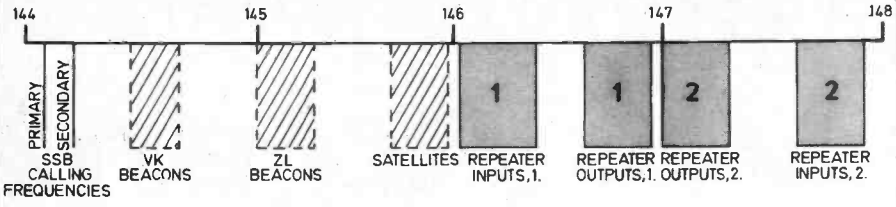
In the metre-wave spectrum this spirit of enterprise – of pioneering new developments – is much in evidence. Since its inception, through-satellite communication has drawn many adherents, many of them on 145MHz up and 28MHz down, but, in the case of restricted licence operators who are the equivalent of Britain's VHF-only Class-B licenses, 144MHz up and 432MHz down.

Repeaters Sublimated . . . And Ground-Borne

Satellite communication is a sublimated form of through-repeater operation, in an exalted plane in more senses than one. At the more mundane level of ground-borne repeaters, developments in Australia have been truly remarkable. Repeater coverage of all the great urban areas is complete. Further out, coverage in between the conurbations is considerable. For example, throughout the 650-mile drive from Melbourne to Sydney an operator is rarely out of range of one or other 2m repeater station, except for a small area near Canberra where topography exercises its toll.

Unlike procedures in the UK, no tone-burst access is required to bring up repeaters in Australia. Voice-access is the norm, but not exclusively: there are many RTTY and video repeaters as well.

The original licence for the Melbourne broadband amateur television repeater, VK3RTV, was granted as long ago as September of 1978. Now a full colour-vision service is provided at 444.25MHz in and 579.25MHz out, sound 5.5MHz high in each case, with functional control exercised through a 6800 microprocessor. Video and audio ident are given every 10 minutes and at the start and finish of each transmission. Much friendly rivalry is evident on the TV repeater front, for



2m band plan in Australia: all intervening spaces in diagram are available for simplex FM communication.

example, between the VK3RTV team in Melbourne and the VK5RTV enthusiasts in Adelaide.

Back to voice-operated repeaters; because Australia enjoys a 4MHz spectrum for its 2m band there is room in it for two repeater services. The simplified diagram below of the VK bandplan for "Two" shows how these two services are fitted into the upper two megahertz of the band. What might be called Repeater Service No 1 provides outputs *high* while Repeater Service No 2 provides outputs *low*, both at the standard offset of 600kHz, between transmit and receive.

Channel numbering has been so simplified as to be readily identifiable even by a driver hassled by the heavy traffic of Sydney or Melbourne.

"QSY to 6750, old man," tells a listener to move his channel change switch to the repeater input frequency of 146.150 which provides 6750 from the repeater.

On 70cm – where 30MHz of space is available – repeater inputs are between 433.025 and 433.725MHz, with outputs 5MHz higher. Similar four-figure channel identification applies on "70" as on 2m. Simplex operation occurs in the wide remaining spaces of both bands.

Incidentally, these frequency parameters, widely used "east of Suez", should discourage even the most hardy of rig-modifiers from bringing transceivers into the UK with their duty-free luggage!

Also widely available east of Suez is the 6m band. Here too the Australians have developed a bandplan to incorporate repeaters, providing 16 channels from 53 to 53.357MHz, with inputs 600KHz low of outputs.

Indicators Of Conditions

Apart from repeaters, Australia's metre-wave bandplans place "DX" low and "local" high. It will be noted from the diagram that beacons that provide an indication of propagation conditions are placed next to the DX segment.

Across the Tasman Sea VHF beacons operate in New Zealand. Their value as indicators of propagation conditions is recognised in Australia by the provision of a "window" just above 145MHz where these beacons, most of them more than a thousand miles distant, are of considerable value to the DX man sensing the 2m band's potential.

With the Australian DX segment on 2m band-planned to lie between 144 and 144.4MHz ("all narrow band modes") there are those who ask "Could there not be a similar segment on 'Six'?". For a long time the 6m band in Australia has extended only from 52 to 54MHz (as wide as the whole of the British 2m allocation!), available on a secondary basis. Negotiations are in train to allow operation in a DX window between 50 to 10.15MHz, if need be only to stations outside TV broadcast radii and perhaps with a 50W power level. The television proximity problem is a real one in Australia: the colourvision "Channel Nought's" upper video sideband extends almost to 50MHz.

If a DX window were to be granted at 6m it would enhance the opportunities for trans-Pacific contacts to be made. Some indication of what might be achievable was given in the March, 1983, edition of *Amateur Radio*, the official journal of the Wireless Institute of Australia (which is the Australians' "RSGB"). A masterly article from VK8GB recounted how in four years of observation from his station at Darwin he documented the characteristics of both the 6m and 2m bands at extreme propagation ranges, and was able to record the remarkable behaviour of trans-equatorial signals at ranges of 5,000km. Try to imagine contacts on "Two" at QRBs in excess of 3,000 miles!

That Antenna

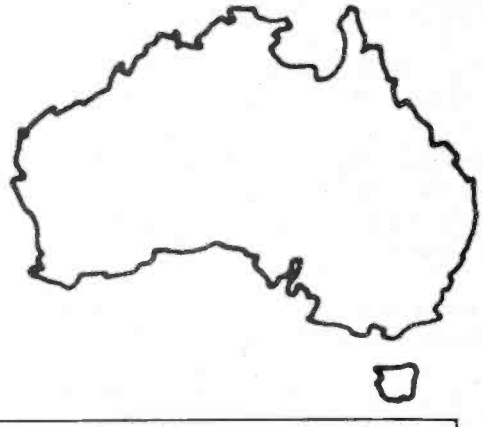
To work the DX on the metre-waves you need a good antenna system – a point made more than once here. But sometimes there are "official objections" to large aerial structures.

Looking at the size of many of them in VK-land one came to the conclusion that what restrictions exist are interpreted liberally. One VK3 man described the situation to your correspondent in the following laconic terms:

"To get planning permission for an antenna in these parts you must leave a letter with your neighbours asking if they have any objections to what you propose. You also leave a placard outside your front gate for two weeks saying the same thing in letters half an inch high (they are provided by the council). No objections from the public? Then no objections from the council!"

And Finally The "Ks"

It is an indication of the popularity of VHF/UHF in Australia that means have been found to enable the novice class operators – and there are thousands of them – to use the metre-waves. Originally, novice callsigns, characterised by "N" after the figure (eg, VK3NAA) were to be heard only in limited areas of the 10m, 15m and 80m bands. A recent development has been the creation of the new "K" callsign block (eg VK3KAA) which in effect commonizes the restricted licence with the novice licence. If as a novice ("N") you wish to operate the metre-waves you apply for a "K" ticket. And now already there are thousands of these, too, in Australia's nine widely dispersed callsign regions.



ALL MODE TRANSCEIVER Project

PROJECT

OMEGA

Part 5

By Frank Ogden, G4JST, and Tony Bailey, G3WPO

The output filters perform a secondary function in a transmitter or transceiver system. Strictly speaking, they are not essential to the functioning of a transmitter but, if left out, can lead to a social problem with television-watching neighbours. They also serve to remove low harmonics of the original signal which can cause interference to users of the higher-bands, if allowed to each the station aerial.

The PI tank circuits used almost universally in the days of valves were reckoned to attenuate the 2nd harmonic of the transmitted signal by around 20dB or more, 3rd harmonics by at least 30dB and so on. The addition of a single 30MHz low pass filter after the tank circuit was generally acknowledged to be all that was required to reduce TVI to manageable proportions. We have followed this same yardstick with the *Omega* design. Fig. 1 shows the position of the filter block in the *Omega* system.

The Design

Solid state push-pull broad-band PA stages produce rather different harmonic products than single ended valve designs. The latter generates very high levels of 2nd harmonic while the product of push-pull amplifiers is mainly 3rd, 5th and higher-odd order products, the even order ones (2nd, 4th, etc) tending to cancel each other out. This makes things easier for the filter designer. A well balanced P – P transistor output stage may have a 2nd harmonic content that starts out at least 20 to 30dB below the fundamental where the single ended version will yield only 10dB below fundamental. The odd order products from both types will be very similar. RF amp design has much in common with hi-fi audio gear!

While you can't ignore second harmonics, the output filter network needs to be most effective at the third harmonic and above.

The *Omega* filter comprises six cascaded sections to cover the nine HF bands. Each section has been designed from standard tables to exhibit a turnover frequency just above the highest working frequency of each band group. Thus the last section in the cascade has a cut-off of 30MHz and provides harmonic attenuation on both the 24 and 28MHz bands. The second section exhibits turnover at 22MHz and covers operation on 18 and 21 MHz. The remaining section turn-over frequencies are: 15 MHz (third section, for 10 and 14 MHz bands); 8 MHz (fourth); 4 MHz (fifth); and 2.5 MHz (sixth).

The *Omega* filter system is unusual, in that the sections are cascaded in a chain with a succession of single-pole change-over relays used to break the chain and enter the signal. Thus, a top-band transmission passes through not only the first (low frequency) filter but all successive sections as well. Similarly, a 20m transmission will enter the chain at the 4th section, the preceding sections being disconnected, and pass through remaining sections to the end. At 24 or 28 MHz, the signal passes

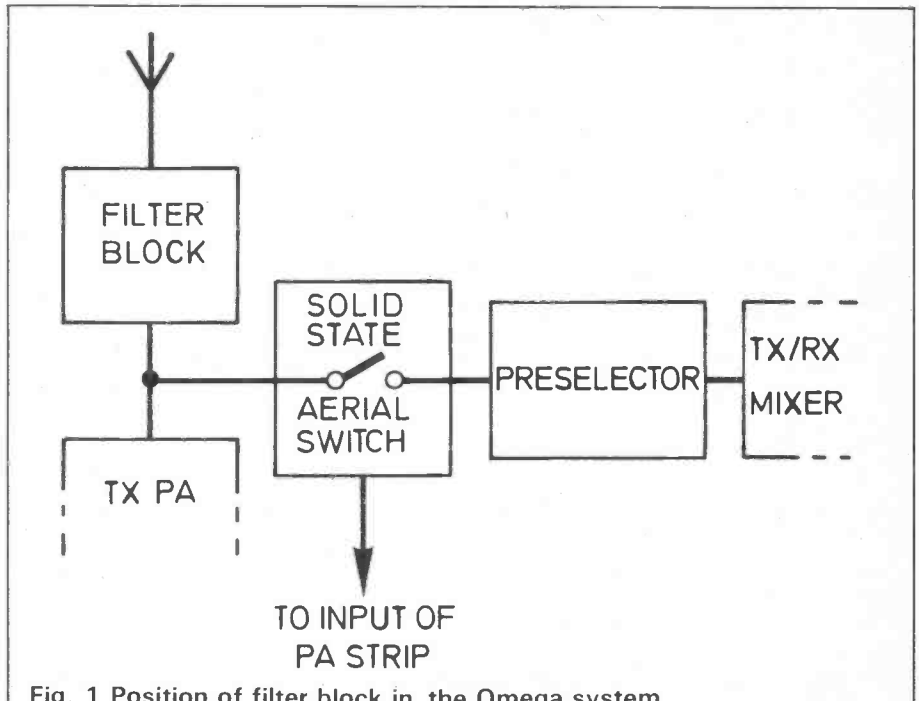


Fig. 1 Position of filter block in the Omega system.

through only the end section.

Frankly, a massive chain of filters like this defies mathematical analysis, and the only comment that can be made about performance is of an observed, empirical nature. It works and is easy to construct. Attenuation of harmonics is satisfactory on 10m and excellent on all lower bands. Loss is under a dB without excessive pass-band ripple. Since each section presents an attenuation of 18dB/octave beyond cut-off, lower-band harmonic suppression is limited by leakage around the physical layout rather than network attenutation.

There is one last spin-off in the *Omega* system. The output filters also act as a low-pass filter to the incoming (receive) signal augmenting further the operation of the preselector circuit. **G4JST**

Construction

The complete low pass filter is built on one double-sided printed circuit board, of similar size to the CIFPU unit. We do not consider it vitally necessary to mount this in any form of screening, but if you wish to obtain the ultimate attenuation from the filter, it will fit inside one of the diecast boxes used for the VCO or CIFPU units. If this option is chosen, then SO239 sockets should be used for the input and output connections, together with feedthrough capacitors for the +12V connections. The circuit of the low-pass filter is shown in **Fig. 2**.

As some of the capacitor values required are non-standard, these are made from combinations of capacitors as shown on the circuit. Silver mica types are required, rated at 350V DC or above.

Construction should be tackled as follows:

1. Insert and solder from the underside the 14 connection pins used for relay selection and RF I/P or O/P.
2. Insert and solder six connection pins at the points marked (see the key) These link the earthy side of the relay coils to the PCB ground plane, and should be soldered both sides of the PCB surface.
3. Insert and solder the seven 1N4148 diodes, ensuring correct orientation.
4. Insert and solder the silver-mica capacitors. It is important that they are mounted slightly proud of the PCBs – not for any electrical reason but simply that the leads are fragile and are less likely to break if inadvertantly knocked. About 1mm of lead above the PCB surface is all that is needed. The earthed lead should be bent at right angles to the body, cropped to about 3mm in length and then soldered.
5. Inductors – each inductor is wound on two Amidon dust iron cores for the required power handling capacity. At the maximum power envisaged here (100W), no additional insulation is needed around the cores and the windings are made directly onto a pair of cores simply held side by side while winding. The component list gives the wire lengths required to wind each, with a total of about four metres of 20swg enamelled wire (1.0mm) needed. Note that the six lowest frequency inductors are wound on grade-2 cores (red) and the other six on grade-6 (yellow) cores.

When winding of each is complete, space the turns out over about 3/4 of the core's circumference as indicated in the drawing. Each pair of inductors that comprise one filter should be wound similarly with the windings as tight as possible on the cores. Winding with 20swg wire is a litle awkward but the knack will come after a few have been done.

The complete inductor should then be inserted through its mounting holes until the cores rest on the PCB. Cut off excess wire leaving about 3mm protruding on the underside, remove the inductor, strip off 4mm or so of insulation, then replace and solder.

6. If you intend running the high-power PA, and may be using either FM, or RTTY (i.e. 100% duty cycle modes) it is advisable to remove the top half of the plastic covers on the relays supplied. Some dielectric heating does take place at high power, and the additional ventilation will be worthwhile. For QRP work this is not necessary. The relays may now be inserted and soldered.

This completes construction of the unit. Wiring into circuit is quite simple, as shown on the layout – selection of each band is made via wiring direct to the bandswitch con-

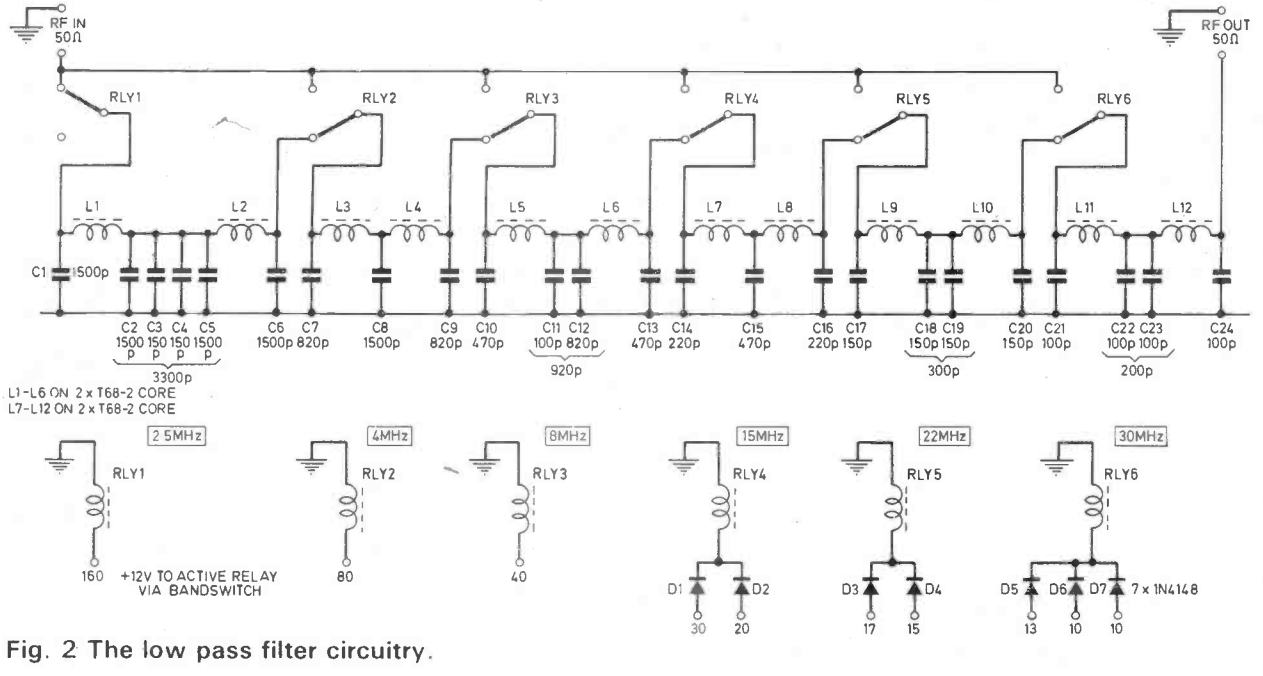
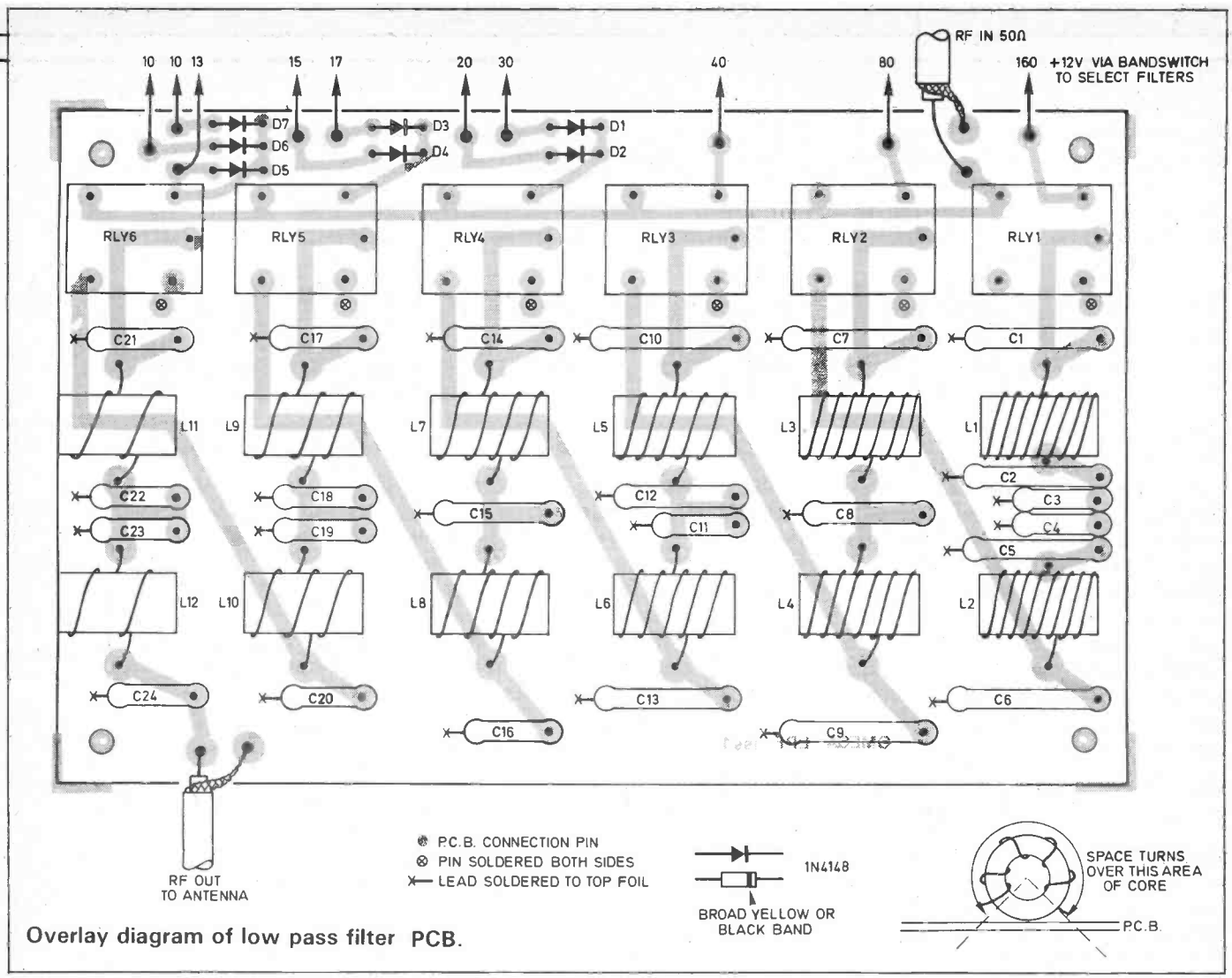


Fig. 2 The low pass filter circuitry.



Overlay diagram of low pass filter PCB.

trol from each pin on the PCB. The unit should be located fairly near the PA, and mounted using 6BA bolts, with 6BA nuts as spacers from the chassis or panel.

No alignment of the LPF network should be necessary. In practice, it is possible that with variation in core permeability and individual winding techniques, an excess of inductance may be created in some of the inductors. This can be recognised by the power starting to fall off near the top end of a band. If this occurs, remove one turn from each of the pair of inductors involved – this is more likely to be necessary on the low frequency bands than the high ones. When you are happy with the filter network, the cores and windings should be fixed in place using epoxy adhesive.

At high powers it is normal for both the relays and cores to get warm. The latter would be quite happy at much higher temperatures than will be experienced in this design.

This filter network can be used with other transmitters that lack such filtering, and make another complementary unit for G3ZVC/G4CLF designs, together with the synthesised VFO and QRP PA units.

Kit of Parts

A complete kit of parts for this project is obtainable from WPO Communications (see their ad.) for £29.50 inc., and includes all the components given, including wire and a drilled, tinned printed circuit board. Boards alone are £6.50 inc.

COMPONENT LISTING

CAPACITORS (all silver mica, 350 VDC)

C1,2,5,6,8	1500pF
C3,4,17,18, 19,20	150pF
C7,9,12	820pF
C10,13,15	470pF
C11,21,22, 23,24	100pF
C14,16	220pF

SEMICONDUCTORS

D1 - D7	1N4148, 1N914

INDUCTORS

L1 - L6	Wound on pair of Amidon T68-2 cores using 1.0mm enamelled Cu wire.
L1,2	16 turns (56cm)
L3,4	12 turns (42cm)
L5,6	8 turns (30cm)
L7 - L12	Wound on pair of Amidon T68-6 cores using 1.0mm enamelled Cu wire.
L7,8	6 turns (25cm)
L9,10	5 turns (22cm)
L11,12	4 turns (19cm)

MISCELLANEOUS

RLY1 - 6	Kam Ling Kuit-B 12V DC

20 off 1mm PCB connection pins.

Radio Yesterday

Can you imagine living in a place and time in which the nearest 'emporium' was hundreds of miles away and the power was supplied from 200V D.C. mains; where high tension batteries were built from stacks of 1.5V 'inert cells', the only available portable voltage supply was 6V 120Ah 'accumulators' and 'black boxes' were forty years in the future?

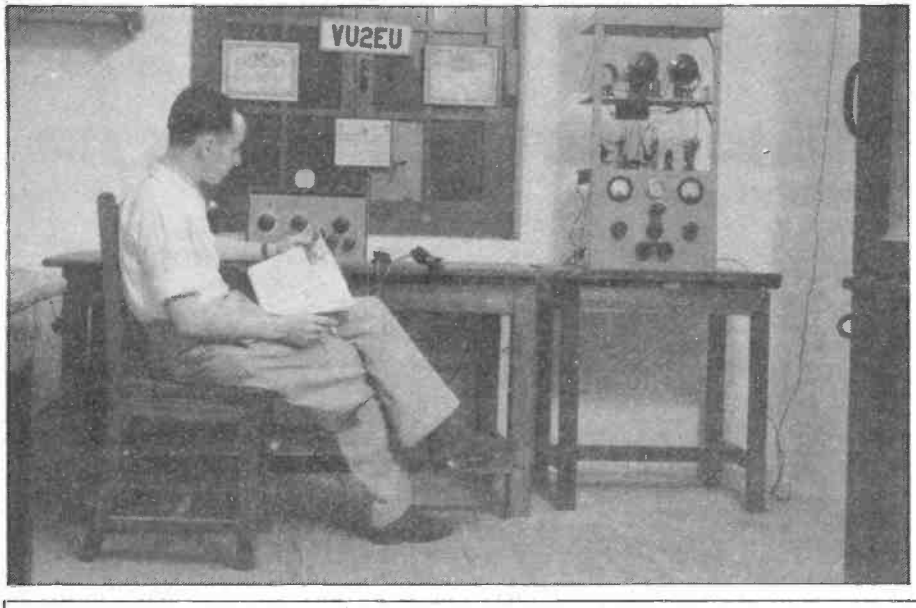
Radio in India before World War 2. By George Metcalf, G6VS, ex- VU2EU.

Such was Meerut in the Central Provinces of India, scene of the outbreak of the mutiny in the early nineteenth century ('just in case' of further outbreaks, even in the mid 1930's, troops were fully armed when attending church parade!) and the operational 'birthplace' of VU2EU nearly four years before the outbreak of the second world war.

The Station

Equipment was not easily obtainable as the nearest supplier was located in Calcutta, about thirty six hour's train journey from Meerut. Radio Supply Stores, Dalhousie Square, Calcutta was owned by Dr. Sen who was very helpful and would attempt to meet even small orders for items not in his immediate stock. They were also main Eddystone agents and stocked a large range of valves, mainly USA types. There was also another shop in Bombay (again hundreds of miles away), but who were not very helpful or co-operative unless the order was of large value.

With a little foresight a 7172 variable frequency crystal together with some variable condensers were obtained in the UK prior to departure, and being attached to the workshops of 3rd Indian Divisional Signals it was not long before sufficient bits and pieces had been assembled to build a 1-v-1 receiver (1-v-1 indicated that the line-up was RF-detector-output), a very popular combination in those days. The RF stage was a variable-mu RF pentode, the regenerative detector a triode and the output stage an LF pentode. All valves were of the 2 volt filament type requiring 150 volts of high tension (This is where the 1.5 volt inert cells came into their own!).



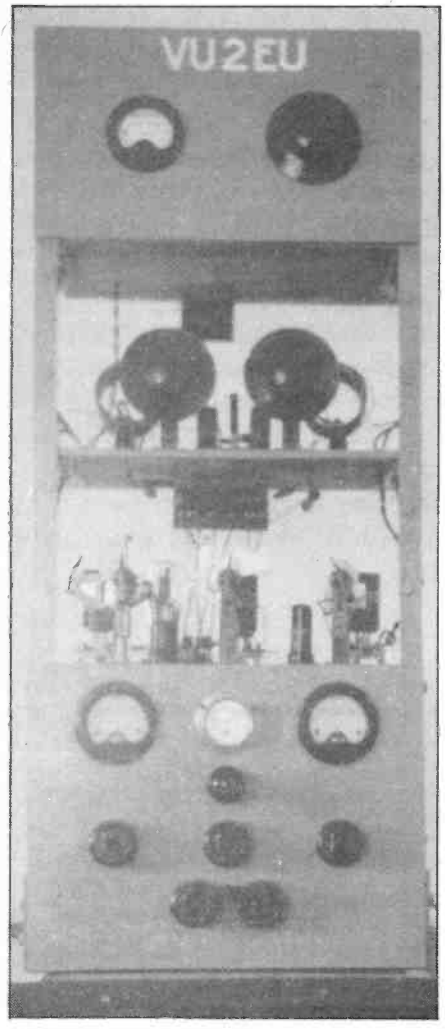
The transmitter presented slightly more of a problem as it had to operate from the DC mains and the only suitable valves available were AC/DC LF pentodes and tetrodes of the Type 43 and 25L6. The type 43 was used for the crystal oscillator, one 25L6 as a frequency doubler to 14 MHz, and a pair of 25L6's in push-pull as the power amplifier on 14 MHz. For 28 MHz operation these were connected in parallel and operated as a power doubler. With 200 volts to the anodes of these valves (makers recommended 125V max!) this system worked very well for a couple of years with an average life for the valves of about four months. Replacements from The Radio Supply Stores cost approximately twenty rupees which was about £1.50 at the rate of exchange in those days.

The antenna was a windom, simple to construct and very popular in the 1930's. Approximately 32'6" long, it was fed with a single wire feeder tapped approximately one third from one end and connected to a simple ATU. Matching was done by tapping the feeder down the ATU coil and tuning for maximum RF in the feeder.

The photographs show the station layout of VU2EU and were taken either late 1936 or early 1937, and following the fashion of those days the transmitter was constructed on the rack and panel system with the DC mains smoothing chokes and condensers in the base, the transmitter proper occupying the next two shelves with the ATU on the top.

Operating Conditions

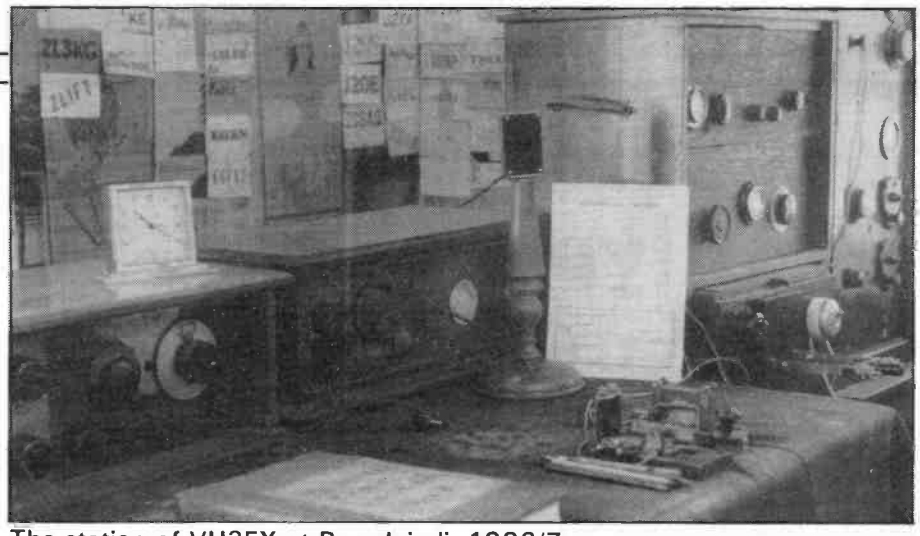
Thousands of hours were spent on the air in those days as we had plenty of spare time — official work commenced at 0630 and finished at 1000 hours as it was considered far too hot for Englishmen to work when the sun got up — mad dogs and Englishmen go out in the midday sun! Something like a dozen or so amateurs were regularly active in VU2 pre-war, mainly on CW; call signs which come to mind are VU2FX, Tommy Thomas in Rawalpindi (now a silent key), VU2ED, Judd Moysey, who joined VU2EU in Meerut in 1937 and the QRO (high power) phone station of the sub-continent VU2CQ in Bombay.



VU2EU TX at Meerut

Conditions for amateur radio operating were far from ideal, particularly during the monsoon season when the air around the electric light was thick with flying insects. The only way to catch them was to place an aluminium bowl of water directly under the light — the light was reflected by the aluminium and the insects were attracted into the water. About every quarter of an hour the water had to be replaced as it was *full* of dead insects.

Another hazzard was lizzards crawling into the PA 'tank' coil and getting burnt up when the transmitter was operating. This could cause mistuning of the PA! (*As well as a certain amount of discomfort to the lizzard and a rather unpleasant smell — Ed.*) This was all in addition to the (*continuous? — Ed.*) interference caused by hundreds of DC motors, which operated the fans of the 'punkkas' — and had to be heard to be believed.



The station of VU2FX at Rawalpindi, 1936/7

Real QRP DX

In 1938 VU2EU was posted to Cherat on the North West Frontier. At nearly ten thousand feet ASL, this was an ideal location for amateur radio and was free from mains interference, as the nearest mains supply was about 70 miles away. A miniature version of the 1-v-1 receiver was built, together with a small transmitter using a single-valve electron-coupled oscillator, which was followed, later, by a twin triode crystal oscillator/doubler. Both used two-volt filament valves with 150 volts on the anode and gave a maximum power of five watts. *The UK was worked many times using 250 milliwatts to a windom antenna!*

Pirates

Even in those days before the war, there were a few 'pirates' around. One of the most notable was a chap called Livingstone-Allen, who used the call sign VU2AA. He even had QSL cards printed with the skull and cross bones superimposed over the VU2AA and used to sign himself 'Unlicen Owner and Opirator'. Unfortunately his card, together with the logbook and all the other QSL cards I received whilst operational as VU2EU, were lost during the war.

The late Tommy Thomas, VU2FX

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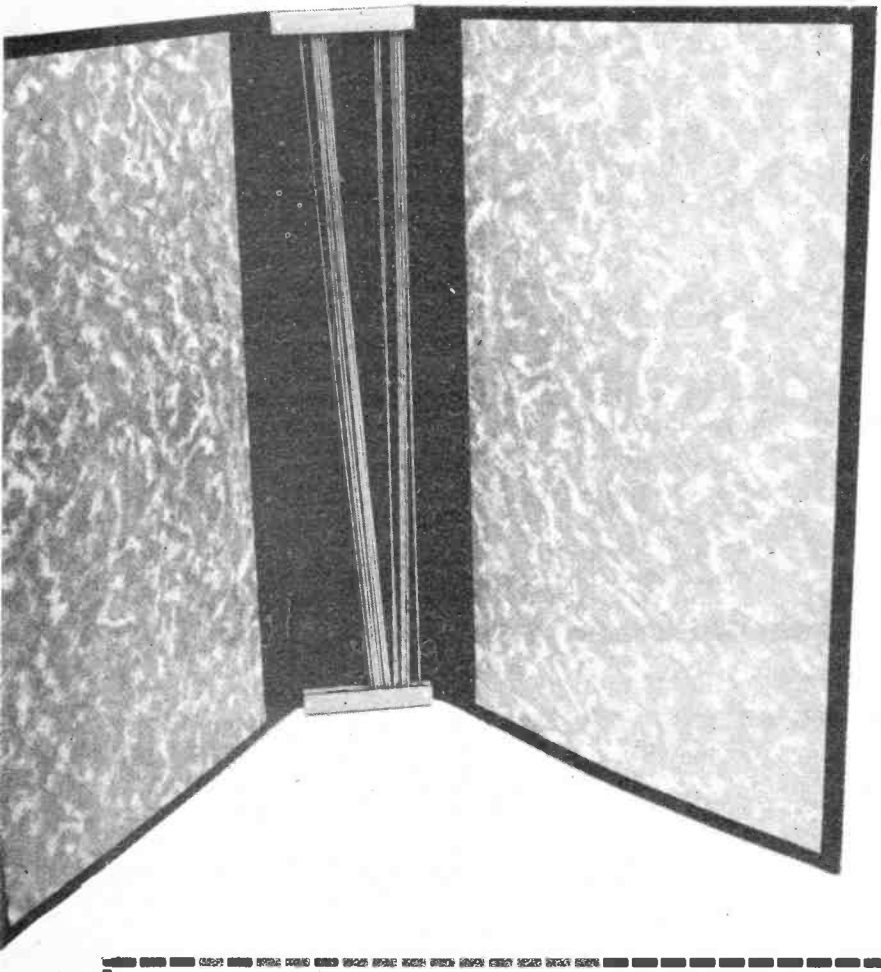

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WIRE ANTENNAS ON 2m — a practical proposition?

A VHF antenna doesn't have to be a Yagi, quad or co-linear. Graham Packer, G3UUS, shows how good old wires can be used.

To the newcomer on VHF, 'antenna' means a series of rods, either 'parasitic' to a radiating element, such as in a yagi or quad, or stacked and fed in phase, such as the various forms of co-linears.

It is true that beams, quads and co-linears have their place; they provide easy-to-mount and rotatable structures of predictable performance. However, they can be very expensive and certainly create aesthetic problems in built up areas.

Much early VHF work was done on the antennas amateurs already had erected for their HF activities — and their signals did 'get out!' Their transmitters were simply adjusted for maximum power into whatever impedance their antennas presented and that was that.

Then the war came and amateur operating ceased for a number of years. Development of antennas progressed particularly in military laboratories and by the time operations re-commenced after the war the scene was set for an almost universal take-over by the 'yagi' — which has remained until this day.

Not all amateurs were convinced, however, and much early moon-bounce work was done with VHF rhombics. The gain available can be immense but the disadvantage for moon-bounce is that the array is not steerable, giving you a narrow time-window for operation. *(The array is not only highly directional but has a very low angle of radiation; it is useful only when the moon is on or near the horizon and in the direction of fire of the antenna — Ed).*

For fixed links, however, the rhombic came into its own — see **Fig.1**. Amateur and commercial meteor-scatter circuits still use the rhombic and, as a cheap, high-gain antenna, it is hard to beat.

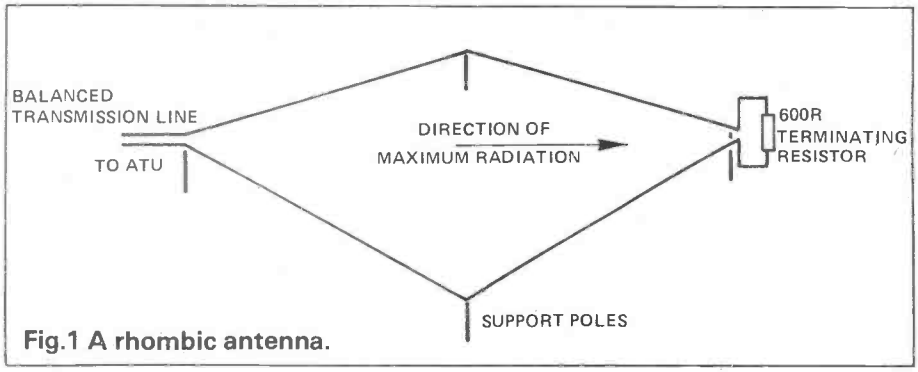

Fig.1 A rhombic antenna.

A simple version is the end-fed inverted Vee or 'half rhombic' shown in **Fig.2**, which needs only one support mast in the middle.

Both these antennas require a terminating resistor for wide band operation with the optimum front-to-back ratio. Suitable terminating resistors for VHF are shown in **Fig.3**.

The half rhombic requires two earths, not a simple matter at VHF. Theoretically an earth is an infinite conducting sheet or surface; this can be approximated by laying two sheets of copper-clad board, aluminium or even cooking foil, about 1 metre square at each end of the aerial!

Operation of both these antennas without terminating resistors is possible, but be prepared for your RF to go in any direction!

Many amateurs are experimenting with G5RV's, HF dipoles, long wires and Vees; in fact a Vee-wire antenna is included as an option for the Clansman, the British Army's latest VHF transceiver. The Army certainly realises the advantages of an almost

Table 1 Alternative resistor values for the VHF load resistor; note that all should be 2 W carbon types.

For 600 ohms	For 300 ohms
4 × 2k2	4 × 1k2
or	or
5 × 3k3	5 × 1k5
or	or
6 × 3k9	6 × 1k8

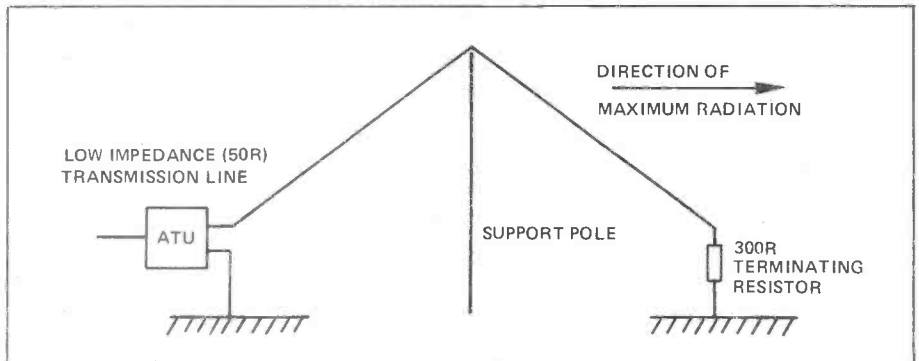

Fig.2 End-fed inverted-V or half-rhombic

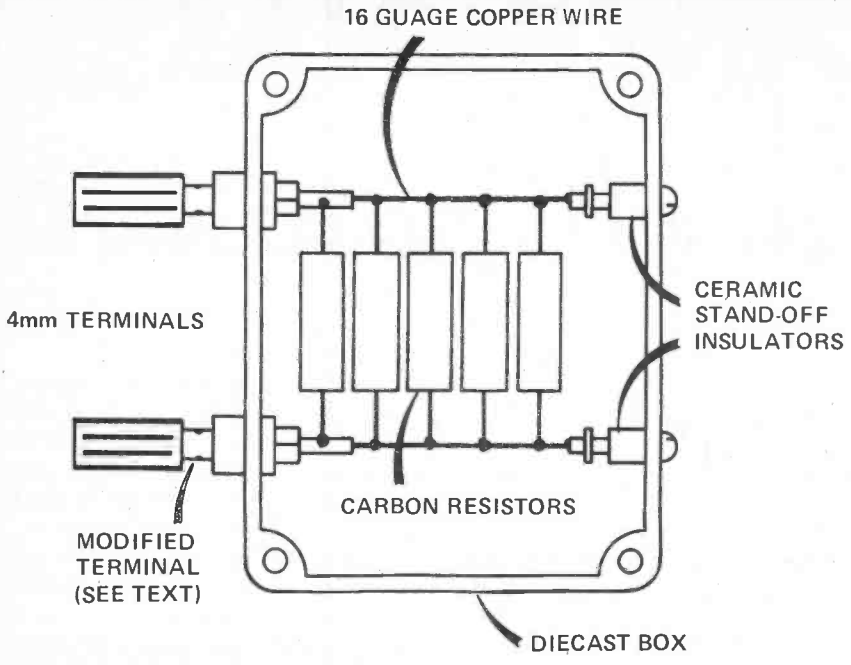

Fig.3 Construction of the VHF load resistor; note that for 300 ohm operation, the lower terminal should have its insulating skirt removed so as to short to the case, which should in turn be earthed as described in the text. See Table 1 for details of the resistors.

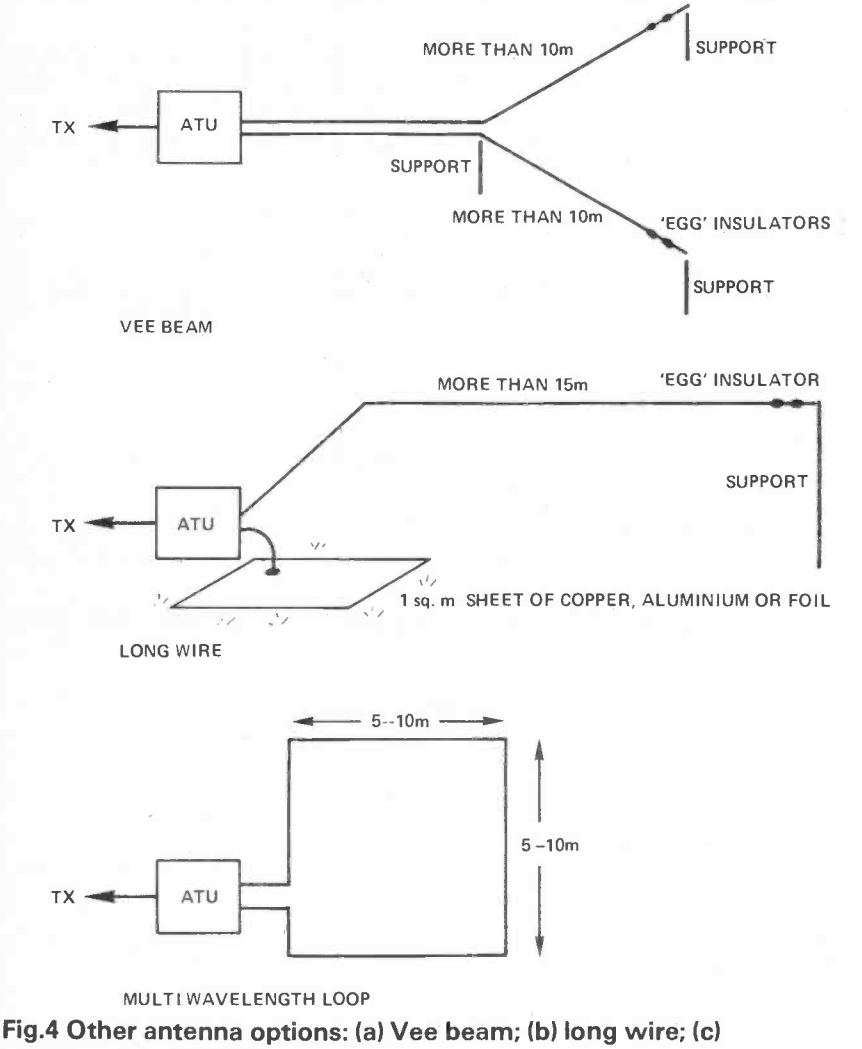

Fig.4 Other antenna options: (a) Vee beam; (b) long wire; (c) multi-wavelength loop.

invisible antenna with gain, one that would take very accurate gun fire to bring down!

The only criteria for use of any antenna at VHF is whether there are highly inductive or frequency selective 'reactive' components likely to reflect back the RF power we want to feed into it.

For instance, its no use trying to load up a base-loaded CB antenna, or an HF beam with traps on VHF. Likewise HF dipoles with ferrite baluns are not going to get our signal very far.

With the tuning unit to be described later we could use a G5RV-type HF antenna (*preferably fed with open wire feeder as ribbon type feeder is beginning to get a big 'lossy' at VHF — Editor).*

Do ensure, however, that the feeder isn't knotted at the top or, again, you have yourself an RF choke. Speaking of G5RV's, one station recently commented that he would prefer a G5RV in the clear to a nine-element beam stuck on the roof. The few dB less performance was worth the 10dB difference in price.

An Antenna Tuning Unit For 2m

There is no point constructing antennas if they cannot be fed with RF. At HF every station uses an ATU to match the impedance of the generator (transmitter) to the load (antenna). Why should VHF be any different?

ATUs are not used as widely as they should be at VHF, which is surprising as rigs have NO means of matching different load impedances, unlike nearly all HF rigs with their 'tune' and 'load' controls. Antennas are rarely their stated impedance; also, they will vary considerably in impedance from one end of the band to the other, thus varying the VSWR of the antenna. In addition, have you ever noticed the variation in the VSWR of a 2m beam as it is rotated? This is due to the effective change in proximity of nearby metallic objects — such as drainpipes — which will affect the radiation pattern of the antenna and thus its impedance.

The ATU of **Figs 5 and 6** is a general purpose 2m matching unit capable of being used with 'long wires' and co-axial and open wire (balanced line) fed antennas. It comprises a pi-network with ½ wave balun transformer. When used for coax or a single


EUROPEAN LOCATOR MAP
presented with
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Orkney Islands
Hebrides
Isle of Skye
Inverness
SCOTLAND (GM)
Aberdeen
Mull
Dundee
Islay
Kintyre
Glasgow
Edinburgh
Londonderry
NORTHERN IRELAND (GI)
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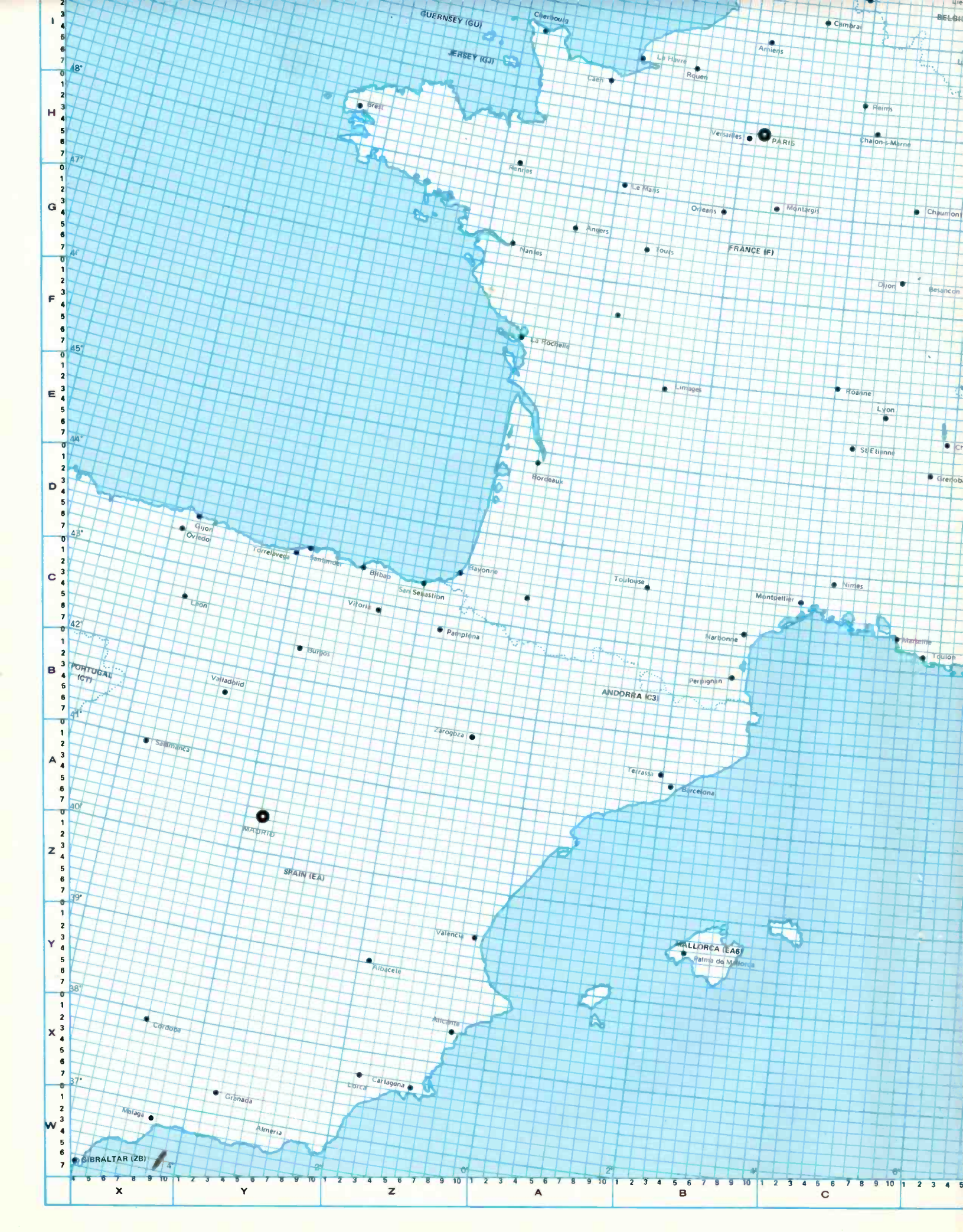
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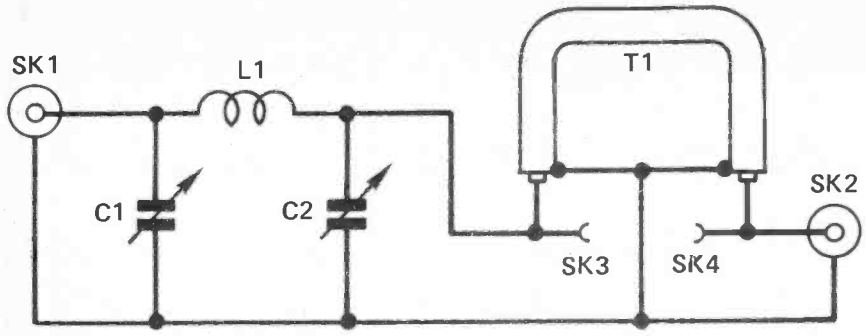

Fig.5 Circuit diagram of general purpose 2m matching unit.

long wire it can match 10-300 ohms resistive and for twin open wire feeder 100-2000 ohms. These limits may change for reactive loads.

Construction

Construction isn't particularly critical (see **Fig.6**) but, as usual for VHF, use the shortest and most direct connections possible. It is housed in a standard 'medium' alloy die-cast box, perhaps pre-painted or hammer-finished to give it a professional finish.

Operation

Connect your equipment together as in **Fig.7.** Ensure you are switched to LOW POWER if possible and that if you have an external power amplifier it is switched **off**. First tune the two controls on the ATU for maximum received signal from (say) a local repeater or beacon. The two controls do interact in the manner of the 'tune' and 'load' controls of an HF rig. Try slowly rotating one control whilst rocking the other. Its a knack to be learnt but an hours twiddling will pay dividends.

Now switch to transmit and watch the VSWR meter. Unless the antenna is very 'reactive' it should be possible to get a 1:1 VSWR very easily. Only now let yourself loose with HIGH POWER. You may have to 'touch-up' the controls if your VSWR meter is a bit insensitive on low power but don't do anything drastic! Most modern tranceivers will withstand a bad match, in fact they have built in VSWR protection circuitry, but don't push your luck! Adjusting for minimum VSWR with the power level fluctuating wildly is at least fairly certain to give you a nervous breakdown.

Now check the bandwidth of your antenna. As most wire antennas are very broad, you may not even notice the VSWR rise at the band edges, but do find out. Your PA can now be brought in to play, but remember an ATU is capable of producing a violent mismatch if misused. Be careful, 100W PA transistors can be expensive!

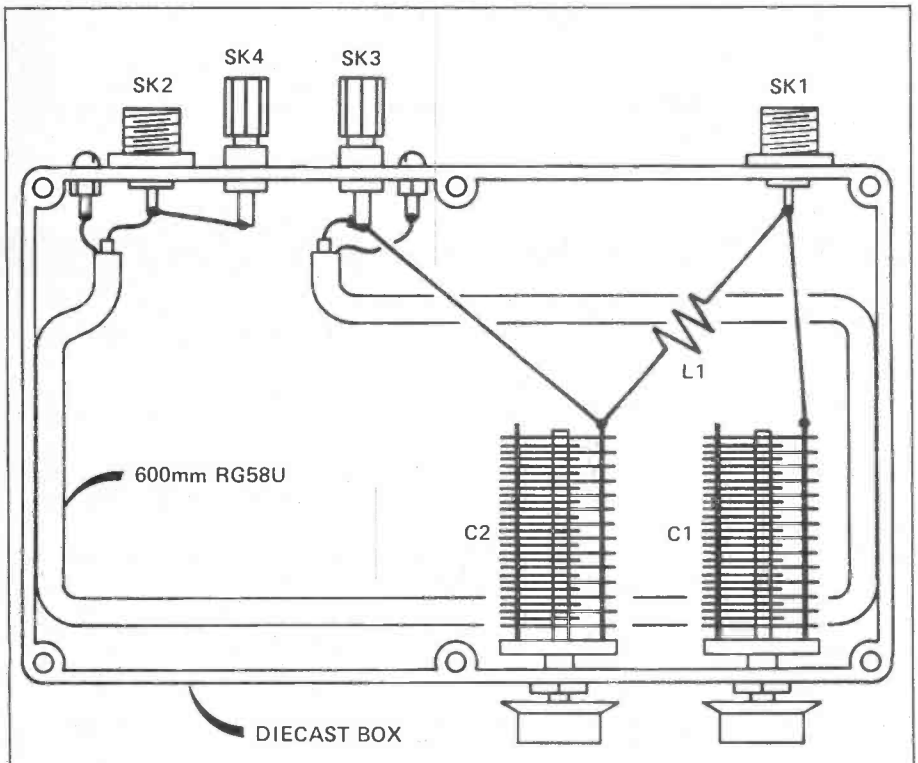

Fig.6 Construction of matching unit.

COMPONENTS – ATU	
C1,2	30 pf variable
LI	2turn 16 swg 10mm dia, 5mm spacing
SK1,2	S0239 or BNC
SK3,4	4mm terminals
T1	600mm RG58U co-ax

Suitable components and boxes for the ATU and 'terminating resistance' may be obtained from HAMPTRON, Sanderson Centre, Gosport, Hampshire.

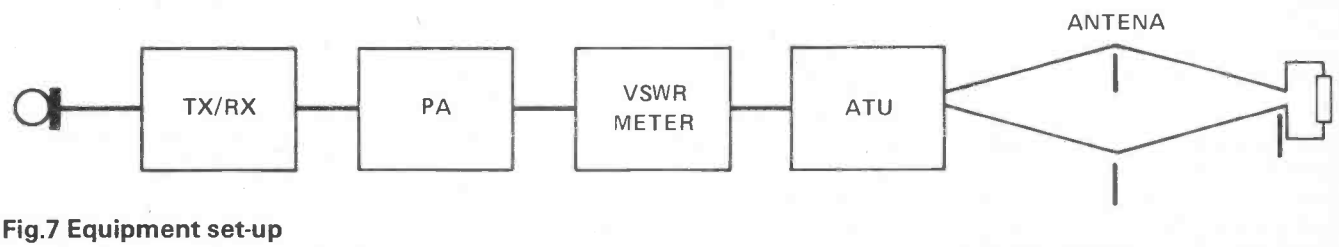

Fig.7 Equipment set-up

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AD149	0.70
AD161	0.39
AD161/2	0.90
AD162	0.39
AF124	0.34
AF125	0.35
AF126	0.32
AF127	0.32
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BC107	0.11
BC108	0.10
BC109B	0.12
BC139	0.20
BC140	0.31
BC141	0.25
BC142	0.21
BC143	0.24
BC147	0.09
BC148	0.09
BC149	0.09
BC157	0.12
BC158	0.09
BC159	0.09
BC160	0.28

BC170B	0.15
BC171	0.09
BC172	0.10
BC173B	0.10
BC182	0.10
BC183	0.10
BC184LA	0.09
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BC307	0.09
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BC557	0.08
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BF183	0.29
BF194	0.11
BF196	0.11
BF197	0.11
BF198	0.16

BF199	0.14
BF200	0.40
BF258	0.28
BF259	0.28
BF336	0.34
BFX29	0.30
BFX84	0.26
BFX85	0.32
BFX86	0.30
BFX88	0.25
BFY50	0.21
BFY51	0.21
BFY52	0.25
BFY90	0.77
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BT108	1.89
BT116	1.20
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BU108	1.69
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SILVER 70

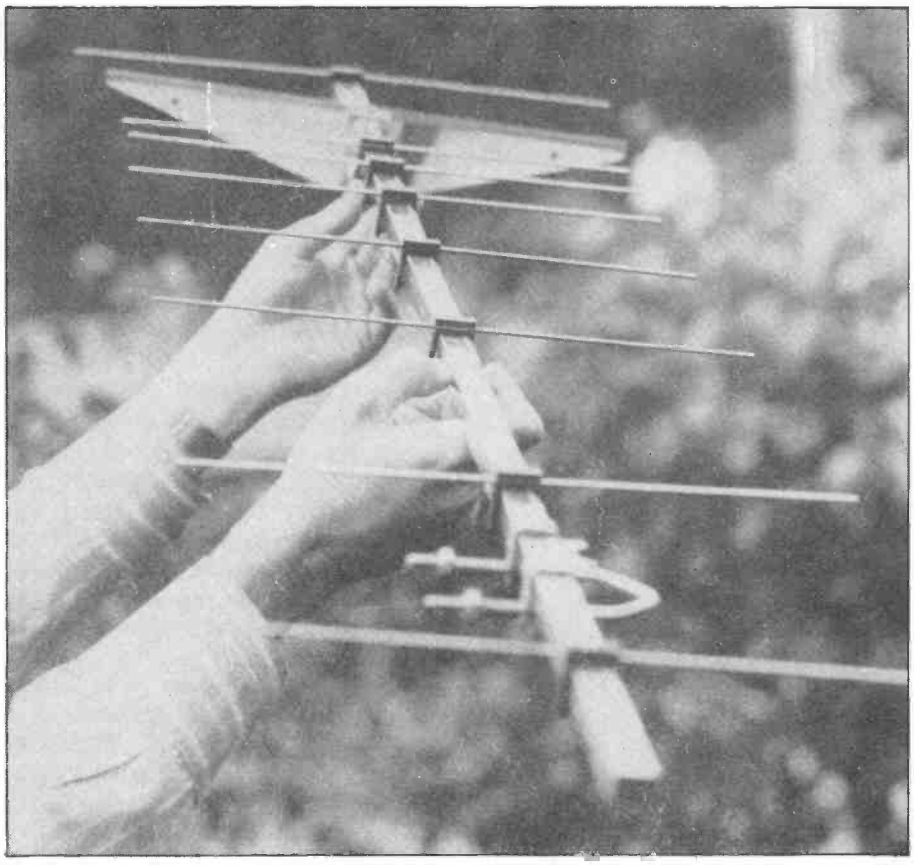
70cm Yagi Beam

Trevor Butler, G6LPZ, reviews the Silver 70 432 MHz antenna from Ant Products.

Claimed by its British manufacturers to be "the result of years of research and development", Ant Products' 432 MHz 14-element Silver 70 yagi arrived recently and was tested and evaluated for Ham Radio Today. Upon opening the box I was confronted by a well packaged piece of amateur radio equipment — a mass of metal and plastic parts to be assembled.

Assembly proved to be straightforward and initially took some 30 minutes (although with practice this time can be cut by half!). The enclosed instruction and data leaflet was generally helpful if rather confusing over protection from adverse weather — a polyurethane-type lacquer is not recommended. Instead a light coat of clear varnish is suggested.

Undeterred by this, I assembled the two boom sections and assembled and attached the angled brace. Next came the connection of the unique (patented?) elements — the most interesting being the driven element (of which more in a moment). The reflector and 12 directors are each attached to a black plastic clip, which in turn fixes to the boom into pre-drilled guide holes. These clips provide insulation for the elements and help to ensure correct polarity is obtained as well as helping to prevent any corrosion due to the interaction of metals.



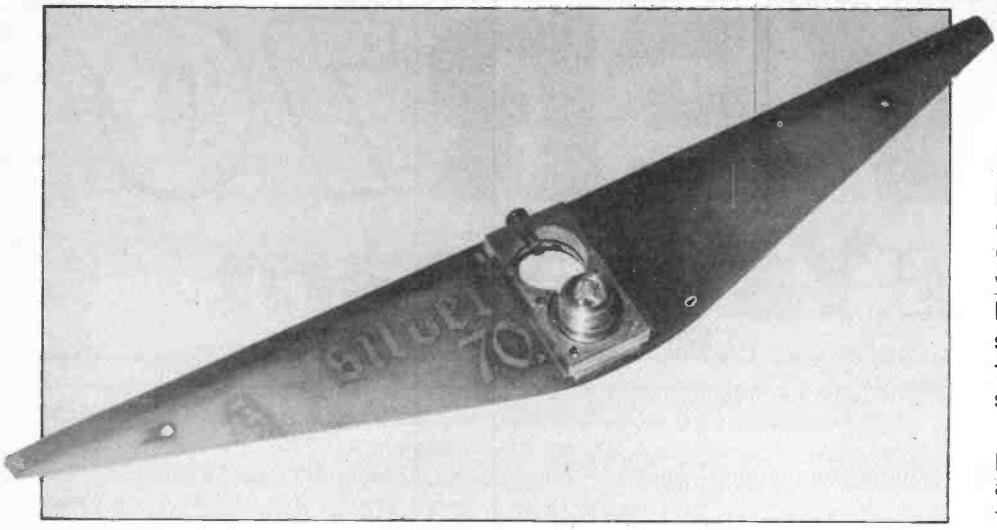
Having virtually assembled the beast (it's 2.7 m long when complete, although a mere 1.1 kg in weight) I felt that the driven element was worthy of closer attention. It consists of a shaped piece of double-sided glass fibre board with a silver-plated copper element on one side, hence the antenna's name, and a delta/gamma match to the other side. Bolted to the board is an 'N' type socket (50 ohm) for connection of a suitable down lead. The driven element is held in place on the boom by a single screw biting into the metal.

One interesting observation was that there was a round hole to fix the element to the square boom! It was found that on field trials the driven element tended to move and a more rigid fixing would be an improvement.

Giving It A Try

Having selected a suitable length of UR67 feeder complete with 'N' type plug, I mounted the aerial on a 16 foot pole and situated myself on the South Downs, close to my home. Whilst there, many stations were worked and although direct comparison to other 70cms antennas was difficult, some pleasing results were obtained with the Silver 70 and many favourable reports exchanged. A gain of 16dBd is reported — it is good to see a dBd quotation instead, as one often finds, manufacturers' isotropic quotations, as the former means more to the radio amateur. The figure of 16dBd can, in my opinion, be taken as a fairly accurate figure based on the performance of the antenna in respect of other aerials tested and also in respect of received signal strengths.

There is a 3db Beam width in the E plane of about 22° and a satisfactory match was obtained across 10 MHz with good ATV reception available. Side lobes are rated to be some 10 to



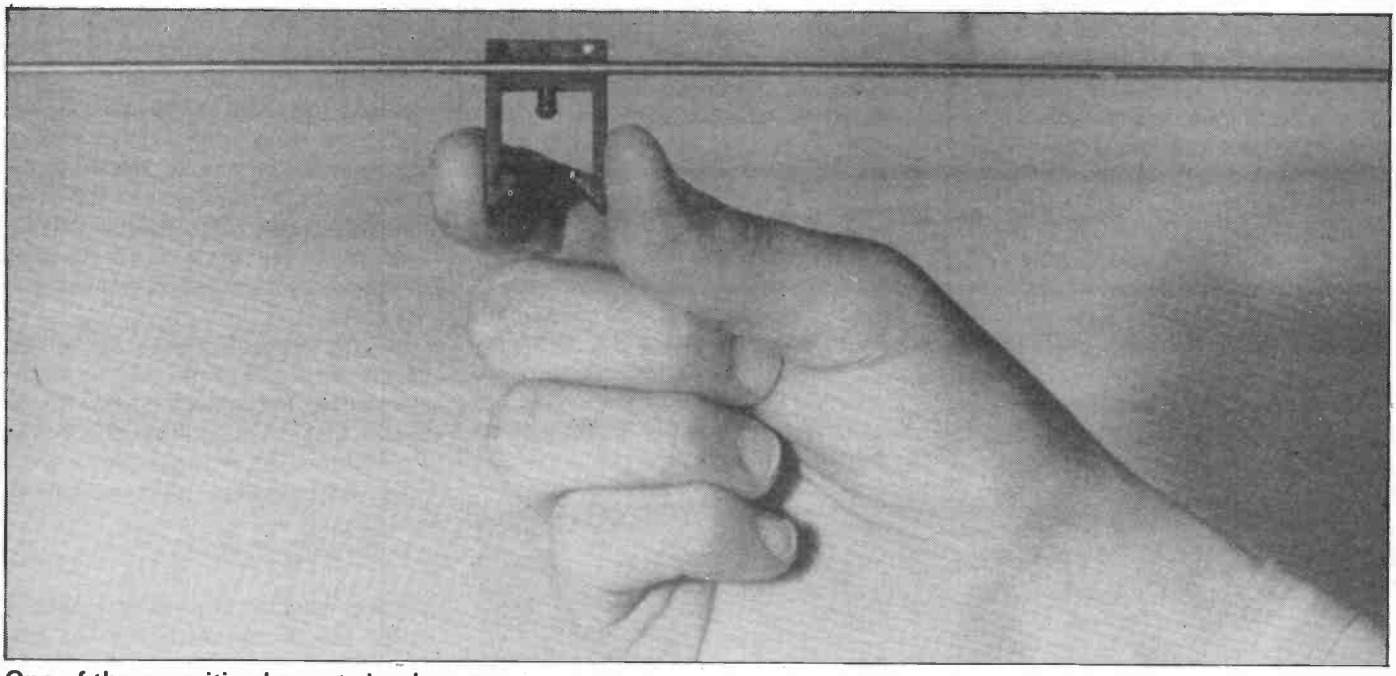
Driven element with 'N' type connection

16 dB below peak with a front-to-back ratio of about 24dB.

Silver Gimmickry?

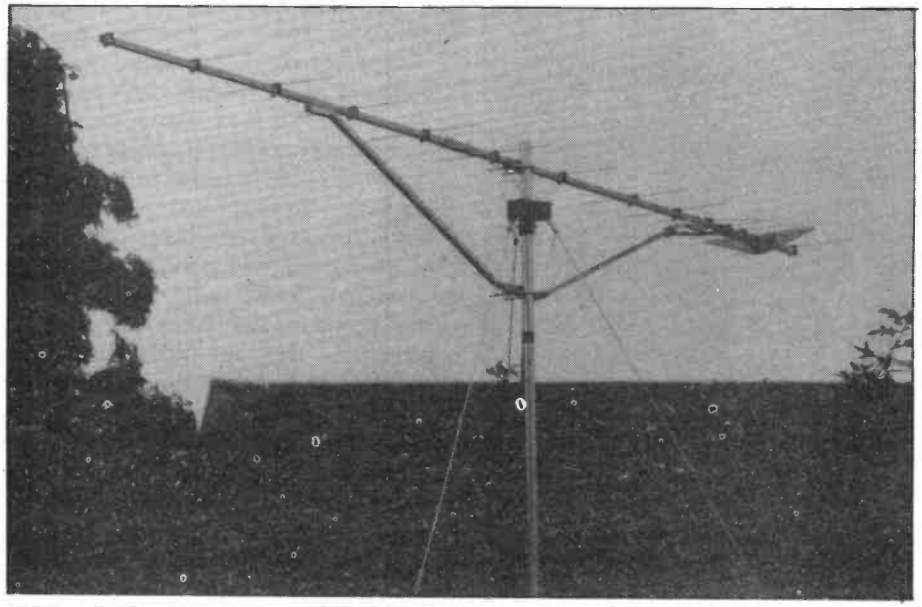
I wondered to what extent the silver plating was a marketing gimmick for although, as the manufactures explained, "its oxide is such that it would have a lower resistance than the base metal, thus adding to overall stability", it was noted that after just a few weeks the thin layer of plating was showing signs of deteriorating.

The Silver 70 would make an ideal portable antenna as it is so easily assembled and so manageable to transport, although the reviewer later erected the antenna at his home QTH and found that as passing birds perched, the elements slipped and maintenance was required to restore the position.



One of the parasitic elements in close-up

Erected at the author's home



Clamping to a mast is accomplished by means of two clamps supplied which allow for a maximum mast diameter of 52 mm, although mounting for horizontal polarisation only is possible. To achieve vertial polarisation an extra hardware kit is available from the manufacturers, as is hardware to allow several of these aerials to be stacked or banked (with quoted wind loading of 0.83 sq.ft. there should be no problem in doing this).

Supplied complete with a two-year guarantee, the Silver 70 is available from Ant Products, All Saints Industrial Estate, Baghill Lane, Pontefract, West Yorkshire, for £31.95 plus carriage.

EVALUATING SURPLUS BARGAINS

Things may not be what they seem to be, particularly if they are feeder cables... by Andy Emmerson G8PTH

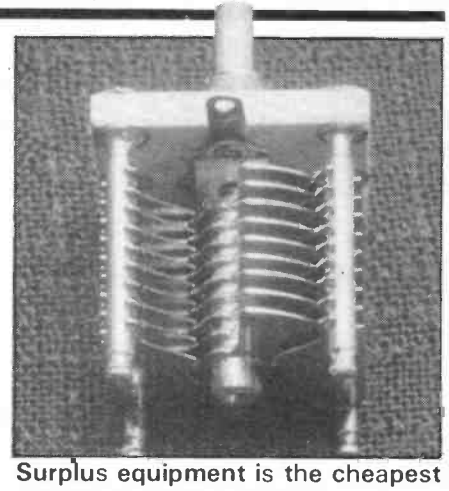
Being a spendthrift and an impulse purchaser is quite a problem, since yours truly cannot resist a bargain! The loft and garage at my house are littered with equipment racks, old test sets, boxes of valves, connectors and panel meters. Readers who suspect this is just journalistic licence are invited to take a conducted tour... Some of these surplus bargains picked up at rallies, junk sales and surplus shops never turn out to be the bargains they seemed at the time, well not until a fortnight after I threw the items out in disgust, and I end up wishing I had counted to ten before dipping into my pocket! So this article is intended to give you a guide to sorting out the real bargains.

Beauty is said to be in the eye of the beholder and to a large extent, so is a bargain. Very few vendors are in the charity business, so I suppose the first thing to check out is why an apparent bargain is so cheap. I can think of four reasons:

- it has no commercial use,
- it is beyond economic repair (or is unrepairable),
- it cannot be identified (or no data is available), or
- it is stolen.

Setting aside the last case, which is fairly uncommon, we need only consider the other three situations.

Items with no commercial use may just be junk which has fallen out of favour on account of its size or because it uses outdated techniques. Space is not always a prime consideration for us hams and we may well be prepared to tolerate something bulky or valvey which commercial users would no longer give houseroom to. A good case is valved frequency counters, video monitors and general coverage receivers. If properly maintained some of these will be perfectly serviceable and will additionally save the cost of a room heater in winter. Claims that an item is in good working order should be treated with some suspicion, but your eyes should give you a good idea of how an item has been treated in its past life. 'Sold as seen' means exactly that, built-in faults and all.



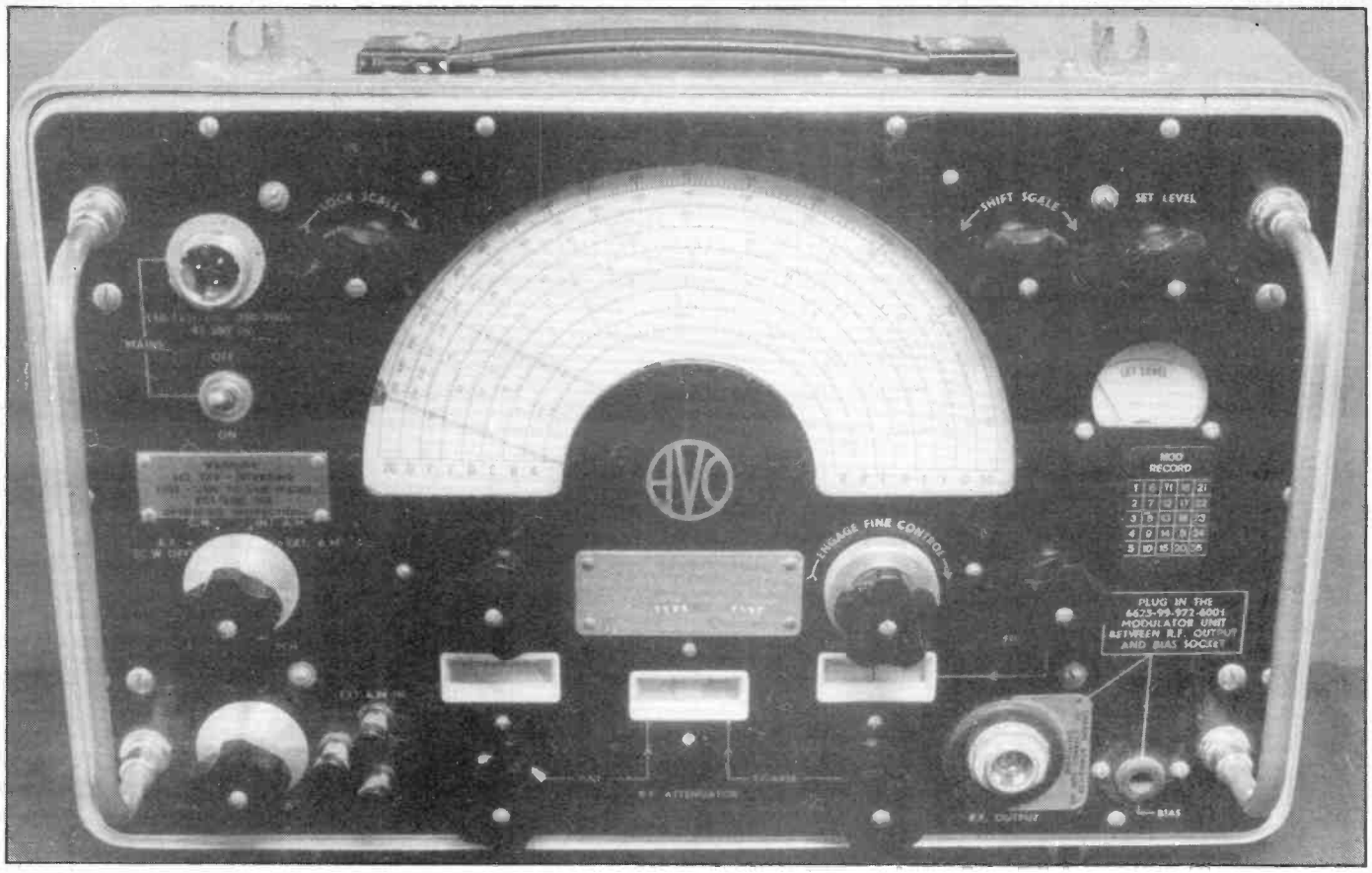
Surplus equipment is the cheapest source of quality variable capacitors.

Base for the 4X/CX series of valve — commonly found in ex-MOD RF equipment

PA of many a public service RT and 2m TX — the QQV03-20A.

Items beyond economic repair can also be valuable. If you don't cost your time on an economic basis and enjoy a challenge you may be able to restore an old unit to its former glory. Some people take this to elaborate extremes and clean panel knobs with detergent and toothbrushes, and crackle finish paint with baby oil to get a sleek, like new, finish. You should be sure that service data and spare parts are still available, and if in doubt don't spend more than you can afford to lose. I can look back with mingled amusement and sorrow at one item on which I spent many pounds replacing leaky and dried out capacitors, changing high resistance and open circuit resistors, not to mention many weekends, and even then the thing never worked properly! Equally, some obsolete varieties of valve, transistor and connector may still be available only at ludicrous prices. You only need look at some of the advertisements in the back of the magazines to see the astronomical prices quoted for some replacement valves these days.

Items which cannot be iden-

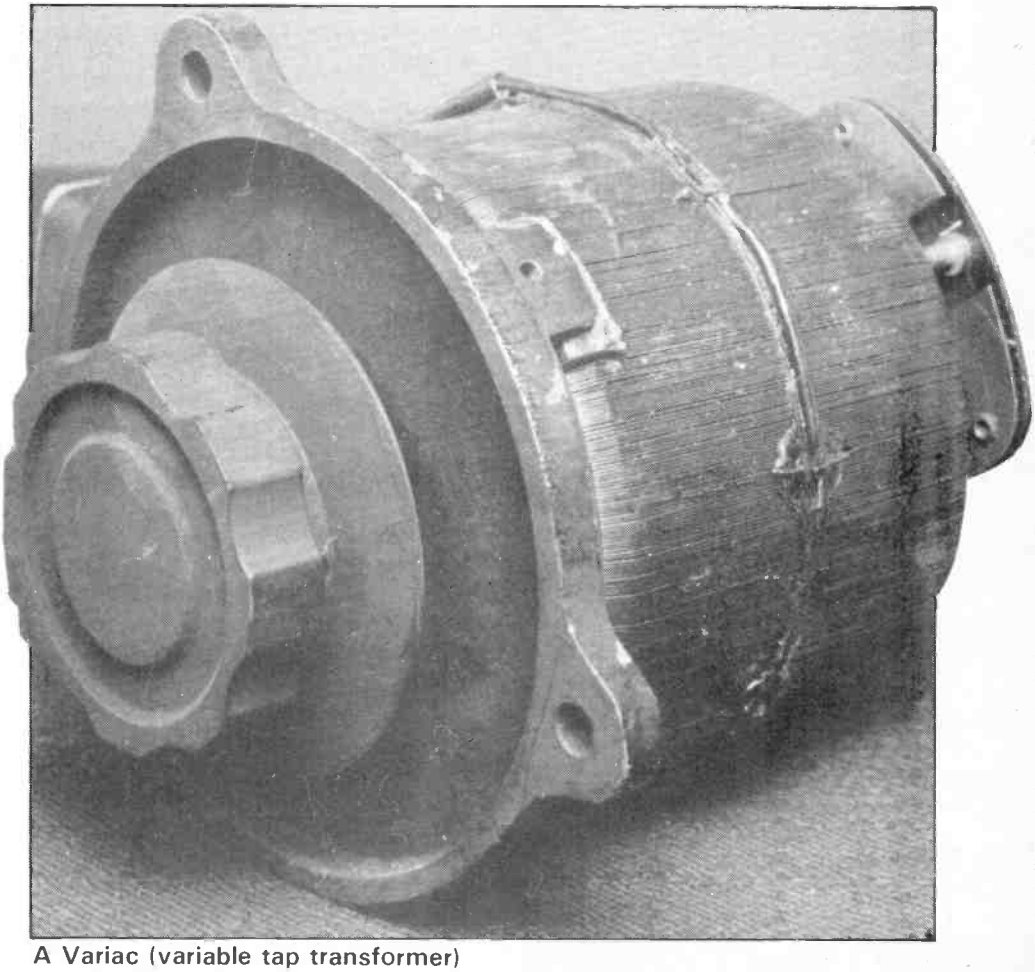


AVO RF signal generator bought as surplus.

tified are still a source of real bargains, particularly if the trader doesn't know what it is and YOU do! Most dealers in 'pre-owned' equipment have a pretty shrewd idea of the identity and resale value of their stock-in-trade but they occasionally pick up 'one-offs' for a song which they pass on at low cost. If you know its true value — and have sufficient documentation to get it going — this could be a way of getting a real bargain. I picked up a video-frame store for £35 which I later found was exactly one hundredth of its original cost (but I must admit I haven't got it going yet!).

Some items are well worth searching out surplus: power supplies and the parts used in them spring particularly to mind. RF cables and connectors are also cheaper bought surplus and in many cases these are in new condition. There are, however, some very bad deals in connectors and cables and these must be avoided at all costs unless you like buying expensive attenuators. Worst of all, looks can deceive and for this reason I shall devote the rest of this article to this subject.

As we all know, most flexible



A Variac (variable tap transformer) of unknown manufacture.

A useful surplus buy is the Marconi D52 oscilloscope

feeder cables are made of four components — a central conductor of solid or standard copper wire, a dielectric of solid or foamed polythene, a braiding of wire and an outer mantle of polyvinylchloride (PVC). To achieve efficient transmission of RF we need low resistance in the metallic conductors and a non-glossy dielectric. In addition the jacket needs to protect the cable against abrasion and moisture, and a high density of braid is necessary to avoid radiation of the signal from the feeder.

Braid density is not readily visible (unless you strip the outer jacket) and many cables sold to undiscerning CB users have a hopelessly low braid density. The designation RG-8/U etc. is not in itself a guarantee of braid density, so don't be caught out in this way. The chemical composition of the outer jacket is important too, and again without specialist knowledge you might not suspect this. Vinyl in itself is a fairly stiff material and in order to make it flexible and workable various plasticisers are injected into the vinyl compound. Unfortunately some of these plasticisers gradually leach out of the vinyl and start to contaminate the braiding and dielectric. Exposure to the elements, particularly summer temperatures, hastens this effect and gradually the plasticiser migrates to the polythene, raising its dielectric constant and power factor and hence VSWR and attenuation. Having lost the plasticiser the outer vinyl starts to go brittle and cracks, allowing in moisture which corrodes the braid. Because of the skin effect this further attenuates the RF signal.

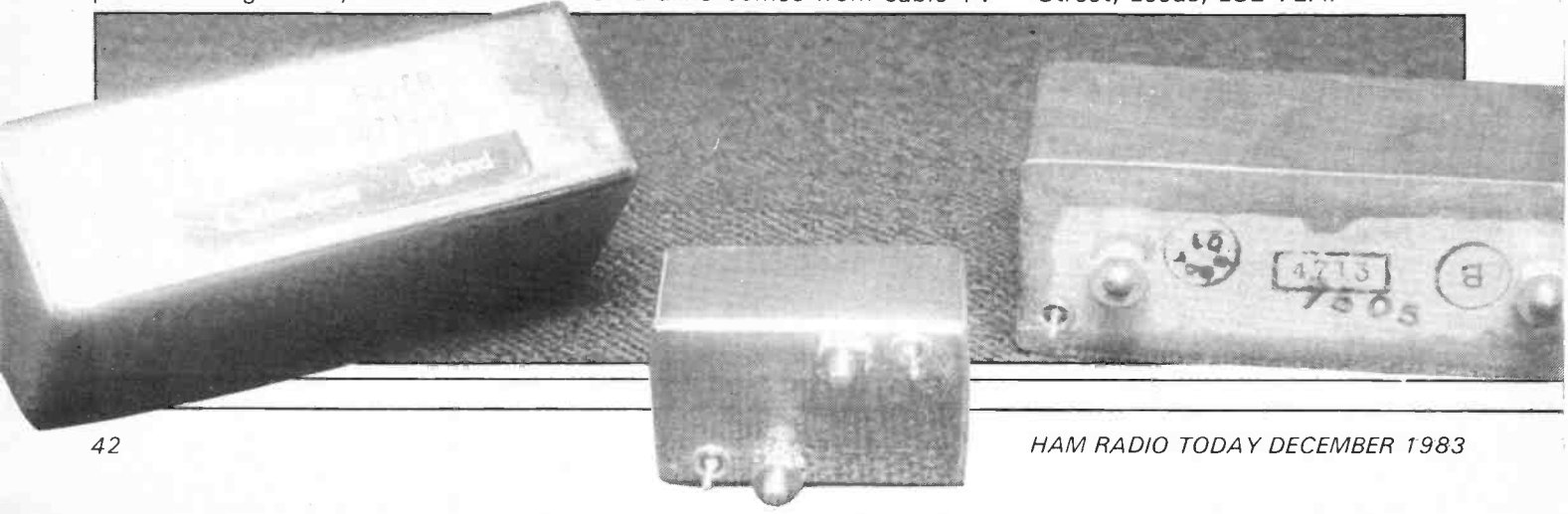
Does this start to sound familiar? After some 15 years many RF cables go brittle, the dielectric goes yellow and the braid is almost impossible to solder. Even if stored unused this type of cable is decidedly 'dodgy' and ends up on the surplus market! So be warned: cables with 'simple' numbers (no suffix) like RG-8/U and RG-58/U are definitely suspect and should be declined in favour of 'improved' cables like RG-8A/U and RG-58B/U. The A and B suffixes indicate 'safe' plasticisers and have a life expectancy in excess of 15 years. Spending £10 or £20 on GOOD cable is really a wise investment for your expensively produced signal.

Occasionally 'exotic' cables turn up at bargain prices, for instance *heliax* and hardline. Some of the hardline comes from cable TV schemes and is of 75 ohms impedance — this may prove difficult to match into your system. In any case the specialised connectors for these cables do not come cheap — prices start at £10 per connector and go up to £30; improvising by homebrew means may result in VSWR bumps and indifferent results. Cheap and nasty connectors can usually be judged by visual inspection: avoid any with dusty phenolic or yellowing polythene insulation and any with dull or corroded metal surfaces. Older BNC plugs will not have captive cable grips, and there are a lot of 75 ohm BNC and N type connectors looking deceptively like 50 ohm ones (until you get them home!).

Finally a word on surplus equipment of USA origin: most of this is of high quality and well worth buying. The abbreviations may look baffling but using the accompanying table you will be able to amaze your friends by identifying the gear's characteristics and purpose. Good hunting! ●

Further Reading:

The Government Surplus Wireless Equipment Handbook Price £7.50 + £1.50 post from Myers Electronics, 12/14 Harper Street, Leeds, LS2 7EA.



Military Equipment Nomenclature

1st Letter (Type of installation)		*2nd Letter (Type of Equipment)*		*3rd Letter (Purpose)*	
A	Piloted aircraft[3]	A	invisible light, heat radiation	A	Auxiliary assemblies (not complete operating sets used with or part of two or more sets or sets series)
B	Underwater mobile, submarine	B	Pigeon (do not use)	B	Bombing
C	Air transportable (inactivated, do not use)	C	Carrier	C	Communications (receiving and transmitting)
D	Pilotless carrier	D	Radiac	D	Direction finder, reconnaisance, and/or surveillance
		E	Nupac	E	Ejection and/or release
F	Fixed ground	F	Photographic*		
G	General ground use (includes two or more ground-type installations)	G	Telegraph or teletype	G	Firecontrol or searchlight directing
				H	Recording and/or reproducing (graphic meteorologial and sound)
		I	Interphone and public address		
		J	Electromechanical (not otherwise covered)		
K	Amphibious	K	Telemetering	K	Computing
		L	Countermeasures	L	Searchlight control (inactivated, use "G")
M	Ground, mobile (installed as operating unit in a vehicle which has no function other than transporting the equipment)	M	Meteorological	M	Maintenance and test assemblies (including tools)
		N	Sound in air	N	Navigational aids (including altimeters, beacons, compasses, racons, depth sounding, approach, and landing)
P	Pack or portable (animal or man)	P	Radar	P	Reproducing (inactivated, use "H")
		Q	Sonar and underwater sound	Q	Special, or combination of purposes
		R	Radio	R	Receiving, passive detecting
S	Water surface craft	S	Special types, magnetic, etc., or combinations of types	S	Detecting and/or range and bearing, search
T	Ground transportable[1]	T	Telephone (wire)	T	Transmitting
U	General utility (includes two or more general installation classes, airborne, shipboard, and ground)[2]				
V	Ground, vehicular (installed in vehicle designed for functions other than carrying electronic equipment, etc., such as tanks)	V	Visual and visible light		
W	Water surface and underwater	W	Armament (peculiar to armament, not otherwise covered)	W	Automatic flight or remote control
		X	Facsimile or television	X	Identification and recognition
		Y	Data processing		

*Not for US use except for assigning suffix letters to previously nomenclatured items.

1 probably large and heavy
2 probably 115V AC powered
3 probably high voltage DC powered

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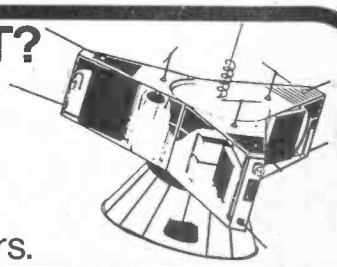

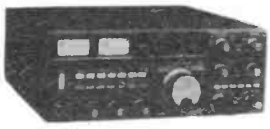

FT726R

TRANSCEIVERS

FT726R	Transceiver c/w 2M	£675.00
430/726	70CM Module	£230.00
SAT726	Full duplex module	£90.00
FT780R	70CM All mode 10W	£399.00
FT790R	70CM All mode 1W	£299.00
FT290R	2M All mode 2.5W	£249.00

LINEAR AMPLIFIERS

FL7010	70CM 1W to 10W o/p	£91.00
MML432/30L	70CM 1 or 3W to 30W	£129.95
MML432/50	70CM 10W to 50W	£129.95
MML432/100	70CM 10W to 100W	£245.00
MML1296/10W	23CM 1W to 10W	T.B.A.

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UR67	P/Metre	£0.67
H100	25 Metres	£19.50
H100	50 Metres	£39.00
LDF2/50	Andrews heliax p/m	£2.85
LDF4/50	Andrews heliax p/m	£3.58

Carriage on coaxial cables
£2.50 for up to 25M, over 25M £3.20

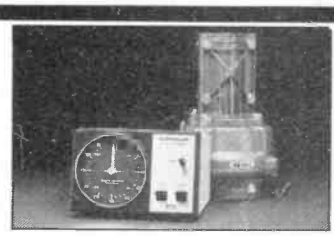
TRANSVERTORS, CONVERTORS AND PREAMPS

FTV707R	Transvertor c/w 2M	£99.00
FTV107R	Transvertor c/w 2M	£89.00
FTV901R	Transvertor c/w 2M	£139.00
432TV	70CM Module for above	£214.65
MMT432/28S	Transvertor 432-436 MHz	£159.95
MMT432/144S	Transvertor 432-436 MHz	£184.00
MMC144/28	Convertor 2M down to 10M	£29.90
MMC432/28	Convertor 70CM down to 10M	£37.90
MMC432/144S	Convertor 70CM down to 2M	£37.90
MMX1268/144	1268 MHz Tx Convertor 2W	£135.00
MMA144V	2M Preamp RF switched	£34.90
SLNA144S	2M Preamp RF switched	£37.10
SLNA144U	2M Preamp unswitched	£22.40
SLNA144UB	2M Unboxed (144U)	£13.70
GBFA144E	2M Gasfet masthead preamp	£129.90
SLNA 145SB	FT290R Preamp	£27.40
TLNA432S	70CM switched preamp	£74.90
TLNA432U	Unswitched (432S)	£29.00
GLNA432U	70CM Gasfet unswitched	T.B.A.

MML 1296/10

MML

Carriage is free except where indicated.



KR

ROTATORS

KR400	Meter controller	£97.75*
KR400RC	Round controller	£114.94
KR600RC	Round controller	£163.30
AR40	CDE	£90.85
Cd45	Meter controller	£136.85
HAMIV	Meter controller	£258.75
KCO38	KR400/600 Lower bracket	£12.07
KR500	Elevation rotator	£112.12*

* Rotators could be used with a home computer for automatic tracking of satellite.

ANTENNAS

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8XY/2M	2M 8 Ele crossed	£35.65
10XY/2M	2M 10 Ele crossed	£46.00
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8XY/70	70CM 8 Ele crossed	£48.87
12XY/70	70CM12 Ele crossed	£52.90
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Carriage on antennas Each £2.50

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XF8.9KA	6 KHz AM filter	£17.25
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MEMT901	Memory Unit	£87.90
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70TV	4m transvertor module	£84.70
144TV	2m transvertor module	£109.65
430TV	70cms transvertor module	£214.65
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XF8.9HCN	CW Filter 300Hz	£26.05
XF8.9GA	AM Filter 6KHz	£26.05
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FT707	Transceiver 100W 10-80M (8 bands)	£49.00
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FC707	Antenna Tuner	£85.00
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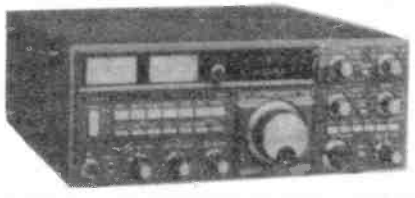
FRB707	Relay switching box	£15.35



FT726R(2)	Multimode multiband c/w 2M	£675.00
FT726R	Main frame only	£550.00
50/726	6m module	£170.00
21/24/28	HF module for 15m, 12m and 10m	£180.00
144/726	2m module	£135.00
430/726	70cm module	£230.00
SAT726	Full duplex module	£90.00
XF455MC	600Hz CW filter	£39.85
FT230R	Transceiver 2m FM 25W	£239.00
FT730R	Transceiver 70cm FM 10W	259.00
690R	Transceiver 6m 2.5W multimode	239.00
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SC1	Station console	£138.00
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FT720RV	Transceivers 2m 10W FM	£199.00
FT720RVH	Transceivers 2m 25W FM	£209.00
FT720RU	Transceiver 70cms 10W FM	£229.00
FT720R	Control head	£100.00
720RV	deck only 2m 10W	£100.00
720RVH	deck only 2m 25W	£110.00
720RU	deck only 70cms 10W	£130.00
S72	Switching box	£39.00

Prices include VAT & Carriage

E72S	cable, 2m long	£10.00
E72L	cable, 4m long	£15.00
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FT708R	Transceiver Handheld 1W 70cms	£209.00
FNB2	Nicad Battery Pack	£19.95
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NC9C	Slow charger	£8.00
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NC8C	quick charge and PSU	£50.60
MMB10	Mobile bracket	£6.90
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DCRG7700	DC modification kit	£1.15
MEMG7700	Memory option	£98.90
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Yaesu FT726 VHF/UHF multimode transceiver

Just occasionally we have seen rigs developed which could be described as 'all eggs in one basket' machines. After years of development, Yaesu have now introduced their more amazing new box, the FT726R into which can be put three seperate bands in the form of modules, the review sample incorporating 70cm, 2m and 6m. USB, LSB, CW and FM modulation us included, and several methods of tuning are available. The normal VFO covers either 10KHz of 100KHz per rotation in 20Hz or 200Hz steps, the VFO being available for all modes. A conventional click position rotary can be selected for FM and programmed to either 12.5 or 25KHz channelling on 2m or 70cm, but the 6m module has 5 and 10KHz channelling.

Marketing an all-singing all-dancing transceiver can be a risky business — it takes only one bad section to let the whole rig down. Has Yaesu's risk paid off? Angus McKenzie investigates the FT726R.

For the UK market, models sold by official Yaesu dealers will have the previously mentioned channelling, but a hugh variety of alternative modules are available with different frequency ranges and/or different channelling and repeater shifts. You may need to watch out for 'parallel' imports and check to see if they have the correct modules which are better suited to the UK situation. (SMC, who supplied the review model, have pointed out that Japanese home-market models, possibly available in this country as 'black imports', are *not* readily convertible to UK specifications.)

There are also up and down buttons which can be used either to step FM channels, or to start a scan, this latter option cutting in when the button is held on for more than 0.5 second. Audible pip tones show the commencement of scanning, etc. Three buttons on the microphone also select up/down and 12.5KHz steps if the FST button in the middle is depressed at the same time, this FST button duplicating the large/small steps button on the front panel.

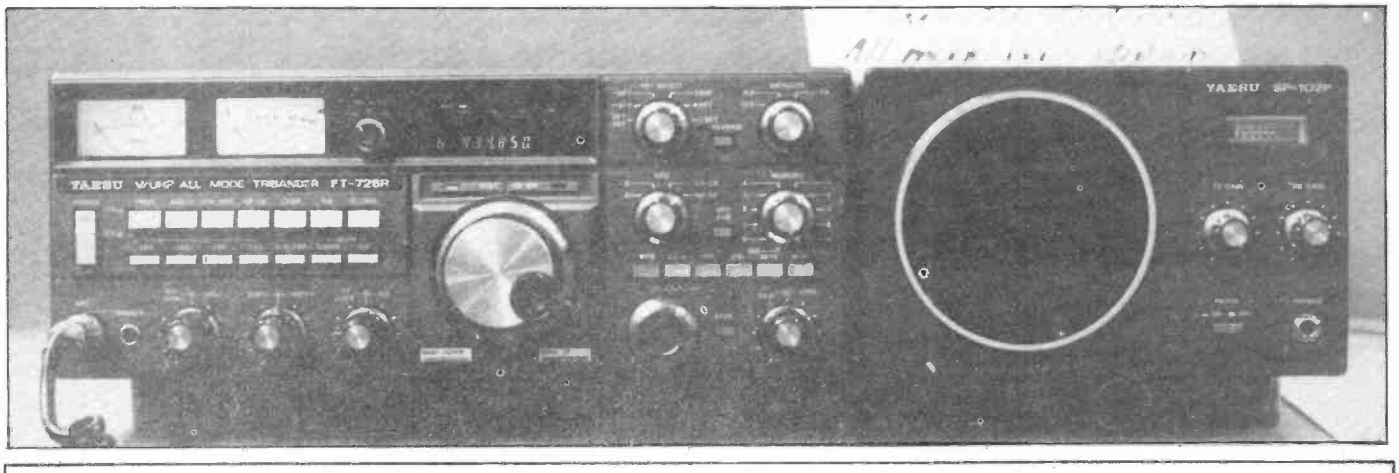
Scanning speeds vary from 2KHz/20KHz per second for SSB/CW and FM/VFO to 100/200KHz per second on FM channels. A repeater switch selects either the appropriate up and down repeater shifts on the band selected, or user programmable shifts. A seperate button selects normal or reverse repeter mode, operating properly on both RX and TX.

Two VFOs are incorporated with facilities for splitting them on RX and TX. Ten memories allow mode, frequency and band to be stored. A sweeping function with frequency limits selected by the first and last normal memories allows any required portion of a band to be swept. Buttons control the selection of VFO, call with tone, memory recall, priority channel, memory/VFO changeover and memory write. The two VFOs can be set onto the same frequency by pressing one button.

On the left side of the box, there are two rows of pushbuttons for selecting mode, clarifier with clear (the FM channel knob becomes a clarifier when this is selected), up/down scanning etc., processor on/off, AGC fast/slow, narrow CW filter (optional), FM channels or VFO, noise blanker, and dial lock. A rotary switch selects meter-read discriminator, ALC, or power out. Two meters are provided which have normal modes of S-meter and power out, although indications were not too accurate from these.

The frequency displayed is to the nearest 100Hz, and thus seven digits. Various other functions are also displayed on the meter panel. Along the bottom are split concentric pots for mic gain and drive (variable on all modes from extremely low to full power), shift and bandwidth (centre indented), AF RX gain and squelch, and RF gain and RX tone.

The review sample was supplied with an additional satellite plug in, which, rather astonishingly, allows the user to transmit on one band at the same time as receiving on another. This is quite



uncanny, and there was only a barely preceptible blocking, thus allowing very efficient duplex or satellite working.

You will certainly need a cold wet towel round your head when you are getting to know all the facilities, and after my lengthy perusal I needed a long think in order to find what was actually missing! The supplied microphone, of course, has PTT, which is duplicated on a socket on the rear panel, but no PTT MOX button is provided on the front panel, which is inconvenient for a long over. A desk mic is available which has a MOX button on it, but I was surprised to see that VOX is also missing from the rig; many will consider this a pity, although I personally do not like VOX. CW keying is semi 'break-in', however, and this worked well.

The only other serious omission that I found is that you cannot turn the AGC off. The rig has an odd little foible on SSB in that even with squelch at minimum, ie. off (squelch works on SSB and FM), the RF gain control will, when turned back beyond a certain point, causes squelch action which is very inconvenient when you want to peak up on a *very* strong signal or increase the receive dynamic range on such a signal.

Well Connected

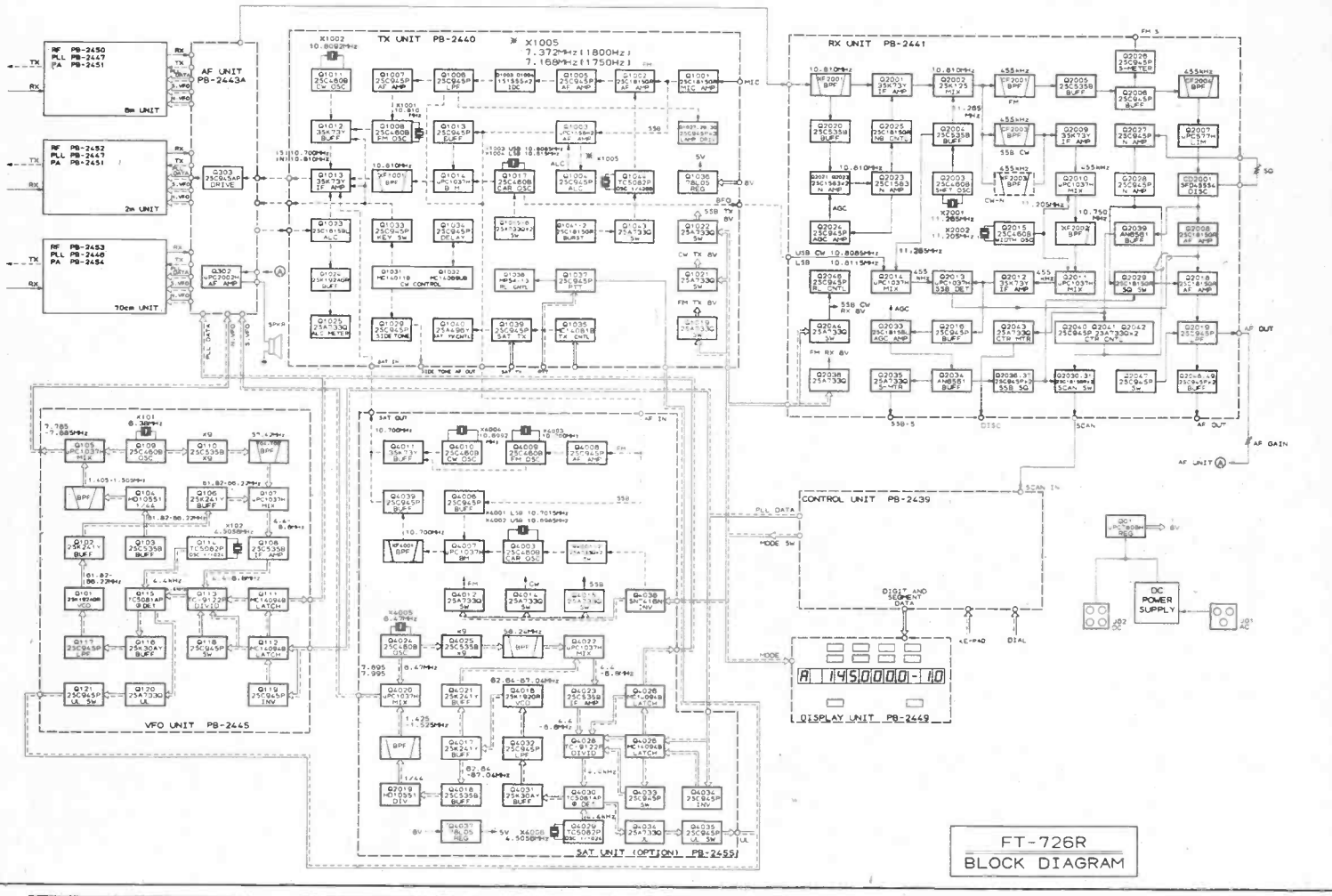
Each band module on the back has its own individual antenna socket, SO239s for 6m and 2m, and an N for 70cm. Beside each socket is a standby 3.5mm jack for interconnecting linears so that the appropriate linear is selected for each band, the sockets applying a short circuit on TX and open RX, which is just how we want it for most linears. Other back panel sockets include a 3.5mm speaker jack, AF out on a phono socket (around 0.5V from 600 ohms from the top of the volume control, and therefore independent of the control setting), PTT on phono, CW ¼" key back, 13.8V DC (chassis socket requiring a 4-pin plug). An IEC mains socket is complemented by its fuse and a large grounding post with wing nut.

Inside a well on the top are four switches selecting scan for busy, manual or clear, scan stop or pause, tone squelch (optional accessory but of no interest in UK) and repeater toneburst on/off (unfortunately this also works on simplex, I don't mind this as you can switch it off, but some will find it irritating and might well forget that it is on when transferring to simplex). A lithium battery is provided internally for holding the memories when mains is unplugged and this facility is switchable.

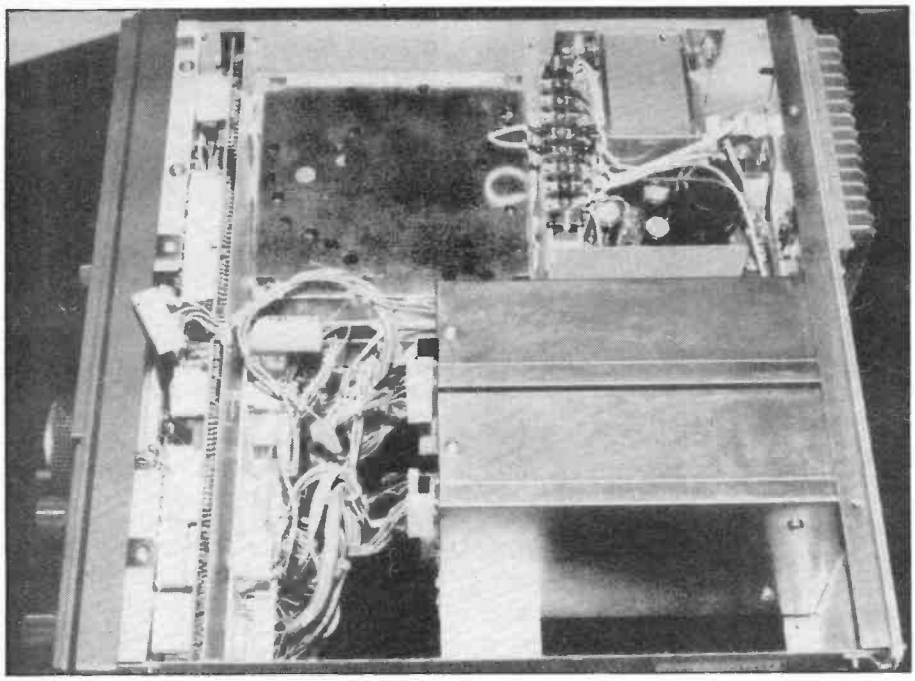
Mere Niggles?

At this stage perhaps I should mention a few more niggles, but please realise that this is my opinion, though it is shared by one or two other 726 users.

When using VFO on say 2m, it is very easy to knock the band up or down buttons accidentally and when you step back again, you find that you have lost your frequency which requires you to find the station again. You can lock the rig on a frequency but then you cannot VFO from this lock position easily. I



FT-726R
BLOCK DIAGRAM



Top view of FT726R showing the general layout. The Motherboard is mounted vertically parallel to the front panel (LHS). PSU at top RHS.

got over this problem, which kept on occuring because my fingers are rather large, by inserting the frequency in use into a memory and then recalling it, followed by memory to VFO. At any time I could then re-establish frequency with VFO in a second or two. I feel that Yaesu should have had seperate memories on the VFO automatically switched on for each module. If you just shunt 1MHz within a band, incidentally, you do not lose the KHz frequency, and just the MHz changes.

The frequency readout can easily be read at a distance, and it is set back from the front panel slightly thus helping to reduce the effects of glare from the sun for example; however, if you move your head vertically off axis, it becomes difficult to read.

And There's More....

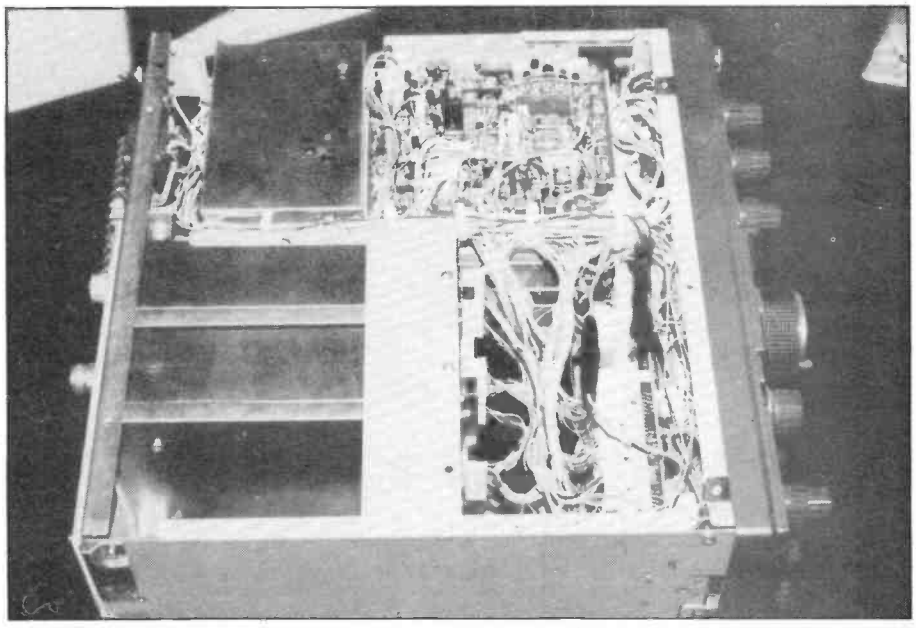
I do not want to bore the reader by detailing the facilities any further, so suffice it to say that it provides almost every requirement except preparing coffee (or beer), although one could possibly fix this too! But how did it all work out in practice?

I used the rig on and off for several weeks, and found the RF performance to be very good in almost all areas. On 2m for example, I found the VFO to be smooth and convenient for SSB/CW, but I preferred to use the channel click switch on 12.5 or 25KHZ spacings for FM; however, just occasionally I used the VFO for FM to cope with the very occasional station who insisted on using 10KHz offsets. Scanning worked superbly well either from the mic or rig, and in the pause mode it stopped for just about the right time for me to decide whether to stop it or not.

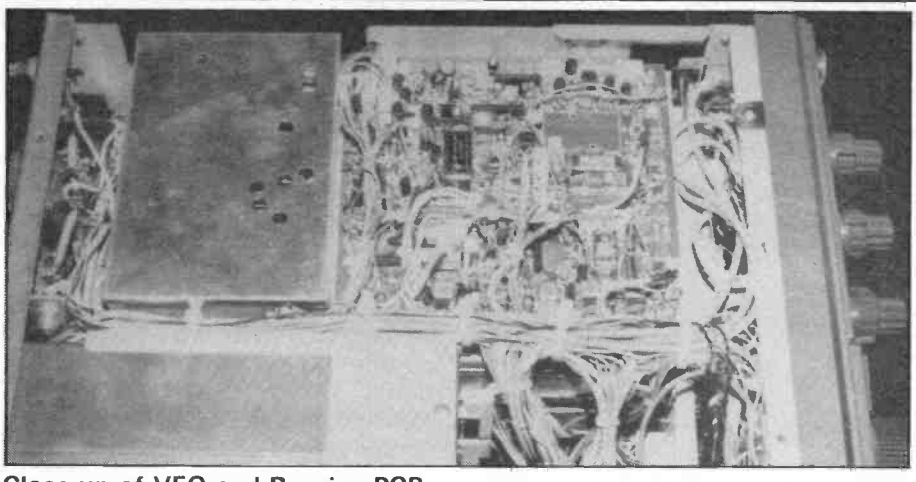
The facility for transferring from memory to VFO is marvellous, allowing you to return at an instant to a calling frequency, or beacon, and then VFO from it. RF input sensitivity was excellent on 6m, and good, but not outstanding, on 2m and 70cm. The RIFM performance was good on all three bands, and so an RF preamp external to the rig could be used quite frequently, provided that nobody was belting RF at me within very close range! Selectively on all modes was most certainly better than average, coping well with 12.5KHz spacing on FM for example, whilst the CW narrow optional filter was most useful, although I would have preferred a slightly flatter top and steeper skirts.

Transmitted audio was particularly good on all modes, but you will need to watch the position of the power control on SSB, for strange things seem to happen when this was advanced beyond the point where ALC is just beginning to act. A number of stations reported that not only was I producing audible clicks on transients up to 50KHz either side of the transmission on 2m, but there was a tendency to roughness on the channel. These transcient clicks could muck up somebody else's DX QSO. I had to reduce the power control to half way before the clicks virtually went, so clearly the module itself had too much gain. After correction, the PEP reading had only reduced by 0.5dB, so no significant peak power was lost.

Other 726 users that I contacted did not have this clicking problem, so presumably my 2m module was slightly faulty. I much prefer a power control which starts cutting back almost from the mo-



Bottom view of FT726R. VFO (in screened box) top LHS. Receive board top RHS. 2m and 70cm modules centre and lower LS.



Close up of VFO and Receive PCB.

ment of turning down from maximum.

The compressor action was almost inaudible unless I was being received extremely weakly, and in a way this is a good point since it was not obvious when I was using the compressor at all. I would have preferred, though, to have the availability of more control on the degree of compression and clipping.

Received audio was definitely better than average on FM, although I have heard better. On SSB however, the audio just did not seem clean, for whilst a continuous tone was acceptable, but not good, speech transient seemed to be surprisingly rough from stations that I know always put out very clean sounding signals as heard on my normal station equipment. I suggest that something is not quite right with the attack time of the AGC, or the transcient performance of the product detector. Other 726 users tended to agree on this.

I would also have preferred a better quality built-in speaker on such an expensive rig, for it is often inconvenient to use an external one. An external speaker improved matters, but I would have liked a little more power reserve when using the rig in the open air as a demonstration station.

The IF shift and bandwidth controls are easy to use. I tuned the receiver over the entire width of each band and to my amazement found only one minute spurious tone equivalent to around 0.05uV on 50.926MHz, which I don't think could possibly worry anyone. This is outstandingly good, especially because of the rig's complexity. Oh yes, I almost forgot, I particularly liked the power variation facility — which could be set to give as low as a few mW of RF output on all modes.

All the repeater normal and reverse shifts operated perfectly, reverse repeater being extremely useful, especially on 70cm.

Hot Stuff

The large heat sink on the back left hand corner does get very hot, so you will need to allow plenty of air behind the rig on your bench. I can't see you using this rig in the car unless you have a ginormous parcel shelf, but it would be fabulous for Field day.

I have a personal prejudice against plastic bodies and front panels, and I would have much preferred this machine to have a nice shiny metal front rather than its plastic one which could become rather tatty after a while.

The front panel layout could have been better thought out; for example, would it not have been better to have the RF gain with the AF gain, and the squelch with the tone? The up and down band buttons are very inconveniently positioned, and I would have preferred these much higher up.

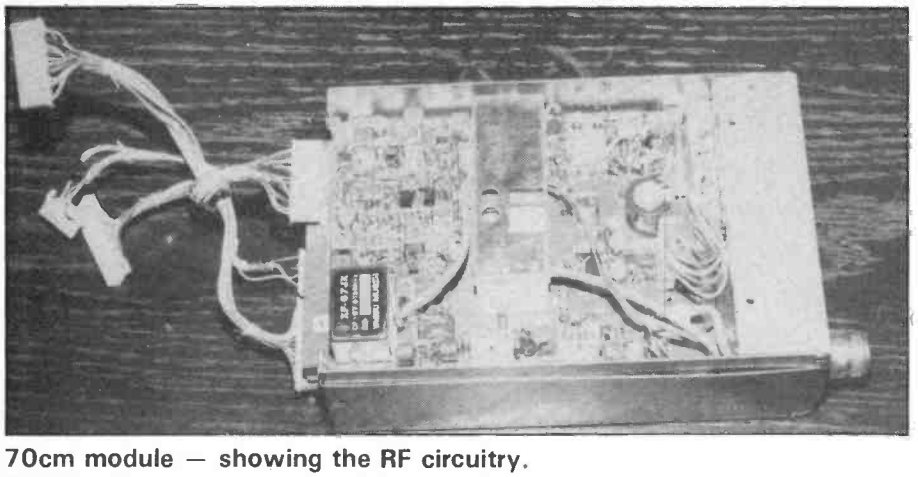
Many have found the satellite duplex provision to be quite awkward to use, but I would have thought that after a few times most users would find the procedures almost instinctive, although it is not always clear what the frequency readout is indicating during setting up this mode.

Laboratory Tests

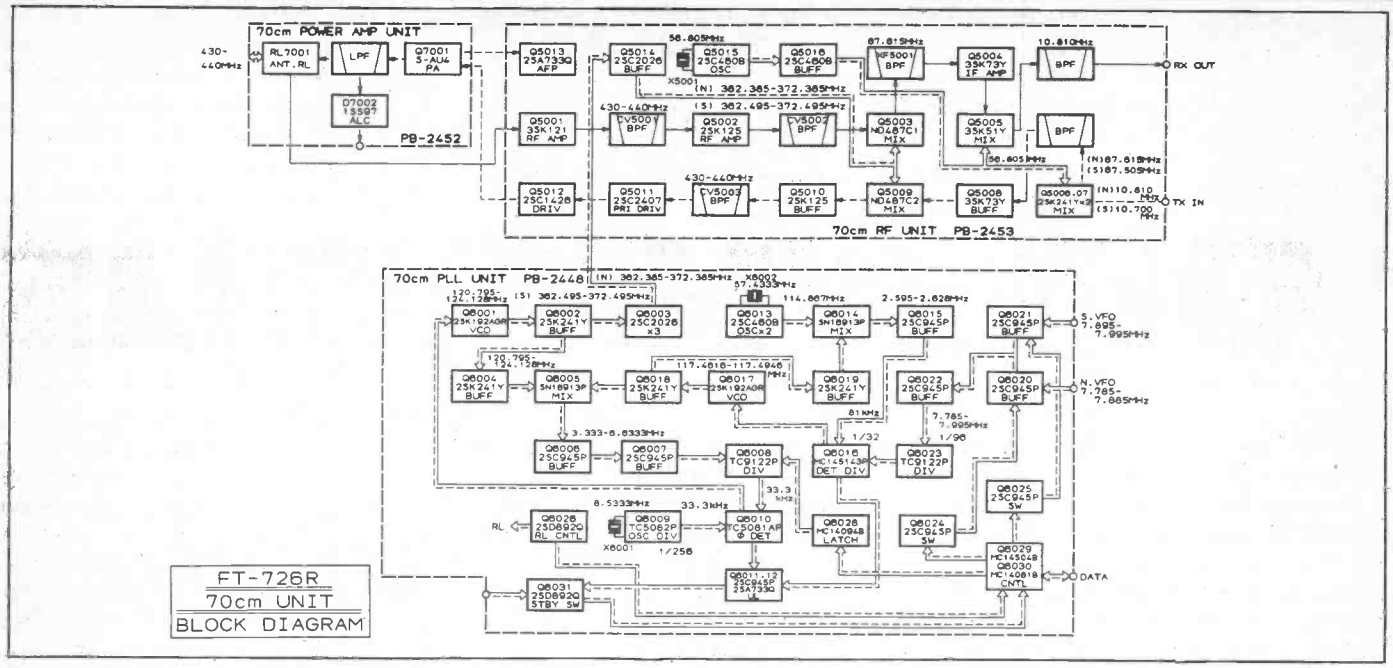
Looking over all the vast array of figures from the lab. tests, we can see that the RF sensitivity on all bands is better than average on both FM and SSB, although not quite 'state-of-the-art'. I am particularly impressed with the 70cm performance, as normally one would expect it to be slightly worse than that on 2m. The SSB performance was virtually identical to that of FM, the CW narrow bandwidth with the optional filter of course giving more sensitivity still.

Two-tone radio frequency intermodulation (RFIM) on each of the bands. All the results were reasonably good on 6m, very good on 2m and excellent on 70cm in comparison with other raw black boxes. I gain the impression that Yaesu designers have at last realised the importance of giving a good RFIM performance combined with a good sensitivity, although they could have achieved even better, as was shown in the recent IC251E/Mutek review.

In practice, I did not on any occasion hear any IM products developed from stations outside the 2m band, no problems being noted from the hundreds of police transmitters around my area, which are above 146MHz. Very strong signals on SSB caused no serious problems quite close to a received



70cm module — showing the RF circuitry.



frequency provided that the adjacent signals were themselves clean.

Selectivity

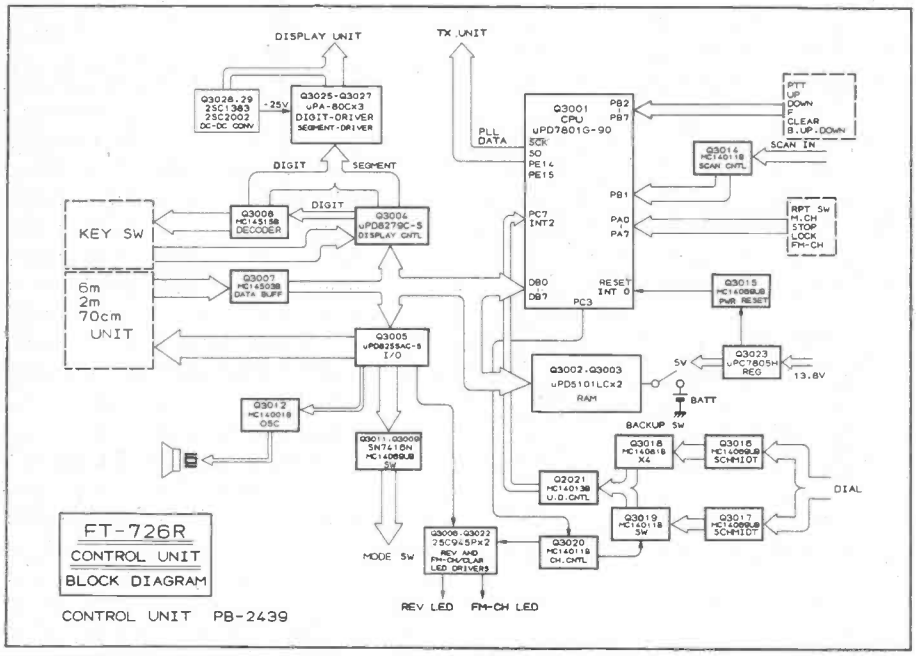
The selectivity on all bands on FM was very slightly lopsided, but very good on 12.5kHz channelling and superb on 25kHz channelling. On SSB the 3dB bandwidth was just about right, the skirts being quite sharp down to −60dB, thus giving a very good shape factor. The passband ripple was minimal on the SSB filter, thus helping received audio to be better than on the IC251E. I quite liked the optional CW narrow filter for it did have less loss than usual, although its shape was not ideal.

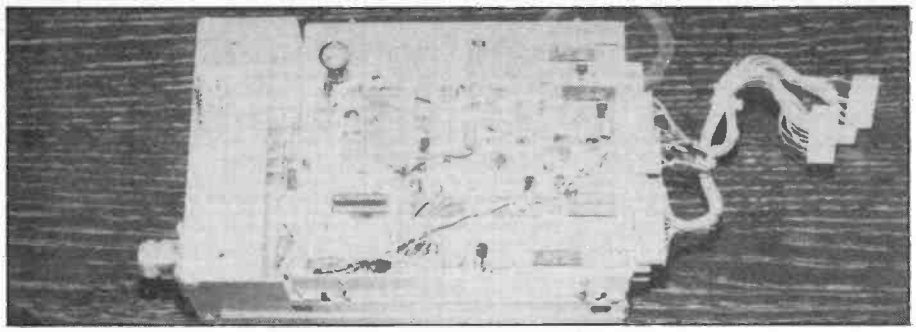
The S-meter on FM offers a very poor performance from S3 to 9 + 20dB, the actual difference being only round 10dB between these points. On SSB and CW the S-meter scale covers a far greater range, and this is very useful.

Frequency Accurancy

We checked frequency accuracy on receive on both SSB and CW. The 50MHz band was excellent, whereas 2m and 70cm were up to only 300Hz out. The intended frequency is that indicated when a carrier is zero beat on SSB, but with a beat note of 700Hz on CW. This CW offset could be annoying for some users whilst convenient for others and I cannot really show any preference in the case of the 726. I was a little annoyed by a slight shift from USB to LSB on SSB of 100Hz. We used our Marconi 2019 generator with an external standard synchronised to Rugby on 60kHz for checking frequency accuracy. On FM best SINAD was always obtained right on channel which shows excellent alignment of the discriminator.

The reciprocal mixing performance was checked 20kHz and 100kHz off channel on 6m and 2m, and just as 100kHz off, on 70cm, since my lab. equipment is itself not good enough for testing this parameter close in on UHF, and there is no point in quoting meaningless readings. I am just slightly unhappy with the 20kHz figures for they show some synthesiser noise present on the local oscillator, the ratio between noise and reciprocal mixing level averaging at 94dB (82dB ref. 12dB SINAD point). This figure is certainly not bad, though, and better than many other rigs, but what is rather fascinating is the exceptionally good figure on the same two bands at 100kHz spacing, 6m representing an overall dynamic range from this parameter of 110dB, and 2m being around 104dB. I am not altogether happy about some crictics giving receiver dynamic range calculated just from the reciprocal mixing ratio for, as you can see, the figure depends upon how near the carrier you get to make the measurement. The





Other side of 70 cm module — showing the PLL unit.

main receiver IF is at 10.8MHz approximately, the three modules acting as transverters, 70cm having an extra higher IF.

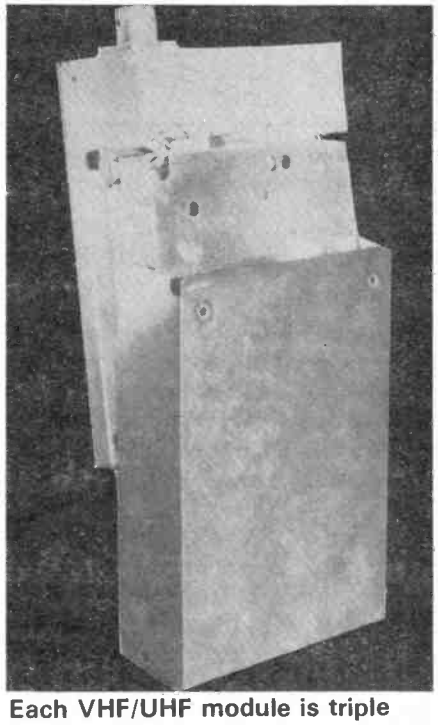
We looked at the static distortion of the product detector on SSB and the discriminator on FM for an audio output level of 125mW. On both modes the distortion was a little high, but whilst FM was acceptable, the SSB measurement did not correlate with the audible transient distoration on speech, whereas ordinary carriers sounded moderately clean, this showing that the AGC attack time was not quite right, and/or there was possibly insufficient overload margin in the entire IF chain to accomodate transients before the AGC could take hold. Fast AGC as very fast indeed, whilst slow AGC is just about how I like it, full recovery taking many seconds. The maximum available output from the rig into 8 ohms was about average and I really would like to see more available.

Output Powers

We checked FM, SSB and CW output powers on all three modules, and whilst I was happy with 6m and 70cm, the 2m module seemed to have been set up for too much available output power, which was confirmed in subjective trials with golden eared listeners! We had a look at the 2nd and 3rd harmonic outputs on all the bands and the only one that worries me is the 2nd harmonic of 52MHz at −59dB, which of course is well within Band II. When the band is opened up to 104MHz in the next few years, we shall have to pay very close attention to 2nd harmonic distortion if we get 50MHz; this should not be a major problem but just a nuisance, because we will all need good output filters.

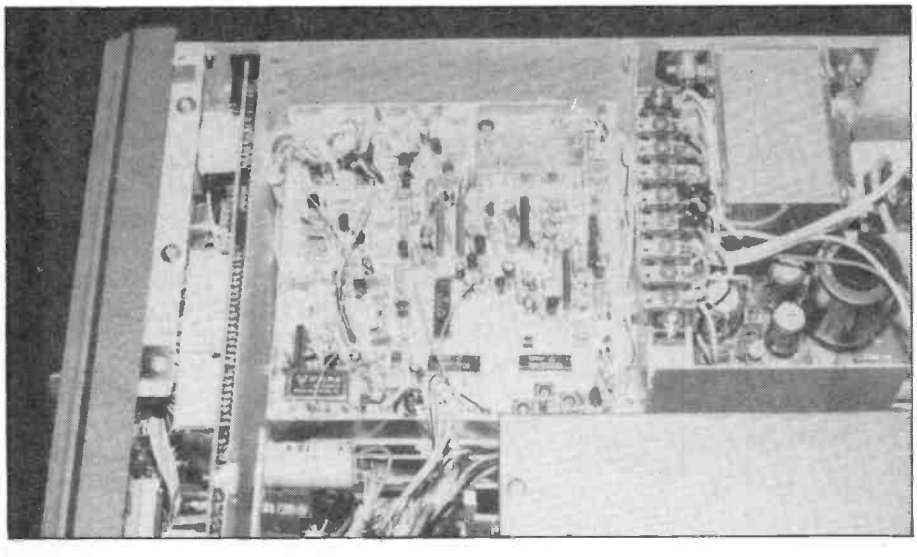
We carried out two tone IM tests at two power levels on each of three bands. The 6m results were good for a black box, the higher orders falling down well below the lower orders quite rapidly. At lower power levels the IM performance was excellent. On 2m at high power levels, higher order harmonics were worse than they should have been, and these did not fall rapidly enough at lower power levels. 70cm IM performance was far better, although it is odd that the third order product at low levels was higher than I might have expected it, although not of any concern. Note that the two tone PEP levels are somewhat lower than those for speech, as the former was continuous, whilst the latter represented transients.

The deviation level of the tone burst of all frequencies was slightly high, but absolute peaks of modulation very high when measured with wide bandwidth on a Marconi 2305 peak reading deviation meter. In practice, the maximum deviation seemed full but not excessive within a communication bandwidth, but high total deviations seemed to be rather common on almost all FM amateur radio equipment, perhaps because very steep audio filters above 2kHz would be extremely costly to instal. Frequency accuracy coincided pretty well throughout with received frequencies.



Each VHF/UHF module is triple screened.

We checked the carrier rejection referred to full single tone output on SSB with the power control on the onset of ALC. Carrier rejection was excellent at −60dB, which degraded to −51dB when the power control was fully advanced, so well into ALC, which is not recommended. SSB side-band rejection was better than −49dB, which is excellent. With mic gain at minimum, the noise within the filter pass-band was around −70dB per 50Hz bandwidth, which thus



Optional satellite unit (PCB in centre of picture).

shows 52dB dynamic range after the gain control. Noise at + or − 5kHz from the carrier was below − 90dB within a 50Hz bandwidth, which is excellent.

Conclusions

There can be no doubt that this is an amazing new box. It seems unique in having so many bells and whistles, almost all which are most useful, although I personally would not use the programmable abnormal repeater shift function. It is certainly recommendable, and although it is very expensive, three separate multi-band rigs would cost a lot more. I also very much enjoyed using it, and I do appreciate that many readers will regard some of my minor criticisms as niggles, but I feel that they are all worth pointing out. The two worst points are probably the 2m SSB transmit performance (probably a sample fault) and the general SSB received distortion, presumably due to insufficient clipping margin in the final IFs before the product detector, perhaps in combination with an insufficiently fast AGC attack time on long AGC.

Yaesu are to be congratulated for producing such a wonder box, and it is not surprising that so many people have already purchased it, despite its cost, thus proving that there are many amateurs prepared to dig deeply into their pockets to put all their eggs in one basket. There is so much that is right about this rig, the tuning ergomonics and memory facilities being excellent.

Quite often the first production of a new rig has teething problems, and the review sample was an early one. So frequently Japanese manufacturers improve some of the early problem areas in later production, and this will probably occur in the case of the FT726, which is now way beyond the early production stage. I have just received news of a new module covering 21, 24 and 28 to 30MHz, which will give 10W output, and contain switchable 100kHz repeater shift, thus allowing one to access US 10m repeaters. This gilds the lily, and I really look forward to trying the new module when it arrives one day.

I found the instruction book excellent, and well up to the high Yaesu standard. The equipment was very well put together, and it is possible to work on the modules as the connecting leads are reasonably long to assist in this. I would like to thank SMC for providing the rig for review, including the one and only 6m module at the time of writing, and also my colleage Simon Roberts, G8UQX, and many friends who have helped me with all the measurements and subjective evaluations.

RECEIVER MEASUREMENTS

Sensitivity FM

Rf level (in uV pd) for 12dB SINAD; 1kHz modulation, 4kHz deviation.

@ 432.000MHz	0.14
@ 435.000MHz	0.14
@ 439.000MHz	0.13
@ 144.000MHz	0.14
@ 145.000MHz	0.14
@ 145.975MHz	0.13
@ 50.000MHZ	0.12
@ 52.000MHz	0.1
@ 54.000MHz	0.13

Sensitivity, USB

RF level (in uV pd) for 12dB SINAD; 1kHz modulation,

@ 432.000MHz	0.14
@ 435.000MHZ	0.14
@ 439.000MHz	0.13
@ 144.000MHz	0.14
@ 145.000MHZ	0.14
@ 145.975MHz	0.13
@ 50.000MHz	0.11
@ 52.000MHz	0.12
@ 54.000MHZ	0.14

Selectivity, FM

Ration of on channel signal to off channel interfering signal (in dB), to degrade SINAD 3dB. Interfering signal high/low of on-channel.

@ 12.5kHz offset	66.5/43.5
@ 25 kHz offset	78 /77
@ 50 kHz offset	78.5/78.5

Selectivity, USB

3dB bandwidth (kHz)	2.0
60dB bandwidth (kHz)	2.4
60dB bandwidth (kHz)	3.5

Shape factor (60dB Bw/3dB Bw) 1.8

Selectivity, CW (with optional narrow filter)

3dB bandwidth (kHz)	0.24
6dB bandwidth (kHz)	0.62
60dB bandwidth (kHz)	1.15
Shape factor	4.8

S meter calibration

Rf levels (uV pd) (@ 145 MHz) on FM/SSB to give the following readings:

S1	0.3/ 0.5
S3	1.4/ 1.2
S5	2.1/ 2.2
S7	2.7/ 3.8
S9	3.2/ 5.9
S9 + 20dB	4.7/ 35
S9 + 40dB	6.7/ 316
S9 + 60dB	10.0/3300

RF intermodulation distortion, FM

RF levels at the quoted offsets to give 12dB

SINAD/S5 products at the quoted frequencies:

435MHz

+25, +50kHz	2.3/3.5
+100, +200kHz	1.5/3.3

145MHz

+25, +50kHz	1.1/2.7
+100, +200kHz	1.1/2.4

52MHz

+25, +50kHz	0.5/1.5
+100, +200kHz	0.5/1.5

RF intermodulation distortion, USB

RF levels (mV pd) at the quoted offsets to give S5 product at the quoted frequencies:

435MHz

+25, +50kHZ	4.2
+100, +200kHz	4.0

145MHz

+25, +50kHz	3.3
+100, +200kHz	3.7

52MHz

+25, +50kHz	2.3
+100, +200kHz	2.3

Reciprocal mixing performance

Levels (mV pd) @ +20 & +100kHz to degrade SINAD on USB by 3dB.

@ 435MHz	-/3.3
@ 145MHz	1.0/5.3
@ 52MHz	1.8/9.8

Accuracy of frequency display on USB RX (Hz)

@ 425MHz	+200
@ 145MHz	+200
@ 52MHZ	0

Distortion

with 125mW audio output into 8 ohms

FM/SSB (%)	5.1/2.8

Audio output power

@ 10% THD (W)	2.3

TRANSMITTER MEASUREMENTS

Maximum Power Output

FM (W)/USB (W PEP)/CW (W)

432MHz	12.8/14/12.4
435MHz	13.2/14/12.9
439MHz	13.8/14/13.7
144MHz	12.5/20/12.3
145MHz	12.5/20/12.3
146MHz	12.4/20/12.2
50MHz	10.4/15/10.4
52MHz	10.3/15/10.2
54MHz	10.1/15/10.1

Harmonic, spurious output, FM

Levels of 2nd/3rd harmonics relative to full power (dBc) followed by level and offset (MHz) from carrier of worst spurious.

435MHz	-63/-68/-70
145MHz	-68/ -70/-60@+/-10.8MHz
52MHz	-59/-60/ -70

Intermodulation distortion

2.2kHz & 500Hz injected into mic. socket at equal levels. 3rd/5th/7th/11th/15th/19th order products given in dB relative to level of causatory tones.

435MHz

10W PEP output*	-25/-31/-41/-60/-70/-70
1W PEP output	-20/-40/-60/-70/-70/-70

145MHz

15W PEP output*	-27/-39/-42/-50/-54/-60
1W PEP output	-28/-45/-64/-70/-70/-70

52MHz

16W PEP output*	-23/-45/-42/-60/-70/-72
1W PEP output	-29/-48/-51/-80/-80/-80

Carrier level

With drive set so that ALC is just on threshold (dBc)	-60
With drive maximum (dBc)	-51
Unwanted sideband (relative to wanted sideband) (dBc)	-40

FM deviation

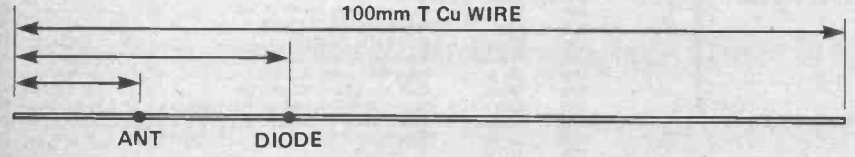
	Maximum (kHz)	Tone burst (kHz)
435MHz	7.5	5.1
145MHz	7.5	5.2
52MHz	7.3	5.2

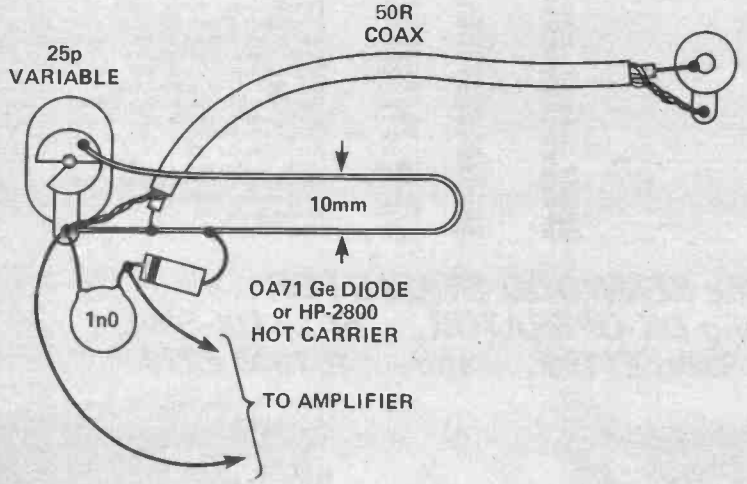
Deviation figures are peak-to-peak ÷ 2 not RMS.

Addendum

Go Foxhunting!
HRT, October

The diagrams below, giving constructional data for the tuned circuit of the simple DF receiver, were omitted from the original article due to lack of space.





Licence Conditions and the RAE
HRT November

Please note that all references to the Secretary of State for the Home Department should now read the Secreatary of State for the Department of Trade and Industry. Also, the term GMT has now been superceeded for log. keeping purposes by UCT (Universal Co-ordinated Time).

Auto Antena Switch
HRT November

The component listing and the overlay diagram were held over from last month due to lack of space. They are given below.

COMPONENT LISTING

RELAY DRIVER PCB

R1	1k5 ½W
D1–D7	1N4148
Q1	BFY51
IC1	ULN2803A
JO1	13-pin Yaesu PCB socket
JO2	2-pin socket
JO3	10-pin angled socket

RELAY BOX

PO1, PO2, PO3	To suit sockets
RL1–RL5	2-pole power relay, 12V (both poles wired in parallel)

MISCELLANEOUS
15-pin plug and soeket; 15-way multicore cable; box, 222 by 146 by55mm

NOTES
IC1 is RS part no. 303-422
Box is RS part no. 509-254
JO1 is obtainable from SMC Ltd – see their advertisment for the address.

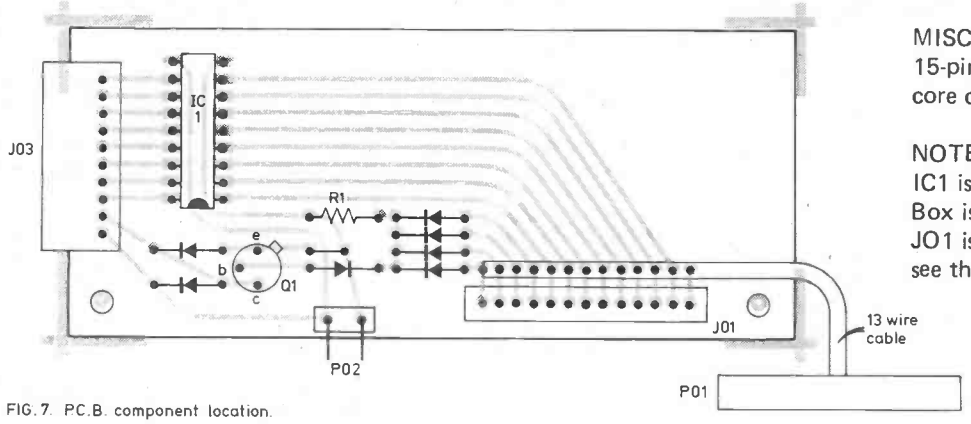


FIG. 7. P.C.B. component location.

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Since we first introduced the "Yaesu Musen" brand name to the UK market in 1970 and more recently the "Kenwood" name for Amateur Radio equipment, you can buy with confidence where experience counts. We maintain links with the factories for spares though we maintain stocks also. We also have extensively equipped service facilities with extensive (and expensive!) test equipment. It's gratifying to hear that more and more discerning prospective customers object to the "knocking and false rumours" put around by our competitors. Thank you Mr A. in Kent for your order for Kenwood TS-530S a few minutes ago. Remember, Kenwood is *THE* brand name throughout the world. It's only for UK that Trio is used. At 'WESTERN' we are not part of any illegal price ring and we are pleased to supply KENWOOD brand equipment known and recognised throughout the world.

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THIS MONTH'S SPECIAL CHOICE . . . YAESU PRICES (carr. paid)

YAESU FT-101Z £499 **FT-101ZD £569**

- ★ Digital frequency readout on 'D' model
- ★ QRM-beating Variable IF Bandwidth
- ★ High performance RF processor
- ★ Rugged 6146B PAs with RF negative feedback
- ★ Full band coverage 160-10 metres
- ★ Compatible with all '901 accessories

VHF/UHF EQUIPMENT

1234	FT-290R	2m all mode transceiver, portable	245.00
1242	FT-720RV	2m FM mobile transceiver, 10W	189.00
1241	FT-720RU	70cm FM mobile transceiver, 10W	219.00
1263	FT-230R	2m FM mobile transceiver, 25W	230.00
1210	MMB-11	Mobile Mount for FT-290R	21.50
1202	CSC-1A	Carrying Case for FT-290R	3.25
1220	FP-80A	AC PSU, 4.5Amps	53.00
1595	C NICADS	Set of 8 Nicads for FT-290R	21.00
1205	FP-4	AC PSU, 4Amps	42.00
1211	NC-11C	Charger for FT-290R	8.00
1200	NC-1	Desk Charger for FT-202R	19.00
1201	PA-1	12V adapter for FT-202R	19.00
1258	NC-7	Base charger for FT-208/708R	26.00
1253	NC-8	Deluxe fast charger for FT-208/708R	42.00
1260	FBA-2	Battery sleeve for NC-7, NC-8	3.00
1262	NC-9	Compact trickle charger	8.00
	FT-208R	VHF Handie FM Transceiver	189.00
	FT-708R	UHF Handie FM Transceiver	199.00
	FT-726R	VHF/UHF multiband transceiver (2m installed)	649.00
	FT-730R	70cm 10W FM SSB Transceiver	250.00
	FT-790R	70cm SSB/FM Transceiver	290.00

KENWOOD PRICE LIST

1301	STS-1	Base stand/charger for TR-2400	43.00
1302	KB-1	Deluxe knob for TS-530/830 series	10.50
1307	PS-20	DC PSU for TR-9000	49.00
1308	PBK-24K	Spare battery pack for TR-2400	16.00
1309	MC-30S	Hand microphone, 500 ohm	13.00
1312	MC-50	Desk microphone, 500 ohm/50k	30.00
1313	MC-60	Desk scanning microphone, dual impedance	50.00
1317	MB-100	Mobile mount for TS-130S	18.00
1318	SP-100	Speaker for R-1000	26.00
1322	TS-130S	HF transceiver	525.00
1323	DFC-230	Digital remote frequency controller	130.00
1324	TS-430S	HF transceiver with gen. cov. receiver	705.00
1328	R-600	Receiver	240.00
1329	SP-930	External speaker	55.00
1330	TS-930S/ATU	HF transceiver with gen. cov. receiver & ATU	1263.00
1331	TS-930S	HF transceiver with gen. cov. receiver	1199.00
1332	R-1000	General coverage receiver, digital	279.00
1333	DCK-1	DC operating kit for R-1000	8.26
1335	R-2000	New general coverage receiver	389.00
1337	TR-2400	2m FM hand portable transceiver	195.00
1339	TR-9130	2m Multimode transceiver, 25W	419.00
1341	TR-9500	70cm FM/SSB/CW mobile transceiver	399.00
1343	TR-8400	70cm FM mobile transceiver, synthesised	250.00
1344	DS-2	DC converter for TS-830S	42.00
1319	SP-430	Speaker for TS-430S	30.50
1320	AT-130	Aerial tuning unit 100W	91.00
1321	MB-430	Mobile mounting bracket for TS-430S	12.50
1325	AT-230	Aerial tuning unit, all band, matches TS-830S	135.00
1326	TS-530S	HF Transceiver 160-10m with new bands	515.00
1327	SP-230	External speaker unit	41.50
1334	FM-430	FM option unit for TS-430S	33.75

from the KENWOOD STABLE FOR . . . the discerning DX-OPERATOR . . . or . . . DX-SWL . . . the TS-930s, £1199 . . . and . . . R-1000 £279

Since, at 'WESTERN', we sell both Yaesu and Kenwood, we do not try to push a prospective purchaser into a particular brand of equipment . . . we have no "axe to grind" one way or the other.

Our M.D. (He's spoilt! He just takes home what he fancies for a trial evaluation!) thought he'd try the top of ranges FT-1 and TS-930S. He promptly brought the FT-1 back to the stock-room (Mr Hasegawa, please note!). Then he took the FT-102. He hitched the FT-102 and TS-930S up together but brought the FT-102 back. Said he'd got too old and lazy to bother with controls like PA Tune, PA Load, Pre-selection tuning, when the TS-930S does the same job with less knobs. He's grown to like the 930S so much he hasn't tried it against the Yaesu FT-980 – although no doubt it's only a matter of time (The FT-102 is back in the demonstration room!). The 'Noise Blanker' really cuts old "Woody Woodpecker" down to size! UA's will have to find something new to annoy a TS-930S owner.

How often have you found a rare DX-station only to discover he has a good pile-up too! With the '930' you just press "M In" and store his frequency in the memory and carry on tuning round or QSO elsewhere. Then to come back smack onto the rare DX you just select 'Memory' instead of the VFO, and up pops your DX station. Since there are 8 memory channels there are more than enough for anyone!

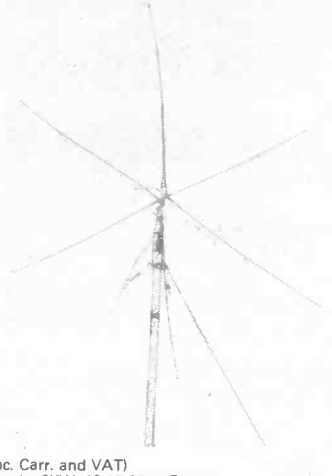
The R-1000 is an un-cluttered simple to use and excellent general coverage receiver. It brings the world to your fingertips in seconds. With its PLL synthesised receiver you get excellent stability and accuracy.

Features are:–

- ★ Covers 200kHz to 30MHz continuously
- ★ 30 1MHz bands
- ★ Noise Blanker
- ★ Terminal for external tape recorder
- ★ Built-in 12hr. quartz digital clock with auto-timer facility to switch 'On' at pre-determined time
- ★ 'S' meter with 'dimmer' control to panel lighting
- ★ Built-in 4" speaker
- ★ Built-in attenuator to prevent overloading
- ★ Digital readout to 1kHz and analogue dial

Electronics (UK) ltd

. . . AN EXCITING NEW ANTENNA IN THE 'PENETRATOR' SERIES



. . . the DX-26Q . . . 6-BAND QUAD

its a formidable force on the band!

5&9 ZP5CDB
5&9+20DB VP8NX
5&9. 8P6DH
5&7. TG9NX
5.9+20DB WD9AEU
5.9 ZD7BW
5.9 WA70PZ OREGON
5.9 VP8AEN. ANTARTICA
5,9+20dB. CX8CB
5&7. 5WIDZ
5H3JR "Strong Signal"
G4HRN/W5 "Very outstanding signal"
W4US/HR1. "Wow Man! are you really in England?"
VK81F "Thought you were local"

The above are a few of the reports and comments received over the course of a few hours operating. They (or the antenna!) speak for themselves. When you upgrade your antenna system to a quad, you'll only have one regret . . . and that's not having done it sooner! Send SAE for specification.

DX-24Q
2 Elements
2,10,15,20m **£199.99**

DX-26Q
2 Elements
2,10,12,15,16 & 20m **£224.25**

Prices (Inc. Carr. and VAT)

DX-31 Dipole, 2KW, 10-15-20m, Rotary	£75.89
DX-32 2 element, 2KW, 10-15-20m	£112.70
DX-33 3-element, 2KW, 10-15-20m	£164.45
DX-34 4-element, 2KW, 10-15-20m	£234.59
DX-6V Vertical 10-80m	£82.79
DX-103 3-element, 10m	£82.22
DX-51, Dipole Rotary for 14, 18, 21, 24 and 28 MHz	£90.85
DX-105 5-element, 10m	£106.95
TD1/10/80 Trapped dipole, 10, 40, 80m	£52.90
TD1/15/80 Trapped dipole, 15, 20, 40, 80m	£52.90

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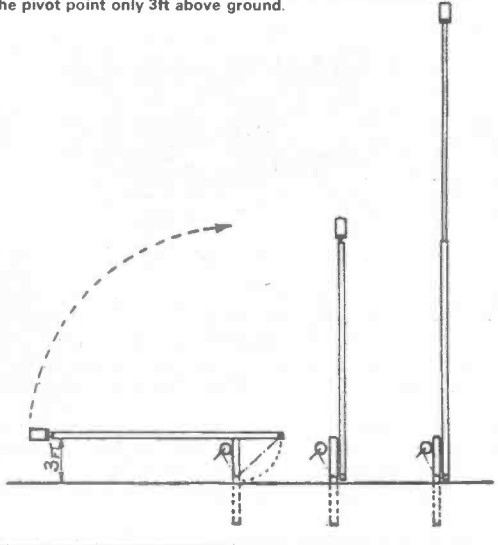
The 30ft ULTIMAST

A new mast for the budget-conscious amateur. Constructed in two sections, the lower being a square section tube and the upper a 3" dia. round tube, the ULTIMAST telescopes up to 30ft and down to 15ft. The tilt-over allows easy antenna access with the pivot point only 3ft above ground.



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We designed our ULTI-MAST for PEOPLE WITH 2 HANDS!

Seems our competitors got it wrong! They need 3 hands according to the review in "Practical Wireless" of March, 1983.

REMEMBER . . . the ULTI-MAST was so called because it is the

ULTI-MATE IN DESIGN

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For VHF and HF antennas
Simple ground fixing
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THIS IS THE TELESCOPIC YOU CAN AFFORD!

Ultimast, UM-1.....£251.85
Reducer head, UHD-1 (reduces to 2" dia stub).....£16.10
Rotor head, UHD-2 (takes up to Emoto 103SAX)....£35.65
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RADIO Tomorrow

Your at-a-glance guide to what's happening around the clubs, on the air and in general radio-wise.

1 Nov
Stevenage DRS *Slow Scan TV* by G4BWU
Aylesbury Vale RS: *Semiconductors* by G8AYM
Mid-Warwickshire ARS: Natter night
Wakefield DRS: Natter night
Fylde ARS: *Nucleonics* by G4DPI
Chichester DRC: Meeting
(Note: Flyde ARS now meet at the Kite Club, Blackpool Airport)

2 Nov
Cheshunt DRC: Natter night
Fareham RC: Natter night/on the air
Wirral DRC: Informal at The Harp, Lower Neston
Edgeware DRS: Visit to British Aerospace club at Hatfield. *UOSAT* by G3YJO
Nene Valley RC: Junk Sale
Stockton DRS: Venue now changed to Billingham Community Centre. Ring PRO for details.

4 Nov
Medway AR&B: Video evening
Cambridge DRC: Informal meeting/morse class
Maltby ARS: *Amatuer Photography*
Harrow RS: Informal/practical

5 Nov
RSGB 144 MHz CW contest
North Devon Radio Rally at Bradworthy Memorial Hall (Nr. Holsworthy). 10.30am-5pm; bring and buy, talk-in S22
Southdown ARS: *The Isaac Newton Telescope* by George Harding.

6 Nov
WAB LF CW contest
Cambridge University WS: Informal

7 Nov
Stowbridge DRS: Informal
Leighton Linstable RC: Meeting
Braintree DARS: Construction contest
Thornton Cleveleys ARS: *Modern Heating Controls* by G8KBH

8 Nov
Stevenage DARS: Constructors evening
Bury RS: *Japanese Morse* by G3CSG

9 Nov
Cheshunt DRC: Quiz at home against Harlow RS
Three Countries ARC: Judgement night of construction contest
Fareham RC: *QRP Operation* by G3CCB
Nene Valley RC; *Wheatstone's Greatest Invention?* by G4ODI
Stockton DRS: Ring PRO for details

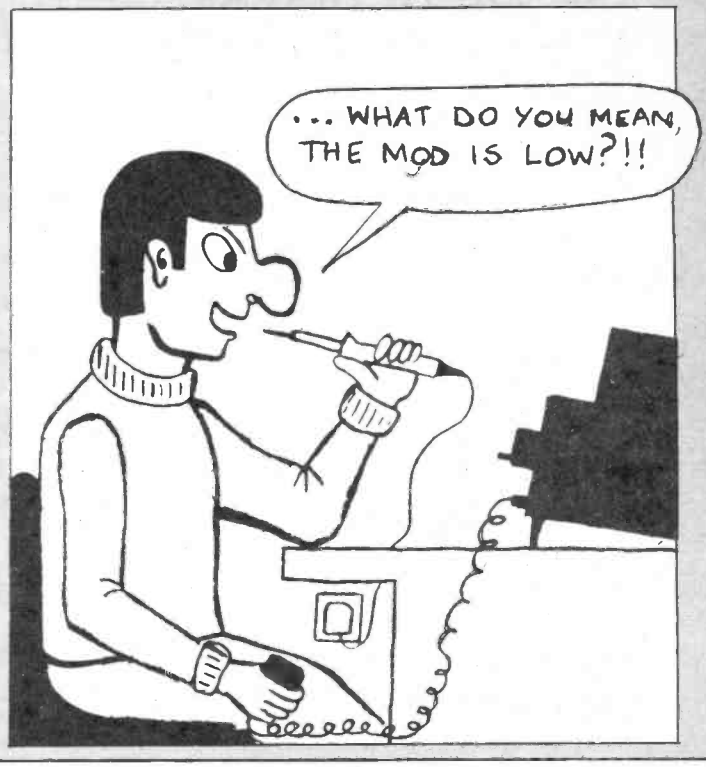
10 Nov
Edgeware DRS: Informal
Smiths Industries RC: FSTV demonstration
(Note: Membership open to the general public. Write to Sec, Smiths Ind RC, Smith ASCo, Evesham Road, Cheltenham GL52 4SF)

11 Nov
Cambridge DRC: Film show
Farnborough DRC: AGM
Maltby ARS: Project night
Spalding DARS: Construction contest for G2BQC memorial trophy
Harrow RS: Annual dinner at the Grimsdyke Hotel

12 Nov
RSGB Second 1.8MHz contest

14 Nov
Thornton Clevelys ARS: *Computers* by G3GIV
Milton Keynes DRS: Junk sale
Plymouth RC: Video or slide show (RSGB)

15 Nov
Stevenage DRS: talk on *Navigational Satellites*
Mid-Warwickshire ARS: *Mobile Interference Suppression* by G8XDL
Biggin Hill ARC: talk on *BBC Radio News*
Wakefield DRS: Film show
Fylde ARS: Informal meeting



16 Nov	Cheshunt DARC: Natter nite
	Fareham RC: Natter nite/on the air
	Wirral DRC: Informal at The Primrose, Liscard Nene Valley RC; Natter nite/on the air
	Stockton DRS: Ring PRO for details
17 Nov	Chichester DARC: *Sporadic 'E' and DXTV* by Ron Ham
18 Nov	Medway AR&B: *A Return to Real Amateur Radio* by G4EVY
	Cambridge DARC: Informal/morse class/on air
	Harrow RS: Informal/practical
21 Nov	Stourbridge DARS: Annual surplus sale
	Leighton Linsdale RC: Meeting
	Braintree DARS: Junk sale
	Thornton Cleveleys ARS: Club operating night
22 Nov	Cheshunt DARC: Quiz against Harlow RS — away, at Mark Hall Room, Harlow
23 Nov	Cheshunt DARC: AGM
	Three Countries ARC: *Hospital Radio*
	Nene Valley RC: *Why do Radio Communications Work?* by G8TTF
	Farnborough DARC: Chairman's evening
	Stockton DRS: Ring PRO for details
24 Nov	Greater Peterborough ARC: *Satellite Working* by G3NRW
	Edgeware DRS: To be announced
25 Nov	Cambridge DARC: *A Guide to Propagation* by Ray Flavell
	Maltby ARS: *Music Sythesis*
	Harrow RS: *Computer Aided Design of PCBs*
28 Nov	BARTG 432 MHz Cumulative contest (2000 - 2200 GMT)
	Thornton Cleveleys ARS: *Small Bore Rifles*
	Plymouth RC: *DF contest*
29 Nov	Aylesbury Vale RS: *Buying Second-hand Equipment* by G30SS
	Wakefield DRS: Alignment of Equipment
30 Nov	Cheshunt DARC: Natter nite
	Fareham RC: Natter nite/on the air
	Nene Valley RC: Buffet and social evening
	Stockton DRS: Ring PRO for details
4 Dec	RSGB 144MHz Fixed contest
5 Dec	Stowbridge DARS: Informal
	Leighton Linsdale RC: Meeting
	Braintree DARS: *Swept Frequency Testing* by G30LU
	Southdown ARS: AGM
	BARTG 432 Mhz Cumulative RTTY contest (2000 - 2200 GMT)
	RAE Examination Day
6 Dec	Stevenage DARS: Social evening
	Mid-Warwickshire ARS: *Satellite Working* by G4ROA
	Fylde ARS: Christmas party
	Chichester DARC: Meeting
7 Dec	Cheshunt DARC: junk sale
	Fareham RC: *Tests on your Radio* by G8GNB
	Nene RC: Natter nite
	Stockton DRS: Ring PRO for details
	Commencement of Geminids metor shower — lasts till 15 Dec approx (max 13/14 Dec)
8 Dec	Edgeware DRS: Junk sale
	Smiths Industries RC: Antenna talk
9 Dec	Spalding DARS: Annual junk sale
10 Dec	Three Countries ARC: Christmas dance
11 Dec	Leeds Christmas Rally, Civic Centre, Pudsey, nr Leeds. Opens 10.30am, admission free.
12 Dec	Plymouth RC: Christmas quiz
13 Dec	Exeter ARS: *Computers* (special venue)
	Bury RS: AGM (followed by wine and cheese)
	Stevenage DARS: Constructors evening
	Biggin Hill ARC: Surplus equipment
	Wakefield DRS: Christmas social
14 Dec	Cheshunt DARC: Natter nite
	Fareham RC: Natter nite/on the air
	Farnborough DARC: Christmas social
16 Dec	Medway AR&B: Christmas social
	Cheshunt DARC: Christmas dinner
	Cambridge DARC: Informal meeting/on the air/morse class
17 Dec	Commencement of Ursids meteor shower (max 22 Dec)
	Chichester DARC: Christmas social
	Plymouth RC: Christmas social
9 Dec	Stourbridge DARS: Meeting
	Leighton Linsdale RC: Meeting
	Braintree DARS: Christmas party
20 Dec	Mid-Warwickshire ARS: Christmas dinner
	Stevenage DARS: Natter nite
	Fylde ARS: (to be arranged)
20 Dec	Cheshunt DARC: Video shows by G8DNR
	Hastings E&RC: Christmas social
22 Dec	East Kent RS: Christmas party
27 Dec	Aylesbury Vale RS: Annual dinner
	Wakefield DRS: On the air/natter nite
1 Jan	Edgeware DRS: 2m Straight Key evening — 1900 GMT onwards.
3 Jan	Flyde ARS: AGM
	Stevenage DARS: Ring PRO for details
5 Jan	East Kent RS: Natter nite

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Quadloops

Many readers will have noticed the praise lavished on full wave loop aerials in Sant Kharbanda's recent authorative series on aerials for LF DX working. As a follow up we include a design for an 'optimum', remotely switched loop antenna for 14, 21 and 28MHz by Malcolm Healey, G3TNO, with assistance from Anne Lambert, G6CXF.

The basic 'quad' loop consists of a vertically mounted square of wire or tubing, each side a quarter wavelength long — making a wavelength in total around the circumference (**Fig. 1**). In fact, if you consider it carefully, it is two half wave dipoles stacked one above the other with the ends of the upper half wave bent downwards, and the ends of the lower one bent upward until they touch. The net resultant gain is actually rather less than the optimum 3dB to be expected from stacking a pair of dipoles. This is due to the lack of stacking distance between the upper and lower dipole 'halves'. A realistic figure for the gain dBd of the aerial (i.e. with reference to a single dipole) is in the range 1-2dB. The quadloop, however, unlike the half-wave dipole, appears not to be so fussy about its height above ground and, as I shall explain later, the effective gain is thus somewhat greater.

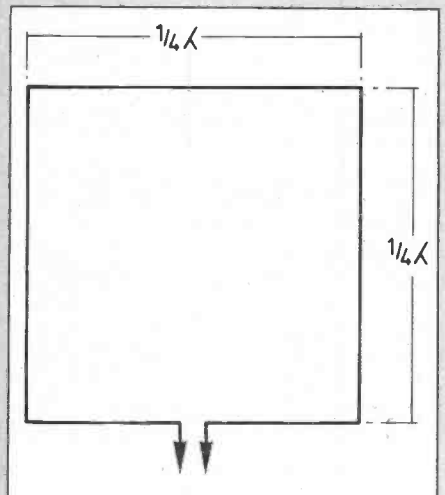


Fig. 1 The Quad Loop

My first experience with the quad loop aerial dates back to a desperate attempt on National Field Day to work some of the DX on 7MHz that had been missed by the club in its field day entries of previous years.

The quad loop was erected, suspended on a rope which was slung between two ladders, with its highest side about 45 feet above the ground. The lower part of the antenna was thus only 10-15 feet high. Also erected for 7MHz were horizontal and inverted-vee dipoles at similar heights. Thus, not only was it possible to assess the performance of the quad loop as a competitive aerial under the most severe of contest conditions, but its performance could be constantly compared with two other aerials.

At the Field Day post-mortem the following consensus was reached: the quad loop enabled us to work VK, ZL, and PY (Australia, New Zealand and Brazil) stations that were unworkable and in some cases inaudible on the dipoles. It was also noticeable that during daylight hours nearer European signals were much weaker on the quad loop as compared with the dipoles. However, the longer distant European signals, YU, UA's etc, were definitely stronger on the quad loop.

In consequence of the NFD results and after some thought, a three band quad loop aerial was made up and erected at my home for 14, 21 and 28MHz with the highest side at about 35 feet (see **Figs. 2** and **3**). I kept this most satisfactory set-up for some five years. Results on all three bands were very good to DX at right angles to the plane of the aerials — *consistently outperforming dipole aerials at a similar mean height by 1-2 'S' units.*

It is fair to ask why the quad loop produces signal reports, both on transmit and receive, that are upwards of 3dB better than the reference dipole at the same height when the quad loop has only a gain of approximately 1-2dBd? The answer is that the gain figure with reference to a dipole does not present the whole picture. The quad loop appears (although I have made no real measurements), to produce a much lower angle of radiation. I have found that DX stations may be worked with the loop when the path to a particular station is marginal, especially when the path is just opening or closing and often when contact is impossible

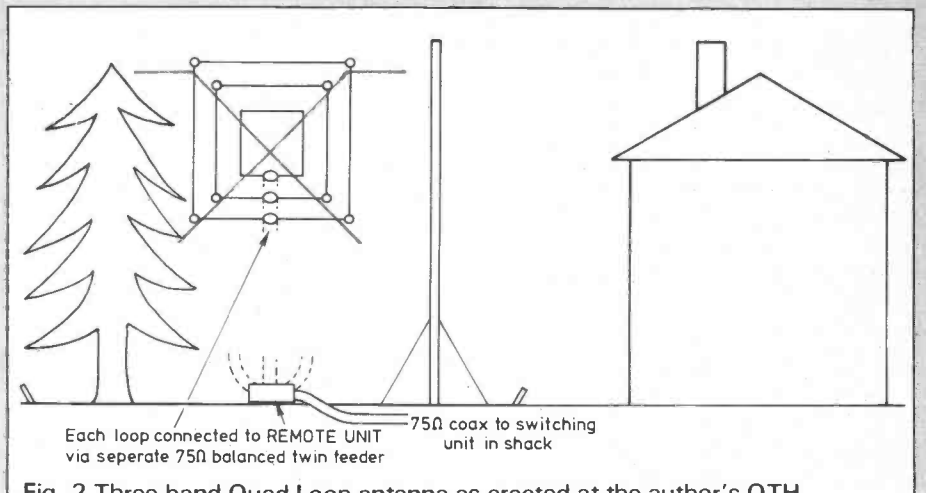


Fig. 2 Three-band Quad Loop antenna as erected at the author's QTH.

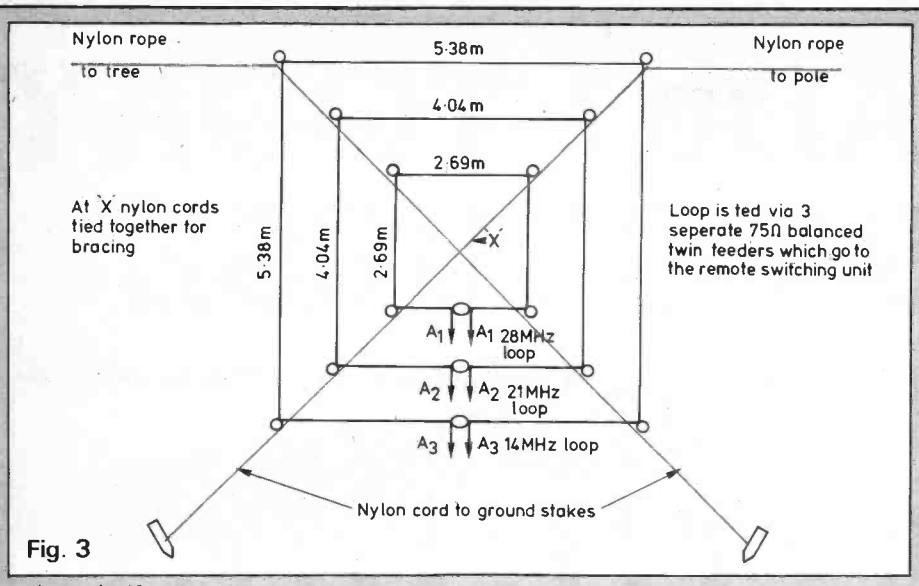


Fig. 3

using a half-wave dipole. A low angle of radiation is vitally important under these conditions as a reduced angle of radiation will consequently reduce the number of reflections needed between the ionisphere and the earth in order for contact to be made between the two distant radio stations. In reducing the number of times the signal is reflected, the resulting attenuation of the signal is also reduced very considerably. So, up goes the signal strength in both directions. Fig. 5 and 6 show the vertical polar diagrams of a half wave dipole and a full wave quad loop at a similar height above ground.

Fig. 4 Horizontal Polar Diagram of loop — similar to that of a half wave dipole.

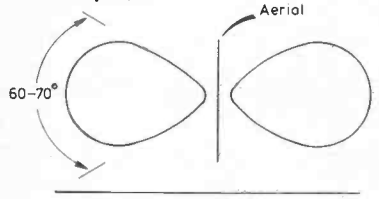


Fig. 5 Dipole.

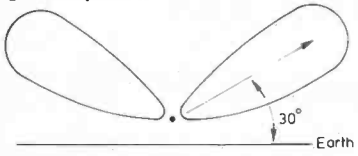
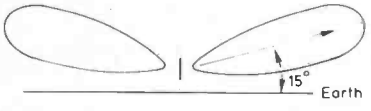


Fig. 6 Quad loop.



Both aerials quarter wavelength high.

Only one coaxial feeder is required to feed the aerial system. Switching from one aerial to another is achieved by "ghosting" DC control voltages down the feeder from the radio shack, using the simple unit depicted in Fig. 7. The control voltages activate a remote unit located at ground level in a waterproofed container, under the feed points of three loops. The circuit diagram of the remote unit maybe seen in Fig. 8. I have found this to be a much more reliable method of feeding more than one aerial from a common feeder than some of the "trick" methods employing matching stubs (the described method is also much superior to the practice of parallel connecting antenna's on the same feeder —Editor). The matching arrangements are often more difficult to set up than the aerial!

This method of remote aerial switching may of course be used in a variety of situations and can save you a lot of money if long feeder runs are used, especially if you are using very low loss feeder cables.

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Semiconductors

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Miscellaneous

T1: mains transformer, secondary to suit RLA1 and 2; RLA1,2: double pole change-over relays, surplus types can be used, e.g. PO 3000 series; RFC1,2: 2.5mH RF chokes.

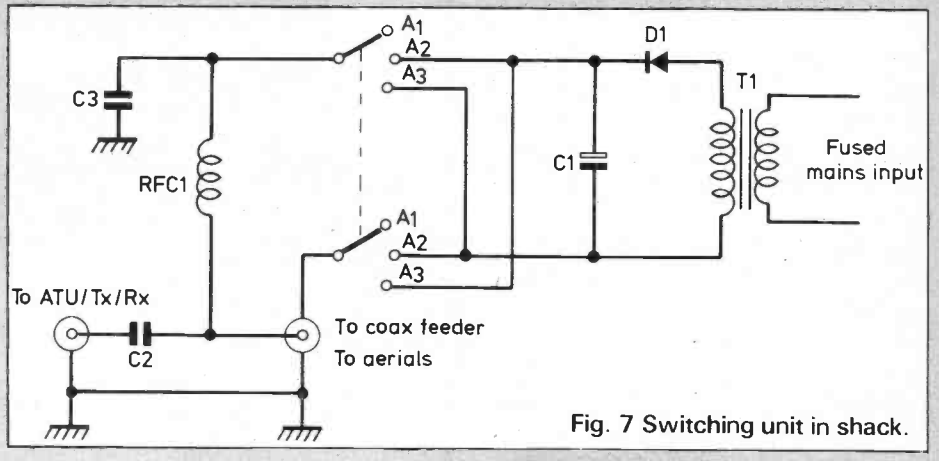

Fig. 7 Switching unit in shack.

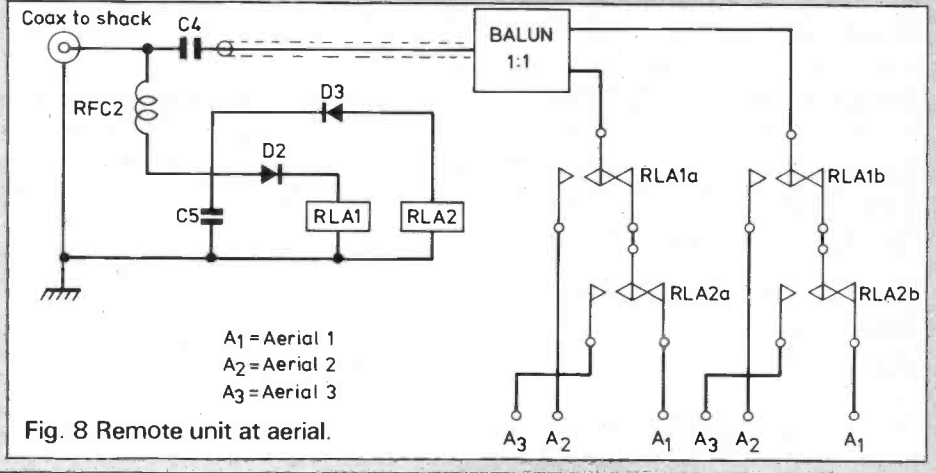

Fig. 8 Remote unit at aerial.

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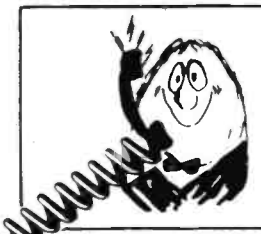

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