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HAM RADIO TODAY

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Unfortunately, due to lack of space, the second part of Amateur Transmitters of the '20s has had to be held over.

TWO FOR THE ROAD.

The very latest IC-28E 2m. FM mini-mobile from ICOM.

This new 2 metre band transceiver is just 140mm (W) x 50mm (H) x 133mm (D) and will fit nearly anywhere in your vehicle or shack. Power output is 25 watts or 5 watts low power and is supplied complete with an internal loudspeaker.

The large front panel LCD readout is designed for wide angle viewing with an automatic dimmer circuit to control the back lighting of the display for day or night operation.

The front layout is very simple, all the controls are easy to select making mobile operation safe. The IC-28E contains 21 memory channels with duplex and memory skip functions. All memories and frequencies can be scanned by using the HM-15 microphone provided. Also available is the IC-28H with the same features but with a 45 watt output power.

Options include IC-PS45 13.8v 8A power supply, SP8 and SP10 external speakers, HS15 flexible mobile microphone and PTT switchbox.

Rx range. 138-174 MHz

IC-290D/490E Mobiles

These SSB, CW, FM transceivers are ideal for mobile or base station operation. The IC-290D for 2 metres produces 25 watts/5 watts low power. The IC-490E for 70 centimetres produces 10 watts/1 watt low power. Both transceivers have a range of operating features, these include 5 memory channels, dual V.F.O.'s and a priority channel to automatically check your most used frequency. Squelch on FM and SSB to allow silent scanning whilst searching for signals, slow or fast AGC for SSB and CW and a noise blanker to suppress pulse type QRM. Sidetone is provided on CW.

Memory and full or programmable band scan with internal switches to stop on busy or empty channels. Programmable offsets are included for odd frequency splits.

Options include: IC-PS45 13.8v 8A power supply, IC-BU1 memory back up battery unit, IC-SP8 and SP10 mobile speakers.

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Total coverage..100Khz to 2Ghz!

IC-R7000.

The R71E now has a team-mate – the IC-R7000. With these matching receivers it is now possible to tune from 100KHz-2GHz.

The IC-R7000 covers Aircraft, Marine, FM Broadcast, Amateur Radio, Television and weather satellite bands. The IC-R7000 incorporates FM wide/FM narrow, AM, USB and LSB modes of operation with six tuning speeds:- 0.1, 1.0, 5, 10, 12.5, and 25KHz. Frequency coverage 25-1000MHz and 1025-2000MHz (25-1000MHz and 1260-1300MHz guaranteed specification). With the IC-R7000 you have normal tuning capability with the front panel tuning knob or for quick tuning of a desired frequency by using the front panel key-pad. A total of 99 memory channels are available for storage of received frequencies and operating mode. Memory channels can be called up by pressing the memory switch then rotating the memory channel knob or by direct keyboard entry.

These receivers are available seperately but together would make a superb listening station for the shortwave listener or licensed amateur.

A sophisticated scanning system provides instant access to specific frequency ranges. By depressing the Auto M switch, the IC-R7000 automatically memorises frequencies that are in use whilst in the scan mode and can be recalled later. The scanning speed is adjustable and the scanning system includes memory selected frequency ranges or priority channels. All functions including memory channel readout are clearly shown on a dual-colour fluorescent display with dimmer switch. Other features include dial-lock, noise blanker, S-meter and attenuator.

Options include: RC12 infra red controller, EX310 voice synthesizer, SP3 and SP7 external loudspeakers, HP1 headphones and the ICOM AH-7000 super wideband discone antenna.

The IC-R71E is a general coverage receiver 100KHz-30MHz featuring direct keyboard frequency entry and infra-red remote controller (optional). SSB, AM, CW, RTTY and FM (optional) modes of operation. With 32 programmable memory channels, twin VFO's scanning systems, selectable AGC, noise blanker, pass band tuning and a deep notch filter. Keyboard frequencies can be selected by pushing the digit keys in sequence of frequency. The frequency is altered without changing the main tuning control. Options include: EX257 FM unit, RC11 infra-red controller, CK70 D.C. adaptor for 12 volt operation, CW filter options and a high stability crystal filter, SP3 and SP7 external loudspeakers, EX310 voice synthesizer, HP1 headphones.

IC-R71E.

Computer Control These receivers can be connected to a computer terminal via a suitable interface.
JT602 Serial Interface for IC-R7000.
JT603 Parallel Interface for IC-R71E (IC-R7000).
The ICOM IC-R71E requires the IC-EX309 interface connector.

LETTERS

POLITICAL WRANGLES — POINTLESS?

Sir, May I suggest a modification to your postscript added to Mr P Crosland's letter in the June '86 issue? What "no-one gives a damn about", as you term it, are the views frequently expressed by a very small minority of malcontents within the RSGB.

There is so much interest in amateur radio, and indeed many problems upon which the undoubted talents of these people could be better employed, that these silly political wrangles seem so pointless. An identical letter from G6JNS appeared in one of your contemporaries recently — perhaps he should see his doctor!

D M Westlake

OOPS! PF1 CANS

Sir, With regard to Chris Lorek's article on Pye Pocketphones, concluding his excellent series of articles on Pye equipment, we would like to point out a small error. Chris says that PF1 crystals are can style HC25/u when, in fact, they are solder-in HC/18u type. We feel sure that with Chris' obvious knowledge of Pye equipment, this is a typographical error.

R D Mersh, for QSL Ltd.

MOUNTAIN RESCUE

Sir, Observation suggests that the continuing miniaturisation of equipment encourages portable operation by many operators with an interest in mountain activities. It is no longer unusual to find CB, 2m or 70cm rigs in the rucksacks of ramblers and hill walkers — a number of whom welcome the advantages of good radio positions among the peaks and hills.

In the event of an accident, the rapid response of on-the-spot radio links would be very vulnerable but no agreed procedures appear to exist. On 2m, for instance, it seems that emergency calls would presently require:—

(a) access to local repeater or nearby station;
(b) called operator telephones police;
(c) police alert rescue team and/or RAF;
(d) recovery procedures set in motion.

Steps (b) and (c) might well require some persuasive powers on occasion and (b) is probably in breach of current licensing rules.

If the procedure is followed as described then no radio contact is possible between the accident site and the rescue team. Of course, it would be feasible to maintain a relay by landline to the RAF and thereafter by HF/VHF to a helicopter but the same means would not be available for a civilian mountain rescue team.

The procedure outlined above might be satisfactory on 2m in most rugged areas of the UK but on 70cm it might be difficult in parts of Scotland. Users of CB would presumably access the emergency channel or break an existing QSO, although operators often seem to maintain contact with their own base party in the valley and as part of their enjoyment of the hobby.

Clearly, some national/regional co-ordination is indicated if the full advantages of radio is to be mobilised and if the proposal receives general support.

In an attempt to generate interest a copy of these remarks has been despatched to the RSGB, to the British Mountaineering Council and elsewhere. Whether the subject will be pursued remains to be seen but nothing will be achieved unless operators express their opinions to the appropriate bodies.

J G Evans, G3WET

RSGB GERRYMANDERING?

Sir, Has gerrymandering replaced democracy in the RSGB? I refer to the minutes of the December 1985 issue of RadCom.

The colossal numbers of proxy votes held by members of council begs the question as to whether the AGM is a total farce. The 1985 President alone had enough proxy votes to hold sway over any decision that the AGM may have made. It is time that the AGM was turned over to a representative forum for discussing questions of today and not for prolonging the ideas of yesterday.

The leadership of our hobby do themselves no credit in adopting these tactics of massive overkill in an attempt to protect their position at the cost of moving the amateur service into the 21st century. I do not doubt that their motives are honest, I feel that they are not listening to enough grass roots opinion on the very basic principles.

The high road to Hades is paved with good intentions, good intentions are not enough.

K Killigrew, G6DZH

Proxy voting is a long established 'democratic' tradition enabling those unable to attend to exercise their right to vote. Proxy voters invest their vote in someone whose judgement they trust. 762 people trusted the judgement of Mrs Joan Heathershaw, G4CHH. This was in spite of an extensive campaign that went to all clubs and appeared in all the amateur radio magazines (apart from Radio Communication who commented on it). The result (71 for G4AJJ, 13 for G3GJW and 43 for G6JNS the authors of the campaign document) shows how much support they gathered.

The AGM was a 'representative' forum of those who bothered to turn up or trusted someone with their vote. A variety of issues were discussed in the opening meeting, though I noticed that few of the 'protagonists' came up with any "questions of today" instead prefering ideas or grievances "of yesterday". Perhaps Mr Killigrew you would like to express these ideas rather than remain simply a critic of the system.

WORKING MOBILE?

Sir, Operators of both amateur and Citizen's Band mobile transmitters have been stopped by the Police and given a warning, if not actually prosecuted, for holding a microphone in one hand and the steering wheel in the other. This, they were informed, did not give them sufficient control over the car — they should keep both hands on the wheel at all times!

In car telephones are becoming increasingly popular; so are we to assume that any driver seen using one will also be stopped by the Police?

Douglas Byrne, G3KPO

RAE OVERSIMPLIFIED?

Sir, L N Bucks, GODLR, letter I found most encouraging. Howsoever GODLR feels about the tone of 'A Laughing Stock' (April '86 HRT), if it is thought that making the RAE comparable to a professional qualification would dramatically lower the pass rate, then surely the exam is a victim of grotesque oversimplification. Something somewhere, is wrong when I find 'radio amateur' to be a term of derision, synonymous with nuisance, both to elements of the general public and the professional radio establishment. If I have to trade my 'tub thumping' for my 'playing radio', I'll keep the radio.

We must improve, and be seen to improve, our credibility before something nasty is done about, or too, amateur radio.

William, G8QRM

LISTEN OUT

Dear YL, XYL and OM, I am DH3AAE and I am going to be QRV on 2m and 70cm from a QTH in Taunton, Somerset. I would be very glad if I could work as many radio amateurs as possible between 12th July and 11th August. I am planning to be QRV on CW, SSB, FM, RTTY and Oscar 10. On 70cm, I am going to use only 15 watts (100W ERP) and on 2m 28 watts (150W ERP). I hope to meet you on the band.

Thomas Pohl, DH3AAE.

Please address correspondence to:
Ham Radio Today,
1, Golden Square,
LONDON W1R 3AB.

RADIO TODAY

A Case of Sour Grapes?

Keith Townsend, G4PZA, reports on the story behind the morse test saga.

It was against a background of "criticisms about the rise in the price of the morse test and the fact that the small number of testing centres meant high travel costs for some candidates" that the DTI decided to look for a new way of conducting amateur morse tests. The result was that from the beginning of April the RSGB took over responsibility for the tests from British Telecom. The DTI had invited proposals for future tests from a number of sources and received bids from the RSGB, BT and the City and Guilds of London Institute.

The contract was eventually awarded to the Society both because it had promised to reduce the cost from £15 to £7 and, perhaps more importantly, offered to establish testing centres in every county throughout Britain, thus reducing the indirect cost of taking the test.

It was inevitable that such a change would create some initial difficulties. A few potential candidates were quick to criticise the practice of carrying out tests during local rallies, although this arrangement was never intended as a permanent solution. Furthermore, the chief examiner, Noel Ianson, GW3GDO, faced the task of testing and appointing a large team of examiners throughout the length and breadth of Britain. Despite this the Society had, within two short months of taking over, managed to establish permanent test centres in no less than 23 counties, with plans to double this number over the next few months.

It has been suggested that these arrangements should have been completed before testing began. However, this would have meant a considerable period during which no tests could have taken place as, not unreasonably, British Telecom had ceased to offer the facility immediately their contract was withdrawn. RSGB General Secretary, David Evans, told me "We were well aware of the task facing us when we asked to be given this responsibility but ....we are confident we can provide the best possible service. Our initial aim was to have a full complement of test centres operating withing six months and we are now ahead of target, with more centres opening all the time. I understand and sympathise with some of the initial criticism but, in exchange for a little patience in the early stage we will soon be able to offer members and non-members alike the kind of service they deserve".

STATION MANAGERS

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GLASGOW
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LIVERPOOL
LONDON
NEWCASTLE ON TYNE
SOUTHAMPTON AND FALMOUTH

CONDUCTING AMATEUR MORSE TESTS.

THE RADIO SOCIETY OF GREAT BRITAIN (RSGB) HAS INVITED SOME BT EMPLOYEES TO ASSIST THEM IN CONDUCTING THE DEPT OF TRADE AND INDUSTRY AMATEUR MORSE TESTS AFTER 31 MARCH 1986.

STAFF CONCERNED ARE ADVISED THAT THEY SHOULD NOT COMMIT THEMSELVES AT PRESENT TO THIS ACTIVITY AS THE ISSUE IS BEING CONSIDERED IN THE CONTEXT OF BT CONDITIONS OF EMPLOYMENT.

FURTHER DETAILS WILL BE GIVEN SHORTLY.

J C GODFREY
AMA/MRS.2
ROOM 410
43 BARTHOLOMEW CLOSE
LONDON (01-936 4735)

This is a copy of the leaked telex. The text reads "The RSGB has invited some BT employees to assist them in conducting the DTI amateur morse tests after 31st March 1986. Staff concerned are advised that they should not commit themselves at present to this activity as the issue is being considered in the context of BT conditions of employment."

Forbidden Employees

Unfortunately, not everyone seems to be so enthusiastic. In a move which suggests an inability to distinguish between high finance and the simple pleasures of amateur radio, British Telecom International has issued instructions to radio amateurs on its payroll forbidding them from any involvement in morse testing whilst "the issue is being considered in the context of BT conditions of employment". Nor, so far as we can ascertain, is this prohibition restricted to the conduct of tests. We have heard from amateurs who, although employed by BT, have no professional interest in radio. Some of these — telephonists, clerks and telephone engineers alike — although never involved in testing, have acted as instructors, both within clubs and at classes run by adult education authorities. All have told us of instructions or advice from their company, preventing them from continuing with this aspect of their hobby.

After one such approach we contacted British Telecom, and were told, "This is a very complex problem and some of our employees may not be aware of the real implications. For instance, we conduct a number of other examinations on behalf of the DTI and if we were to lose those to user organisations, in the same manner

In Brief

Are you a bright spark? Would you be willing to check thoroughly a variety of electrical goods? Oxfam are looking for volunteers to sort out their donated electrical goods at their 750 shops around the country. They lose hundreds of pounds of potential income which, of course, goes to very worthwhile causes. If you can help, or would like to know more, write to Faye Wark, Oxfam, Freepost, London N12 9BR.

● ● ●

In addition to the monthly meetings mentioned in Radio Tomorrow, Milton Keynes DARS have organised extra meetings to accommodate members who work nights or shift work. These meetings are being held every Wednesday from 12 noon at 2.30 at the Wayfyrer, Willen Lake, Milton Keynes. So if you want a natter, noggin and a chance to catch up with the latest society news, pop round — all amateurs are welcome.

● ● ●

The latest issue of Probe, The Midland ARS journal, is devoted to the imminent departure of their S Pacific correspondents G4AAL and G4RUL who are taking part in the first stage of the Operation Raleigh voyage. They hope to be operating from the Cook Islands (ZK1) from the start of July, moving onto the Western Samoa Islands (KH8) from about the middle of the month. These dates are very provisional, but if you hear the pile up, you'll know its them!

Icom's IC751A

Yaesu FT70F/G

that amateur morse tests have now gone to the RSGB, it might lead to job losses within our organisation. BTI is now a public corporation, with a duty to its shareholders and that is why we have to look very carefully at any activity involving our employees which might be to our commercial detriment". He went on to tell us that the company has written to a number of amateurs from within its ranks, asking for details of their involvement in morse tuition and testing. Although the response had been slow they were prepared to consider each case individually and that some employees might then be permitted to continue their activities.

For the RSGB, a perplexed David Evans said, "We are somewhat surprised at BT's attitude. We were invited by the DTI to tender for the right to conduct morse tests and did so at a time when the only other contender appeared to be the City and Guilds.... Whilst we were very pleased to be awarded the right to offer this very important facility, we are only too well aware of the excellent work done by BT in the past. Their current attitude does seem to be a little over the top to me. For example, I understand that the Royal Yacht Squadron also conducts tests on behalf of the DTI but I would be surprised if it took the same attitude toward the private activities of any of its members".

Asked what advice he would offer to RSGB members employed by BT, David said "Naturally members' jobs take precedence over their hobby and we have to advise them to follow the employer's instructions until such time as we are able to sit down and discuss the matter sensibly with BT management. Hopefully we can then come to some agreement".

One BT employee, G4JBB, who has, in his own words, "taught morse code to fellow amateurs for more years than I care to remember" said, "I am utterly bewildered by the instructions I have received. I know nothing of any letter asking for details of my activities and, had I received one I would have replied immediately. Amateur radio is simply my hobby. It has no bearing whatsoever on my job, yet I have been obliged to give up the classes, which I have always enjoyed running, despite the fact that, far from adding to my income, they have, over the years, cost me a fair amount of money. Apart from my personal interest in morse, the classes have been my way of repaying the hobby for all that I have derived from it. Now I have been told that I must not continue them for the foreseeable future. I would most certainly appreciate some explanation".

Other members of BT staff seemed to share his incredulity. When we told them what the company had said to us, one replied, "I have worked for BT and its predecessors for over 20 years, for most of which I have held an amateur licence. Never before has it been suggested to me that to do so compromised my employment in any way. I would never consider engaging in any activity likely to affect either the good of the company or the livelihood of my mates; but I am completely at a loss to see how any aspect of amateur radio can do either, especially when the terms of my licence specifically forbid its use for commercial purposes. The whole thing seems very narrow-minded to me".

We understand that this particular piece of bureaucracy has also led to murmers of discontent from within the hallowed corridors of the Radio Regulatory Division, where the prevalent view appears to be that the RSGB's contract was offered on the basis that it represented the best available option. Suggestions that this might cause commercial embarrassment to BT seem, on the whole, to have caused some eyebrow raising and letters are reputedly flowing back and forth between the RRD and the various bodies involved in the wrangle.

The Problem

So what is the real problem? It is hard to conceive that even at £15 a head this represented any more than a very tiny drop in a very large bucket to an organisation so diverse as British Telecom. It is very hard not to see their present attitude as a very bad case of "sour grapes".

Agreed, BTI has a duty to both its shareholders and customers but is it unreasonable to suggest that it also has a duty to its employees? Does that duty not include resisting the temptation to act like Big Brother on the apparently flimsiest of pretexts? Which user organisations do they suspect might be lurking in the wings, ready to take the bread from their mouths? It is only natural that a fair percentage of those who work within a company so embroiled in electronics should become interested in amateur radio. If the teaching of morse is likely to affect their employer's profits then one must assume that the logical conclusion is to completely prohibit staff from holding licences, since every voice contact represents a potential loss of telephone revenue! I dread to think how the use of RTTY must be viewed!

If the leisure activities of those working for major companies are to become the subject of scrutiny and prohibition in this manner, may we look forward to British Airways staff being told that they may not fly model aircraft? Will British Rail put a ban on train sets and how does the BBC view amateur television?

Come off it, BT! You may be disappointed at losing the right to conduct amateur morse tests but there is no advantage to be gained from venting your spleen on a small section of your own staff, many of whom just happen to be RSGB members. You are, doubtless without intent, creating the unfortunate impression that since you cannot make the rules of the game, you refuse to play. Of course the RSGB does not yet have your experience in this field. It was only to be expected that they would, to some extent, turn for guidance to those of their members who were in a position to offer expert advice and assistance. But do not make the mistake of believing that ensuring this assistance is reluctantly withheld will reduce by one iota their determination to succeed.

Already the RSGB have created the infrastructure which should lead to more amateurs taking the test, both because of a most welcome drop in price and because the location of their test centres will soon mean that nobody has to make the 250 mile round trip I faced. Amateur radio is a hobby, not a threat to the British way of life — so please show a little good grace and let no-one be able to accuse you of sour grapes.

The Latest Not Very Black Boxes

Two new products have been announced by Thanet Electronics of Kent. They are the Icom 28E and IC 751A HF all band transceiver with general coverage receive. Based apparently on the best features of the IC751, it also has an electronic keyer unit capable of 40wpm, a new design of tuning control, 32 memories for all the things you forget, and can detect and monitor the internal temperature on receiver. The 9MHz notch filter, AGC system, compressor and AF gain control have all been redesigned hopefully for better performance. It costs £1399 inc.

The Icom IC28E is a mobile 2m rig providing 25 watts out in a more compact form than your average 2m rig. As can be seen in the photo nearby, it has a large LCD display and 21 memory channels, which can be scanned. It can cover 138-174MHz on receive with a simple modification. The IC28E costs £325 inclusive and further details can be obtained on 0227 363859.

New from the Yaesu stable is an HF 'backpack' portable transceiver called the FT70F/G. This synthesised three mode (SSB, CW and AM) rig gives 10 watts out over the frequency range 2 to 20MHz and has reception from 500kHz to 20MHz. An apparently very rugged construction with built in NiCad battery pack ensures almost weatherproof operation wherever you want to take it. For more information contact Amcomm/ARE on 01 992 5765.

Finally, from Trio is an interesting design for the professional market — the TK701S and TK801S. The 701S covers the frequency range 141-174MHz with a possible 32 channels giving an adjustable 20-40W out. Interestingly, it has 12.5kHz channel spacing although the second one has 25kHz channel spacing and covers the frequency range of 425-512MHz. If you would like to know more, contact Lowe Electronics on 0629 2817.

Trio TK701S and TK801S

Icom IC28E

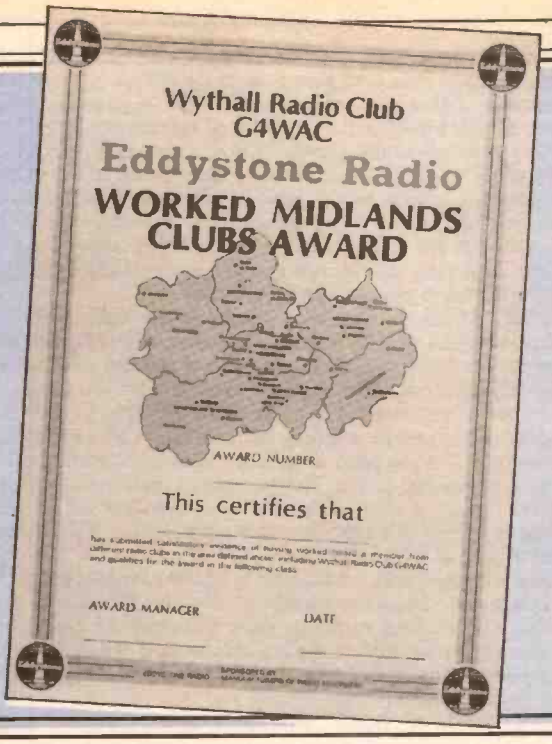
Wythall/Eddystone Midlands Clubs Award

Wythall RC, G4WAC, based in Hereford and Worcester, have organised the Worked All Midlands Clubs award to promote the existence of amateur radio clubs and societies in the area. The award is open to radio amateurs and listeners operating on the 6m, 4m, 2m, and 70cm bands in any simplex mode.

To qualify for it, a certain number of points have to be obtained ie bronze requires 20, silver 35, gold 50 and platinim 65 points. These are awarded to stations worked or heard whose operator's identify themselves as members of a recognised club or society in the counties of Hereford and Worcester, Shropshire, Staffordshire, Leicestershire, Northamptonshire, Warwickshire and the West Midlands. There are some 70 or so clubs in this area.

A member of a club or society who is using his own callsign counts as 1 point; if he is using the club callsign, it counts as 2 points. A member of Wythall RC using the club callsign G4WAC is 5 points. Note that all claimants must work G4WAC and only one contact per club can be claimed for the award.

Claimants must submit log extracts signed by two other amateurs although summary logs are acceptable. Don't forget to note the club name along with the usual details in the log. If you want a list of the clubs in the area, the award manager can supply one if you send a large sae. Only clubs on this list are acceptable, although the list will be updated periodically. To claim the award, send your log with a cheque or postal order for £1.50 made out ot Wythall RC (and stating the class claimed and how the points total is arrived at) to Wythall RC, Mick Pugh, G4VPD, Awards Manager, 37 Forest Way, Hollywood, Birmingham, B47 5JS.



Nice Mast, Shame About the Range Rover

No offence to BL intended, but it does detract from the ultra light weight and apparently strong carbon/glass fibre mast from Antenna Technologies. Designed and built for "portable professional and tactical defence" requirements in mind, (does that mean Raynet? — Dep Ed.) it is half the weight of conventional masts and is less susceptible to corrosion and icing. The masts are available in 10, 15, 20 and 25m versions and can support wire, yagi and dish antennas. For more information, prices etc contact Antenna Technologies on 01 546 7808.

Events and Exhibitions

First on the list for this month is the widely publicised amateur radio and electronics hobby fair held on the weekend of 5th and 6th July at the Wembley Conference Centre, London. There will be a wide variety of retailers and manufacturers of RTTY, satellite TV and communications, microwaves, components, amateur TV etc. Admission is £2 for adults, half price for children (a family ticket costs £4.50). On the Saturday the doors open at 10.30 and close at 6, on Sunday the times are 10 till 4.

From the 10th to the 13th July, listen out for the callsign GW0EJE/P on all HF bands and 2m. The callsign is the club call of the Pembrokeshire RS who are making an expedition to the island of Ramsay. The WAB square is SM62, locator IO71HU. A commemorative QSL card will be available to all contacts and an award will be supplied if you work the club on three different bands.

The McMichael Mobile Rally is being held on the 20th July at the Haymill Centre, Burnham, near Slough. Organised by Chiltern ARC, Burnham Beeches ARS and Maidenhead DARC, a large number and variety of traders have been invited with a flea market, amateur TV, HF station, radio controlled models, mini fairground, and lots more besides. The doors open at 11am.

The 1986 Commonwealth Games are being held in Edinburgh this year and to commemorate this, Lothians RS have organised a special event station with the callsign GB8CG. It will operate on each of the ten days of the games from 24th July to 2nd August from a venue near the Meadowbank Stadium, and will be working as many of the HF bands as possible at different times each day to suit prevailing propagation conditions plus 2m FM and SSB.

Special QSL cards will of course be available. Visiting amateurs are invited to call in on S20 or the local repeater for directions to the venue. For further details phone Mel, GM6JAG on 031 664 5403.

And finally, the Scarborough rally is on the 27th at the Spa, Scarborough starting at 11am. There will be a morse testing station at the rally. If you would like an examination, please make your application as soon as possible. A large number of traders will be attending with all the other usual attractions. For more details ring G4UGP on 0723 376847.

Expanding Range From Arrow

Are you interested in satellite TV? Well if you are looking for a supplier of equipment, Arrow Electronics have a range including 1.2 to 2.4m dishes, low noise block down-convertors, and multi channel receivers with infra red remote control. They also have a variety of accessories and software for the Beeb micro.

As for their amateur range of equipment, they have just installed in their Essex branch, the first Trixtower telescopic. The tower comes in three sections that are erected with one winch and can withstand the equivalent of an 80mph wind load. The basic unit cost £299 inc VAT with an extra £15 for the ground socket.

Finally, they have been appointed distributors for GDN/ISAM from Switzerland whose 'Hotline' range includes Kenpro, Standard, Alinco, Bearcat, Pace and others. A copy of their catalogue is available from Arrow in return for 50p. If you would like to know more, you can ring Arrow on 0245 381673 or their Scottish branch on 041 339 6445.

Micro Mania

With the number of amateurs using their micros to decode RTTY, morse and Amtor increasing by the day, JEP Electronics have devised a terminal unit that can, they claim, improve the performance greatly. The unit provides what they describe as very tight filtering as well as a variety of outputs to drive all the programs known to them. The filter can be switched from 800Hz for CW to three frequencies for RTTY reception. The standard frequencies are 1275, 1445 and 2125Hz although others can be supplied.

The TU is fed from the external socket of your receiver with outputs for TTL, Open Collector (both active high and low) Level and audio. The latter is fixed for a wide range of inputs but can be adjusted. It costs £45 inc VAT and p&p and is available from JEP at New Road Complex, New Road, Kidderminster.

The Ubiquitous FT290R

The Yaesu FT290R is unquestionably the best selling VHF amateur transceiver ever, with in excess of 10000 being sold in the UK alone. Harry Leeming, G3LLL, of Amateur Electronics/Holdings and an acknowledged expert on Yaesu equipment, offers modification and servicing information on the rig that put 'ubiquitous' into amateur radio vocabulary.

In June 1981, the newly introduced Yaesu FT290R took the UK amateur market by storm. Soon dealers had queues of amateurs on a waiting list with money in their hands ready to go 2m multimode for under £250. Especially now, the FT290 fits the requirements of the not too affluent UK market very well. In one piece it provides a unit which is suitable for portable, mobile or base station use with CW, FM and SSB operation being provided for. The FT290 is a little large for portable operation and somewhat small for base station use, but it suits most people who want to do a little of everything on the 2m band and have not a £1000+ to spare for three separate rigs.

What's Inside?

The block diagram, **Fig. 1**, gives a pretty good idea of the circuit arrangement. The receiver section is conventional with a dual gate FET RF stage and first mixer followed by a 10.81MHz first IF. The SSB and CW sections carry on at this frequency as far as the balanced demodulator, whilst FM is dropped to 455kHz by an 'all in one' demodulator chip. AF output to the speaker is about 1 watt, far more than the miniature internal speaker is happy with, but provision is made for the use of an extension speaker — if at all reasonably sensitive this makes 1 watt sound quite loud.

On transmit the SSB and FM signals are developed at 10.81MHz and "squirted" towards the antenna. The PA stage is set up so that without ALC it will deliver 4-5 watts to the antenna when the set is operating from a 13.8V supply. ALC is then applied to reduce this to 2.5 watts and provides some measure of SWR protection to the PA transistor.

Powering The Rig

Provision is made for operation from eight internal U11/C size batteries or from an external 8.5-15V supply. On FM, the internal batteries can be either rechargeable NiCads or conventional types, but for SSB transmit only NiCads are suitable as the higher internal resistance of carbon/zinc batteries tends to cause unwanted FM and distortion on SSB transmissions.

How To Blow Up...

Basically, the FT290R is an extremely reliable unit. However, through dedication, skill and experimentation, our customers have worked out several ways of putting them out of action.

... The PA Transistor

The ALC system on the FT290R is designed to hold the power down to 2.5 watts. When correctly set, it will deliver its 2.5 watts at any DC power supply voltage from about 11 to the top limit of 15 volts. If the ALC is incorrectly set, over 5 watts output can be obtained at the 15 volts end of the scale and some people think that they have "peaked up" their rig by misadjusting the ALC pot. You may get away with it for a time, but any attempt to get more than 2.5 watts will make negligible difference to signal strengths and is likely to result in a £25 bill!

The telescopic antenna on the FT290R can be removed to facilitate the use of a flexy whip or a 'rubber duck'. Once the telescopic antenna has been removed, it is essential that it is refitted and telescoped down into its holder before any attempt is made to transmit on an external antenna. The retracted telescopic whip is part of the PA tuned circuit when using an external antenna, and its omission will reduce output and increase input — and more than likely blow the PA transistor.

... The NiCads

The calculator type socket on the back of the FT290R is for connecting an external DC supply lead. There are at least four different sizes of calculator type DC plug which will fit into the hole in the socket but only one size is correct. The plug used must operate a switch to disconnect the internal NiCads as it is inserted *before* the external supply makes contact. Many plugs when half inserted put the NiCads straight across the 12 volts supply and several FT290Rs have been written off simply by using the wrong size of plug.

You cannot tell if the plug is correct by looking at it, try pushing it in slowly whilst watching the LCD display. If the plug is correct, the display should disappear as it is

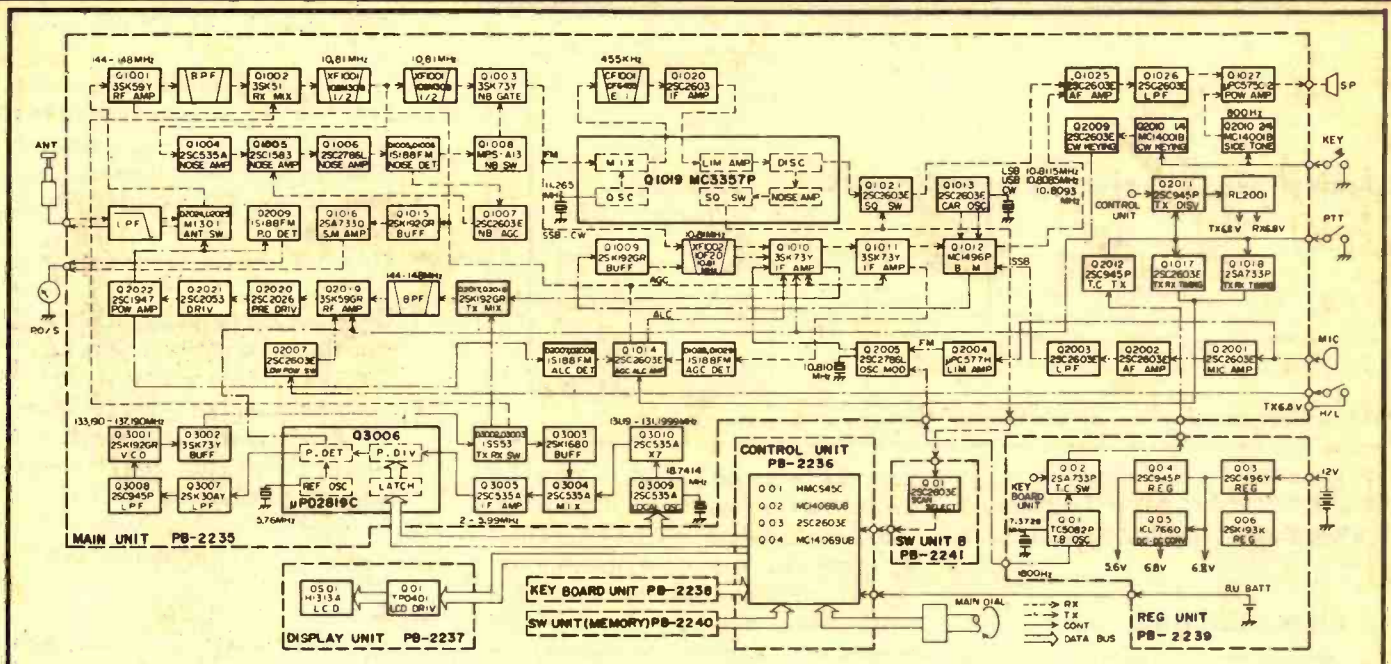


Fig. 1 The block diagram for the Yaesu FT290R.

inserted about half way. If external 12 volts power is connected to the plug, the display should then re-appear when the plug is pushed in further. It is most important that the plug disconnects the NiCads slightly before it connects the external power and *only the correct plug will achieve this.* On the subject of external power the FT290R consumes about 800mA and hence it is essential that the DC lead is fitted with an inline fuse holder with a fuse of not more than 2 amps.

. . . The Micro Processor

The scan pins on the mic socket end up at the micro processor. Also on the mic socket is a 5 volt supply pin. Try soldering a mic socket whilst it is plugged into the rig or short out the mic connections and you are likely to blow the micro processor. This, of course, applies to most rigs using micros and as these devices are about the size of a ½p and have 50+ soldered connections, replacement is expensive and a job for the dealer.

Initially Insensitive

Some FT290Rs did initially seem slightly lacking in sensitivity and there was a rush of modifications and pre-amplifiers to hot them up. Later they were really quite sensitive, and the writer is not too keen on adding internal pre-amplifiers or high gain first FETs. In some circumstances extra gain may help, but when the band is crowded with strong signals, it will only make splatter — due to cross modulation — worse. The writer's feeling is that any extra gain should be switchable so that the "best buy" is a good linear power amplifier with a switchable pre-amp.

If the rig really is deaf, it is possible that the alignment is out, particularly if it started life as a "grey import", originally trimmed to cover 144-148MHz. Touching up the RF alignment of the FT290R is not too difficult provided you know what you are doing — it is covered in the instruction manual. The following notes are provided for the benefit of those without a load of test gear, assuming that the rig has not previously been attacked by a trimmer twiddler.

The simplest way of checking of frequency is to tune to a reliable frequency standard, such as a beacon, a couple of different repeaters, or an accurate crystal calibrator, in SSB mode and note the dial readings. It is very difficult to judge exact zero beat so try tuning to a low beat note first on USB and then on LSB and take the average. If the display is more than about 0.3kHz out alignment is needed. Find L 3007 (see page 41 of the manual) and turn it *very slightly* (about ⅛ turn) until the calibration is correct — you should not have to move the core more than half a turn unless some fault has developed. Use a proper trimming tool — not a screw driver — to avoid damaging the core. Note that holding the trimming tool near the core will upset the frequency.

Once the calibration is correct on SSB receive, the rig will automatically transmit on frequency on SSB and CW, but may be out on FM transmit. To check this, either borrow an accurate frequency counter, or get a few reports over the air. Only when the SSB side is correct should you start adjusting for the FM transmit by slightly turning L2002 (also shown on page 41 of the manual).

Brightening Up The Audio

When used mobile, the internal speaker tends to rattle if the volume is increased sufficiently to read the more muffled FM signals above road noise. A big increase in volume and clarity can be obtained by carrying out a small modification to the de-emphasis network which may have been optimised for higher pitched Japanese voices. This is shown in **Fig. 2.** C110 is removed by squeezing it with a pair of long nosed pliers until it shatters and then shaking out all the bits. This really does make for much clearer Rx audio.

Modifications

It must be emphasised that no work using a soldering iron should be carried out unless the rig is completely disconnected from aerial, power, batteries and all other

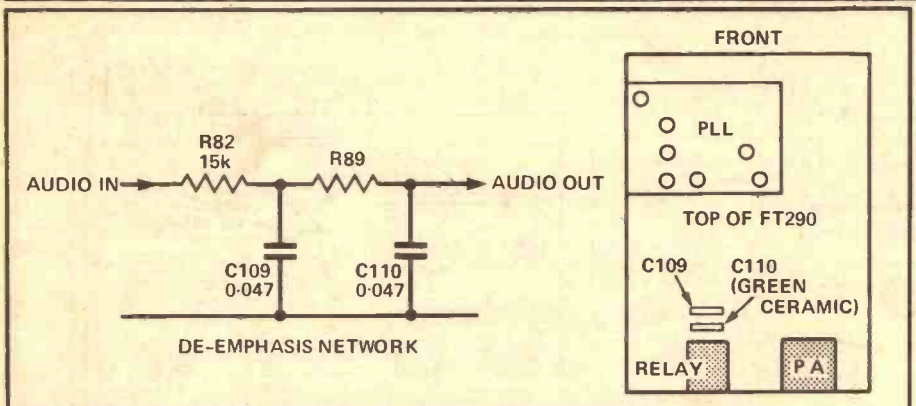


Fig. 2 How to 'brighten' up the receive audio by crunching up C110.

equipment. The soldering iron must be of a low leakage type and should preferably be earthed to the chassis of the FT290R.

Listen On Input

When working through a repeater, it is handy to be able to check if simplex contact is possible by dropping the receive frequency 600kHz. A very simple to carry out modification from the importers, Amateur Electronics of Birmingham, enables this to be done. Referring to **Fig. 3**, remove the bottom cover and locate the black and white wire on SK1 which is the tenth wire from the left. Remove this wire and insulate it from SK1. Find the green and white wire on SK2 and connect the anode of a diode — either an IS1555 or 1M914 — to it, remembering to sleeve the diode leads to avoid shorting. Connect the cathode of the diode to the red/white wire from SK1 at point X on Fig. 3. Now when pressing the call button, the logic of the rig is 'conned' into believing the rig is in transmit mode and so the receiver falls 600kHz without actually going over to transmit. Remember though, that when you want to send a tone burst now, you must squeeze the PTT at the same time as pressing the call button.

However, for those more adept at wielding the soldering iron, there is a modification to provide both listen on input and auto tone burst facilities. The 'listen on input' is wired to the previously redundant +600 position of the selector switch and a one second tone burst is sent whenever the mic is squeezed when switched to repeater mode. (There is no tone burst on simplex). If the tone burst is not required, it can be killed by switching off the noise blanker at the back.

As with the previous modification, the listen on input functions by switching the logic to Tx mode when the unit is on receive. The tone burst is made to run continuously on receive by being fed via D2 and R2 from the noise blanker +6.8V supply. When the PTT is pressed the 6.8V supply disappears leaving the tone burst to run for about one second from the charge in C1.

Here are the instructions for fitting this modification which was developed by ourselves (Amateur Electronics/Holdings of Blackburn).

1. Remove top cover.
2. Fit a 100 ohm resistor, R2, to the rear solder pillar and run a new brown wire from the free end of this resistor through any convenient hole to the regulator board on the underside of the chassis. Insulate any bare wires.
3. Cut the green wire from pin 12 and solder to line end of D3. Insulate diode and connections.
4. Cut back insulation on the black/white wire going to pin 11 without cutting wire and solder D3, the new blue wire and the 47k resistor, R1, to the bared wire.
5. Solder the other end of R1 to the HT pillar which has several red wires going to it. Insulate any bare parts and run the new blue wire to regulator board. Re-fit top cover.
6. Remove bottom cover and battery tray.
7. Slide out the regulator board and cut the printed circuit tracks at the two places shown.
8. Solder D1 to the green wire on the mode switch and the green/white wire on the nearby socket. Insulate as before.
9. Solder the new blue wire to the track on the underside of pin 11 on the socket.
10. Solder a 470uF, C1, to the track cut from pins 13 and 12, the negative end goes to an earth point on regulator board.
11. Feed the new brown lead via D2 to the positive end of C1.
12. Check that all diodes are connected the correct way round and that all joints and bare leads are insulated. Re-assemble the bottom cover.

Testing

Listen on input will occur when switched to +600. Tone burst will appear on −600 with "NB" switched on. If tone burst is too long or short in duration, alter value of C1. If tone burst appears on simplex, fit a 2.2k in parallel with C1.

Distortion On SSB Transmit

If the PA transistor is ever replaced, it is essential that it is

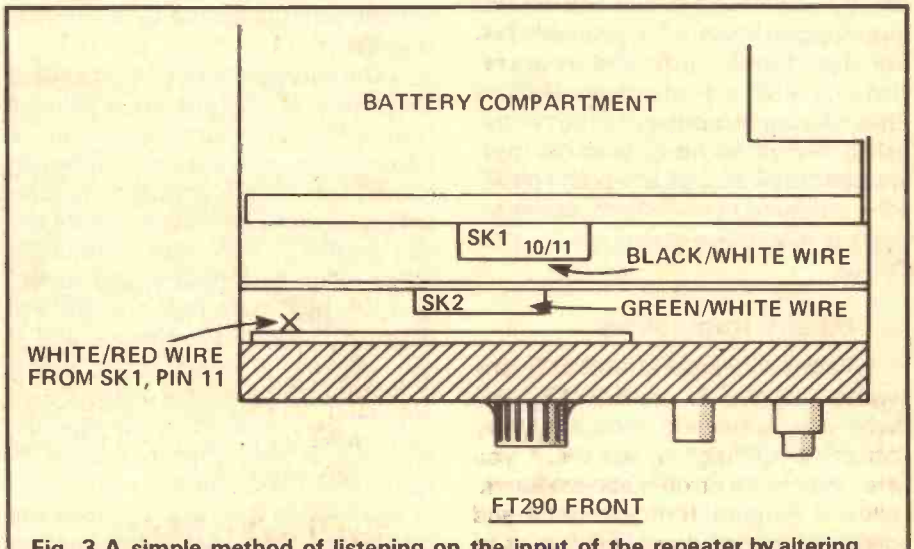


Fig. 3 A simple method of listening on the input of the repeater by altering the wiring to 'con' the logic.

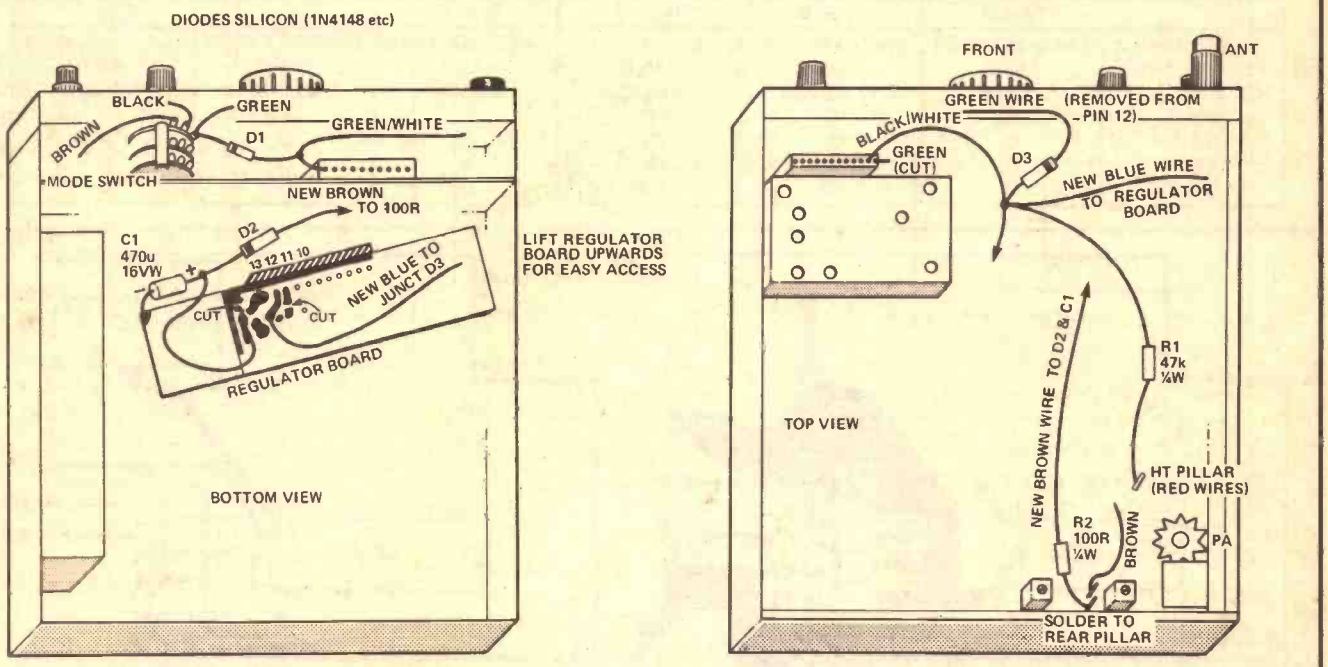


Fig. 4 The more complicated method for listening on the input which enables the tone burst. Please follow the instructions carefully.

correctly biased. A transistor at the end of the gain specification can be under or over biased if it is just swopped. To check, monitor the whole rig's HT current with it set at SSB, transmitting into a dummy load and feeding the rig from a 13.8 volts supply. Check on a sensitive power meter that there is no output, ie ensure that the carrier is correctly balanced, and that no sound is being picked up by the microphone.

Now short circuit the base of the PA transistor, Q2022, to chassis and the total HT current should fall by between 10-15mA. If it does not fall by this amount alter the value of R71 until it does. R71 is a fixed resistor in early FT290Rs and — whilst not shown in manual — is a variable pot in later FT290Rs adjacent to the PA transistor. The small diode, D23, is incorporated to prevent thermal run away and must be installed so that it is in thermal contact with the PA transistor using silicon grease whenever it is replaced.

Replacing The Pilot Lamp

The pilot lamp is probably the worst feature on the FT290R and whilst it does not burn out very often, it is a "pig" to replace. If you are used to electronic service work, allow 2-3 hours. If not, forget it and dangle a well insulated bulb between the display and the meter. Incidentally, a good insurance against lamp burn out is to dim it by connecting a series resistor of about 47 ohms.

If you do decide to replace the bulb, I am afraid I cannot give you a blow by blow description of its replacement, but for guidance, start by removing the regulator board and then work forward removing the other two boards by unscrewing them from their mounting pillars. Do not dismantle the LCD display but slide out and unsolder the old lamp and slide in a new one. The real art is to do the job without wires dropping off or becoming trapped under mountings and short circuited when re-assembling.

Intermittent Rx Or Tx?

If when you go over to transmit the relay clicks but the red light sometimes does not come on, or conversely two or three stabs at the PTT are required before the Rx comes to life, suspect the relay contacts. To clean, remove the plastic cover and whilst rapidly pushing the PTT squirt some *non oily* cleaning fluid in. I must emphasise that cleaner with lubricant must not be used neither must carbon tet otherwise you will have to replace the entire relay.

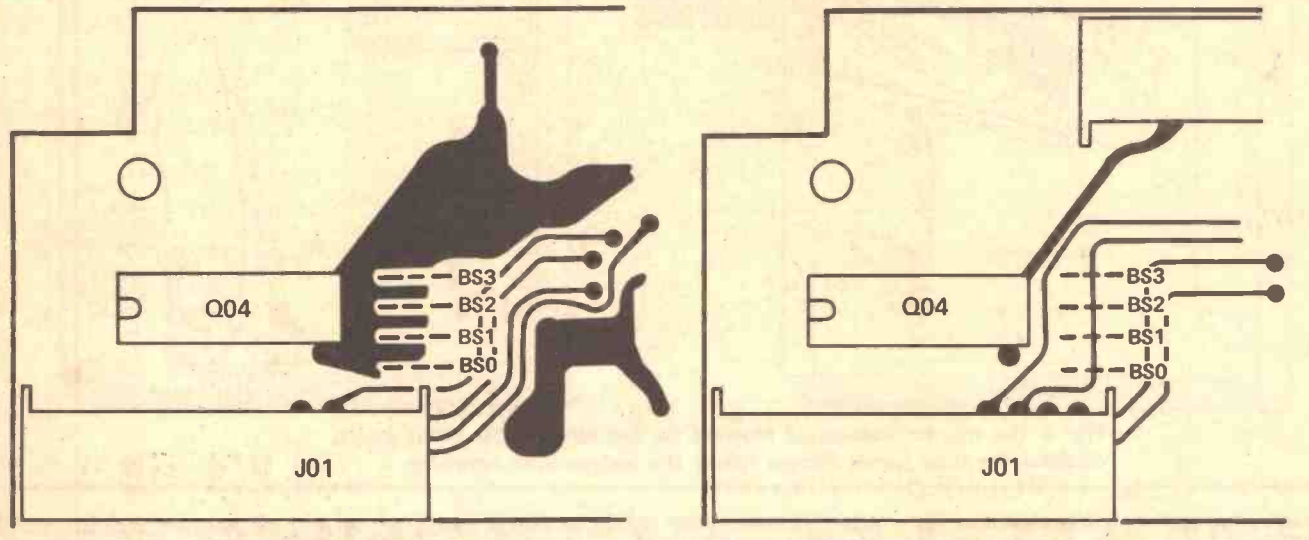
Synthesiser Whine

Some early production models of the FT290R had a rather high level of whine. This can sometimes be reduced by re-tuning the PLL which is explained on page 36, paragraph 2 of the manual. Set the rig at 145MHz and try adjusting TC 3001 for the highest and lowest voltages that can be obtained. Then set it at half way between these extremes — this might not be the 3.5 volts stated. Another dodge is to monitor the whine on a separate receiver and move the wiring harnesses around for minimum noise. The real cure on early production FT290Rs, if you are up some delicate work with a soldering iron, is to locate LO6 in the synthesiser and wire a 15pF capacitor in parallel with it. This can usually be tacked between the hot ends of C24 and C25 which will be found at the rear of the IC in the synthesiser unit.

Burnt Out Battery Holders

If, due to a short circuit, a faulty calculator socket or a wrongly fitting plug, the NiCads become hot, the holders will melt. These items are fixed into the metal tray with double sided Sellotape and are easy to replace as two exact replacements can be obtained from RS Components Ltd, stock no 488-214. After replacing these items do check, as explained previously, that the plug and socket are functioning correctly before putting the rig back into operation.

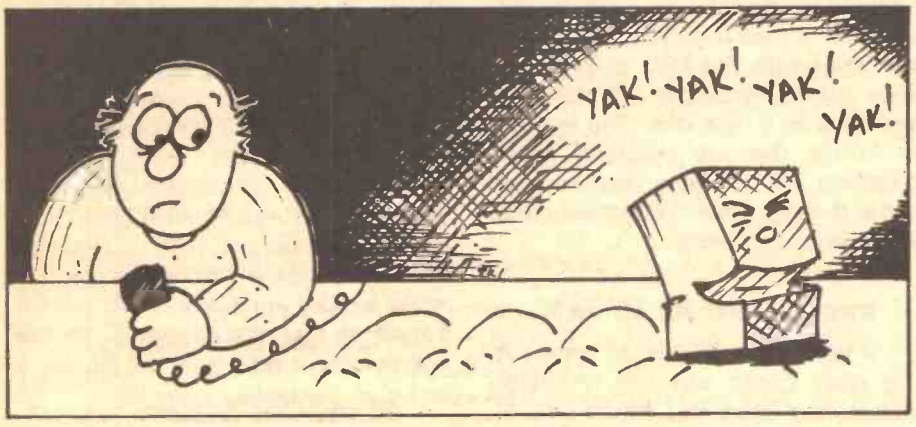
	Type A	Type B	Type C	Type D	Type E	Type F
BAND (MHz)	144.0-147.9999	144.0-145.9999	144.0-147.9999	144.0-147.9999	144.0-147.9999	144.0-145.9999
PRESET (MHz)	147.0	145.0	145.0	145.0	147.0	145.0
CH STEP (Hz)	5k/10k	12.5k/25k	12.5k/25k	5k/10k	5k/10k	10k/20k
BS 0	X	O	X	X	X	X
BS 1	O	X	X	O	O	X
BS 2	O	X	X	X	O	O
BS 3	O	O	O	O	O	O



PB-2236C VIEWED FROM COMPONENT SIDE

PB2236-2236B VIEWED FROM COMPONENT SIDE

Fig. 5 How to modify your transceiver to operate within the frequency range and channel spacings which vary round the world. Determine which type your rig presently is and which you would like to change it to. Then install 'jumpers' in the positions marked with a "O" in the table on the component side of the board. Type A transceivers can have their range extended to 143.5-148.49MHz by removing BSO.



Receiver Distorted On Some FM Stations

First check that the synthesiser is on frequency and then using the clarifier, carefully tune either side of a few stations. Note that the audio should be of good quality for about 2-3kHz either side of the point where the maximum S meter reading is obtained. If it is not, locate T1013, shown on page 40 of the manual, and adjust it so that the best quality falls symmetrically around the point where the highest S meter reading is obtained.

Chatter From Speaker When Transmitting

The audio output IC is muted by a voltage when transmitting to prevent "monkey chatter" in the background. In some FT290Rs, this mute voltage is sufficient to kill the speaker when operating from internal batteries but allows it to come back to life if the rig is run from a supply of more than about 13 volts. The cure is to locate the mute resistor R2076 which is 15k ohms and replace it with one of 10k ohms.

Using With A Linear

The matching Yaesu linear is switched by a DC voltage which appears on the antenna socket when in the transmit mode so there is no problem with the Tx/Rx relay clicking in and out when on SSB. When using an RF switched linear, this can become annoying and you may wish to "hard wire" it. If your linear has a PTT socket, this can be wired to the socket marked "stand by" on the side of the FT290R. If this is done with a linear such as the Microwave Modules MML 144/30LS, the clicking relay annoyance will be avoided.

Different Versions

Different FT290Rs are made for sale in different countries. Apart from the tone burst, these versions are identical except for the placement of the links on the micro processor. **Fig. 5** shows how these may be altered to give different frequency coverage and this may be handy if you are going abroad, or wish to use the rig with a transverter needing extended coverage.

MEGA TEST
Trio TS440S

The age of the super-rig seems to be here to stay — so obviously there are people out there who will spend nearly £1000 or more on a single item. But are these rigs what they're cracked up to be, and can they really justify their price tags? Chris Lorek, G4HCL, gives a qualified answer.

There have been many compact HF sets brought onto the market in the last few years. The Yaesu FT757, Icom IC735, and Trio TS430 were all designed to appeal to the user who wanted a good 'all round' base station set with the versatility of occasional portable or mobile operation. Many amateurs dream of owning a rig such as the Trio TS940S, reviewed in March '86 HRT. The latest offering from the Trio stable is the TS440S, described by many as a "miniature '940" which could serve as a compromise to the impossible dream. Extensive tests, both in the laboratory and on air were carried out on some of the first samples to arrive in this country, to see if it really does live up to the tag of "mini '940".

What's It Got?

The set covers all current amateur bands from 160m to 10m and can receive from 100kHz to 30MHz. USB, LSB, CW, AM, FM and AFSK are catered for with full break-in on CW — which also allows AMTOR usage — and can be switched to semi break-in if desired. An audio speech processor is fitted to give a boost under poor conditions and a manually tunable audio notch filter gives protection against heterodynes masking the wanted signal. Three filters can be selected automatically or manually for SSB/CW/AFSK, AM and FM. Optional narrower bandwidth filters are also available.

An IF shift control allows the operator to place the selectivity at the most appropriate position depending on QRM. The usual AF and RF gain controls are provided and the AGC may be switched to fast or slow decay, although it cannot be switched off. A 20dB attenuator gives protection against strong signals overloading the system and a noise blanker for pulse type interference such as ignition noise. An all mode squelch control allows noise free monitoring of quiet frequencies.

On transmit, they claim it can take a 200W input, giving just over 100W output on all modes except AM (110W input). Continuous operation is possible for up to one hour at this level. A fixed level CW sidetone is provided from the internal speaker. This is set to a frequency of 800Hz as supplied but may be changed to 400Hz if required.

An optional internal aerial tuning unit, operating from 80m to 10m may be fitted. This functions automatically on selection, using a low power carrier and motorised variable capacitors with a claimed matching capability of 20-150 ohms unbalanced.

The front panel meter may be switched to indicate ALC, output power, or SWR on transmit; always indicating signal strength on receive. The SWR indication is an automatic measurement, ie independent of output power. Mode selection is by push-button controls with inset LED indicators, when depressed the first letter of the operating mode is announced in morse code at a preset level. This may be changed to a single 'bleep' if required. When using SSB and changing bands, the correct sideband is automatically selected according to standard amateur convention. These mode switches are also used as a direct frequency entry or memory channel keypad.

Two digital 'VFOs' are linked to the main tuning knob, giving 10Hz steps on SSB/CW/AFSK and 100Hz steps on AM/FM, together with a staggering 100 memories storing frequency, mode and any XIT/RIT offsets. Ten of these memories may store split frequencies, useful for 10m FM use or when transverting to VHF/UHF. Front panel up/down switches select either amateur bands or 1MHz steps as desired. The main tuning knob may be used to step quickly between memory channels either to find vacant channels for programming, or for operation

when in memory mode. Scanning of memories, or frequencies programmed between memories 6 and 7, and/or 8 and 9 is possible. Split frequency operation, either in the same or in different bands is also possible by using the twin VFOs.

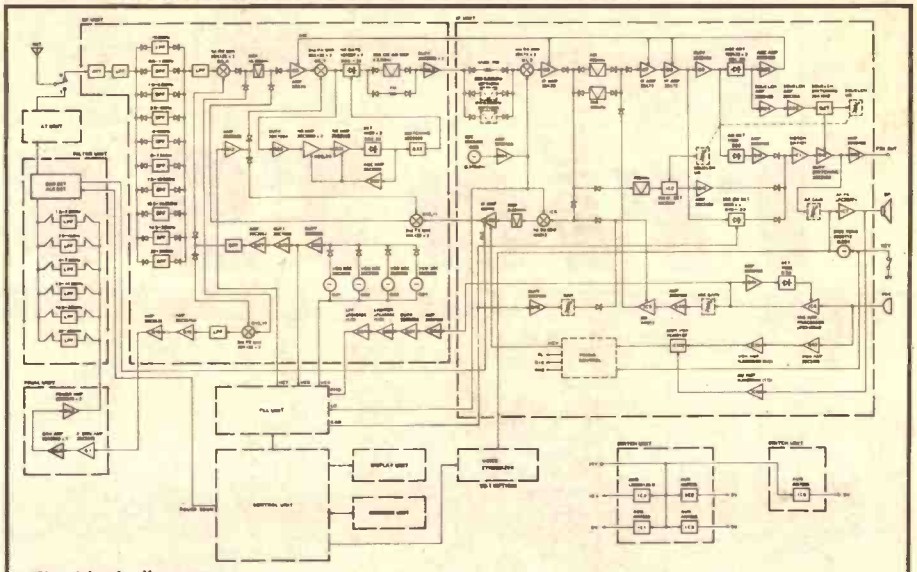
Frequency readout to 100Hz is provided by a vacuum fluorescent display, with resolution to 100Hz. This may be altered to give 10Hz resolution if required. The main display also shows VFO A or B, memory channel selected, and XIT/RIT offset. An optional voice synthesiser announces the operating frequency on command. Memory backup uses an internal lithium battery with an estimated five year lifetime, the microprocessor operating control, held in ROM, is not affected by this.

On the back panel are the usual SO239 aerial socket, ground plug, CW key jack, and DC power connectors. AFSK input and output phono terminals are fitted together with a spare phono socket and multi pin accessory sockets. Vox gain, delay, and anti trip preset controls are also fitted, but no facility for connection of a transverter.

The set is very light, weighing in at 7.3kg, and measures 270mm (W) × 96mm (H) × 313mm (D). It may be tilted up at the front using a fitted bracket on the underside of the set. Power requirements are 20A max at 12 to 16V DC. Trio also supply two optional matching power supplies, the PS-50 heavy duty supply for continuous transmission or the PS-430 for intermittent operation.

Accessories supplied include a heavy duty DC power lead, accessory plug and an operating manual. The manual gives the usual operating instructions, circuit diagrams together with brief circuit descriptions, and simple user adjustments. It is understood that a full workshop manual will be available "in due course".

Home computer buffs may be interested to know that remote control of the TS440 is possible with any machine having RS232 capability, plus an optional interface kit fitted to the transceiver. This allows programming and recall of VFO and memory frequencies, mode selection, RIT/XIT control and scan operation. At present there is no suitable software available but it should not take long before someone comes up with, say, a broadcast station listening program allowing you to input the stations required and automatically select the correct operating mode and frequency appropriate for the time of day and receiving QTH. Maybe one day we'll just come back home from work and see which other rigs our station has had QSOs with . . .



The block diagram.

Circuitry

On receive, the block diagram shows the incoming signal passes first through the switchable attenuator and a low pass filter to the correct band pass filter, which is determined by the frequency range selected. It goes through a further low pass filter to the first mixer consisting of a pair of 2SK125 FETs, where it is mixed with the VCO signal to achieve a first IF of 45.05MHz. A monolithic crystal filter is the next step, then the FET amplifier leading to the second mixer, again a pair of 2SK125s, providing the second IF of 8.83MHz. Noise blanking is performed at this stage, before being fed to a further monolithic crystal filter, buffer stage, and passed via any optional crystal filters fitted to the third mixer. This consists of a pair of 3SK73 FETs and is followed by a buffer and the standard switched 455kHz filters. IF amplification and detection follows, with AGC derived squelch used for SSB/CW/AM and noise derived squelch for FM. Audio notch filtering is performed by a BX7191 IC before being passed to the audio amp and speaker.

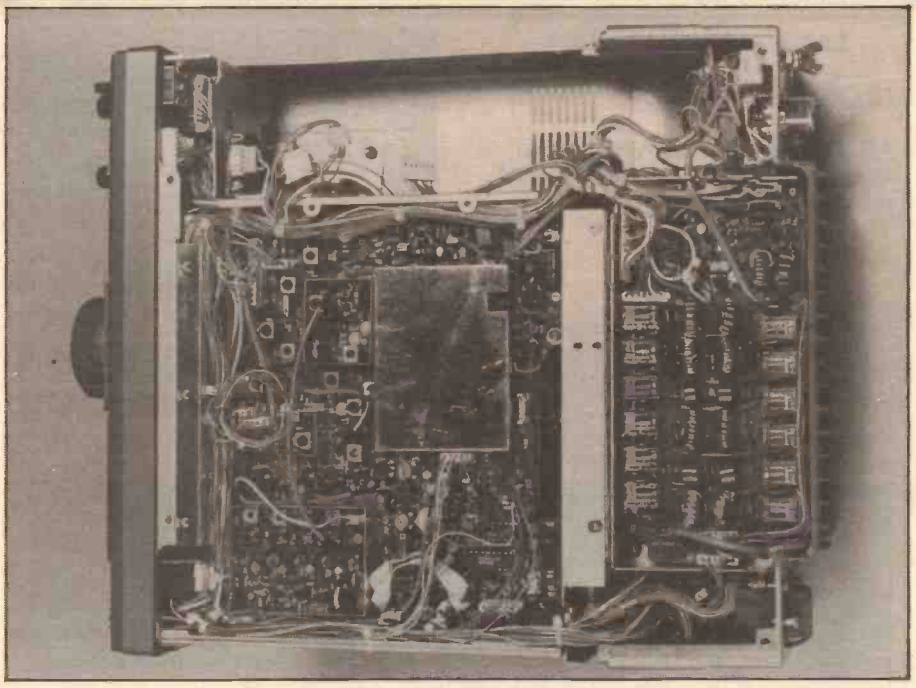
Transmitted audio passes through a UPC1158 IC which performs audio processing before being passed to the mic gain control and further audio amplification (see lab results later for an interesting discovery in this respect). On SSB an AN612 balanced modulator produces a first Tx IF of 455kHz which is put through the 455kHz filter to provide the bandwidth shaping. It is then fed to a further AN612 used as a mixer up to 8.83MHz and then via a monolithic filter and IF amplifier to the next mixer, producing 45.05MHz. There it is filtered and mixed again with the VCO output to produce the final signal frequency. Linear amplification is carried out up to the 100W level, the PA using a pair of 2SC2879 transistors, and fed via the appropriate low pass filter to the output.

Frequency generation is performed by a multi-loop synthesiser under microprocessor control. This drives four VCOs (voltage controlled oscillators) as well as generating the second and third local oscillator signals, all from one high stability crystal.

First Impressions

I looked over the extensive circuit diagrams, then back at the set and wondered, "how on earth did they fit it all in and leave room for an auto ATU as well?". I received a surprise when I picked it up — the set is extremely light. Good use is made of the available space by the stacking arrangement of the main PCBs, with a hingeing facility to aid servicing. Only the PA board was difficult to get to, being mounted right inside the rear heatsink.

Examination of the circuitry



shows that the basic TS940S approach has been followed but with several corners cut. Improvements have also been made, though. I noticed more filtering had been performed in many parts of the PLL section — a lesson possibly learnt from the poor reciprocal mixing performance of the standard '940 (see March '86 review).

The provision of 100 memories had me gasping at first — would anyone need them all? I also thought it a great pity that you could not control the filter width without buying expensive optional filters. I expected control of upper and lower filter slopes for a set of this calibre to be fitted as standard rather than the simple IF shift control available.

Full break-in CW is nice for both the DX chaser and ragchewer and allowance is again made for the fitting of narrow filters. Data users have both good and bad news. The bad news is that the 'FSK' mode marked on the front panel is really AFSK, something rather different. Also with a narrow filter installed, the receive side is centred on the American standard tones of 2295/2125 Hz rather than the worldwide standard of 1445/1275 Hz. You can overcome this limitation by twisting the IF shift control with only minor inconvenience.

The manual suffers from a few mistakes, mainly silly little ones such as telling you the audio processor will increase your output power on FM. The block diagram is at variance with the circuit diagram in one or two places. The manual is written in American English, and the continually repetitive use of "thru" raised my hackles somewhat.

On The Air

The review set was connected up and tested with the PS430 power supply and MC42S hand microphone, into a variety of aerials at my home QTH. Operation was carried out on all amateur bands. The services of an amateur friend who had just purchased a new 440 were also commissioned and both sets were tested both in my shack and in communication with each other with one used mobile.

The quality of received signal was very nice indeed on SSB, although I really needed a reduction in bandwidth when struggling both on 40m at night and in crowded conditions on 20m. The IF shift was of great use but suffered when the desired signal was in the middle of two stronger stations — shifting the pass band away from one brought further problems from the other. The second 440 had an optional YK-88SN 1.8kHz wide 8.83MHz filter fitted in addition to the standard 2.4kHz wide 455kHz filter. This brought about a tremendous improvement and I would certainly recommend this if you intend stretching the rig to its limits.

There was no suggestion of the dreaded reciprocal mixing, where synthesiser noise mixes with signals outside the crystal filter bandwidth to degrade reception. This is a common failing in synthesised sets, that often shows up as noise superimposed on the wanted signal. No amount of RF gain, attenuation, or IF shift adjustments clears the problem. It can be discriminated against blocking and other such effects by the presence rather than absence of noise on frequency.

It appears that Trio engineers have done well considering the standard TS940 performance — the TS440 actually outperforms it in this respect! I did find however that the receiver was prone to blocking from strong, closely adjacent signals when used with no extra filters. Switching in the extra SSB filter virtually cured the nearly strong illegal broadcaster on 40m, the only problem then was caused by the audio modulation which the IF shift helped with. With my 40m dipole at 10m AGL, I felt the need to switch in the 20dB attenuator occasionally with the standard filter fitted — sometimes causing loss of the desired signal when very weak.

The sensitivity on the LF bands was adequate. But on 10m it was lacking when in QSO on FM, with users of an average converted CB rig and amplifier, the odd contact being made difficult as a result. The 'S' meter on FM was grossly over generous. AM general coverage reception was certainly aided by the memory facility, but received quality did seem to be a bit on the 'tinny' side.

On transmit, good audio reports were received when talking around 10cm from the hand mic. Normally, I am used to close speaking, around 4cm spacing between mic and mouth but this seemed to degrade the quality a little. The audio processor was described as 'horrible' by several local stations, but did improve readability considerably when conditions were bad. I noted that the mic gain was always set at a low position, around the nine o'clock mark, increasing it beyond this put nearly every syllable into ALC. There is obviously plenty to spare for when using an unamplified desk mic. The mic gain control is inoperative on FM and I had to speak over 40cm from the mic to get a reasonable audio report. An internal preset FM mic gain adjustment is shown on the circuit diagram but no information on how to adjust it appears in the manual.

When using AFSK, it was necessary to unplug the mic as this was live on AFSK, which was a little annoying. The VOX facility operates on AFSK Tx and I used this with good results to perform Tx/Rx changeover, although hard switching is provided if required.

An amateur friend, an ex-professional CW radio operator of long standing, visited me and took great delight in putting the transceiver through its paces on full break-in CW, using his own precision engineered key. Although we both would have preferred a CW filter or audio peak filter to have been fitted, he left suitably impressed. The sidetone level was a little low but is internally adjustable.

Two friends went on holiday armed with my old TS120 and a tape recorder. In a sked QSO, a comparison recording was made between the signal quality of the TS440 and hand mic and my main station rig with Icom SM10 mic tailored to my speech. Good quality from the TS440 was noted with no undue distortion or excessive 'colouring' being present.

The optional automatic ATU was then fitted to the set. This was found to match far more than the specified 20-150 ohms, matching a 20:1 SWR with ease although taking about a minute to do so. There was the odd impedance it could not find a match for, but by switching to 'SWR' on the meter selection switch, observing when a minimum SWR is passed and hitting the tune 'off' button quickly, an acceptable compromise could be obtained. The tuner was fairly quiet, if a little slower in operation than others available.

In general listening around, I found the set a pleasure to use, the memory selection from the main tuning knob was especially quick to use and proved very convenient. The audio notch performed well, operating in all modes, being reasonably broad to allow quick tuning but still with good ultimate rejection. The noise blanker performed extremely well with no apparent degradation of strong signal handling as can often occur. When the internal cooling fan came into operation it was very quiet and certainly did not create any undue disturbance.

What I did notice though was a high pitched whistle, a bit lower in frequency than TV timebase, coming from the set which varied with settings of frequency, RIT, and so on. This probably comes from the display inverter, those with sensitive ears watch out!

Laboratory Results

RECEIVER

All measurements performed with standard filters selected appropriate to the mode unless stated.

First Image Rejection
Measured as level of image signal required to produce 12dB SINAD on tuned frequency, SSB mode

Freq (MHz)	Image response (in mV)	(+90.1 dB)
0.45	1.9	(+77)
0.55	3.2	(+65)
1.0	5.4	(+68)
1.9	1.7	(+76)
3.6	2.9	(+81)
7.05	6.8	(+89)
10.1	17.0	(+97)
14.2	7.1	(+90)
18.1	3.7	(+83)
21.2	9.0	(+91)
24.9	22.0	(+97)
29.0	12.5	(+94)

Sensitivity
Measured in uV pd for 12 db SINAD

Freq (MHz)	SSB/CW/AFSK	AM (30% mod)	FM (3kHz dev)	S9 sens
0.45	0.26	1.0	0.29	44
0.55	1.8	6.9	1.9	275
1.0	2.1	7.3	2.1	240
1.9	0.27	1.1	0.27	39
3.6	0.26	0.98	0.28	40
7.05	0.23	1.0	0.29	36
10.1	0.23	1.1	0.27	28
14.2	0.22	0.96	0.23	41
18.1	0.26	1.2	0.26	39
21.2	0.24	1.0	0.28	44
24.9	0.32	1.4	0.40	73
29.0	0.25	0.98	0.27	40

Two Signal Intermodulation Rejection
Measured in dB as ratio between levels of two interfering signals and on frequency signal, both giving 12dB SINAD

Freq (MHz)	10kHz sep	20kHz sep	100kHz sep
0.45	73	87	87
0.55	71	84	84
1.0	73	88	88
1.9	73	88	88
3.6	72	88	88
7.05	73	87	87
10.1	68	85	85
14.2	67	83	83
18.1	70	86	86
21.2	68	84	84
24.9	71	87	87
29.0	69	84	84

Laboratory Tests

The receiver was first tested for selectivity and confirmed that reciprocal mixing was not a problem in limiting the adjacent channel rejection. However blocking was evident, mainly due to overload of the third mixer at close spacings. When beyond the cutoff of the standard 8.83MHz monolithic ceramic filter, the blocking rejection improved by 30dB. With this in mind, further tests were carried out, this time on the set fitted with an optional 8.83MHz SSB filter. This verified my thoughts, with ultimate rejection now dependent mainly upon the selectivity of the filter. Even down at −100dB no telltale 'popping' or 'rumbling' noises characteristic of synthesiser noise were evident.

Throughout the selectivity testing, I found it difficult to use a synthesised signal generator due to noise introduction. In fact, three different high quality types were tried to ensure testing of the synthesiser performance of the set rather than that of the measuring equipment. The final answer was to use a manually tuned low noise valve generator with cavity attenuator!

The AM selectivity curve showed a peaky response, explaining the slightly indifferent AM performance, but FM selectivity was more

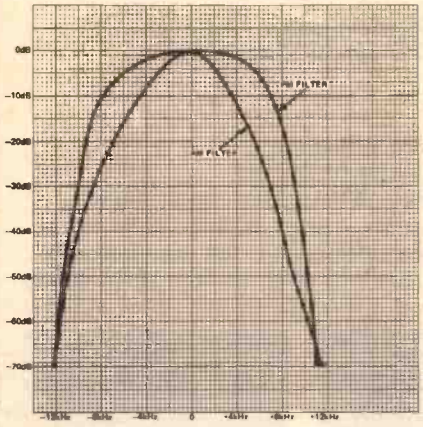
Blocking Rejection
Measure in dB as ratio between on frequency and interfering signal to degrade readability from 12dB to 6dB SINAD

Freq (MHz)	10kHz sep	20kHz sep	100kHz sep
1.9	76	87	107
3.6	73	84	103
7.05	82	93	109
10.1	75	86	105
14.2	76	87	105
18.1	75	86	106
21.2	77	88	108
24.5	76	88	109
29.0	76	89	108

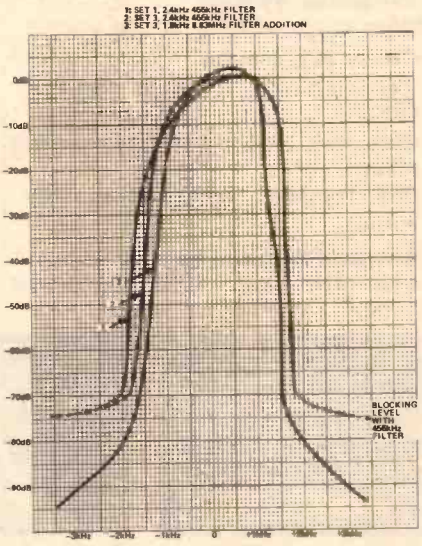
S Meter Linearity

Reading	SSB/CW/AFSK/AM (in uV)		FM (in uV)	
S1	1.34	(−29.7)	0.23	(−17.2)
S2	2.41	(−24.6)	0.45	(−11.4)
S3	3.61	(−21.1)	0.68	(−8.0)
S4	5.60	(−17.3)	0.84	(−6.1)
S5	7.55	(−14.7)	1.00	(−4.6)
S6	10.8	(−11.6)	1.15	(−3.4)
S7	16.9	(−7.7)	1.32	(−2.2)
S8	26.5	(−3.8)	1.50	(−1.1)
S9	41.0	(0dB ref)	1.70	(0dB ref)
S9+10dB	112	(+8.8)	2.11	(+1.9)
S9+20dB	424	(+20.3)	2.69	(+4.0)
S9+30dB	1520	(+31.4)	3.43	(+6.1)
S9+40dB	5400	(+42.4)	4.52	(+8.5)
S9+50dB	17700	(+52.7)	6.2	(+11.2)
S9+60dB	34500	(+58.5)	11.9	(+16.9)

The TS440 AM/FM selectivity.



The TS440 SSB selectivity.



Selectivity
See nearby graphical plots

Squelch Sensitivity
Tested at 29.0MHz, RF gain at max. Measured in uV

Mode	Threshold	Full
SSB/CW/AFSK/AM	0.56	3.29
FM	0.11	0.28

Internally Generated Spurii
1.2184MHz, all modes, S−3.5
1.1971MHz, USB only, S−3.5
8.3750MHz, all modes, S−3.2
All others below S−1 level on SSB/CW

reasonable. The intermodulation rejection was reasonable for this calibre of set and the far-out blocking performance was very good.

To investigate internally generated spurii, the aerial connection was terminated in a screened 50 ohm load and the set tuned, on each mode, across the 100kHz-30MHz range. At this point I wished Trio had fitted a finger hole in the knob! Many signals were found, mainly in the LF bands — not surprising considering the large number of internally generated frequencies. Over 100 signals were found at low levels, ie below S1 on SSB, but these should hopefully not cause too many problems.

On transmit, I found it strange that the allowable range extended to 500kHz below each amateur band, with the exception of 160m. Examination of the internal circuity suggests that transmit power may be linked for 20W, 50W and 100W maximum, although this is not stated in the manual. There appears no other way to limit SSB power output for use on some bands and for transverter use apart from an external ALC input voltage.

The two tone SSB intermodulation was tested by injecting two low distortion audio generators, at 850Hz and 2kHz, into a low noise op-amp acting as a summer, the output of 2mV RMS per tone being fed to the microphone input of the set. A rather bad output signal in terms of spectral purity was noted, which at first was thought to be the leakage of carrier and mixing products caused from this. This was discussed with Lowe Electronics, who suggested testing a further set. This was found to exhibit the same effect, verified by testing on two different spectrum analysers.

Further investigation showed this to be due to audio intermodulation between the two tone frequencies. This rather worried me and led me to suspect the audio signal applied. This was examined on an audio analyser as applied to the mic input and found to be 'clean' as showed in **Fig. 1.** The effect was not dependent upon mic gain, the output power or ALC condition, it only affected the RF intermodulation products which were at an acceptable level. From this, it appears that the problem is probably occurring in the UPC1158 mic amp/processor. This confirms the on air tests which showed up excessive mic gain. The poor IC is continually being blasted with audio at speech peaks which it just can't handle. The mic gain potentiometer follows the amplifier

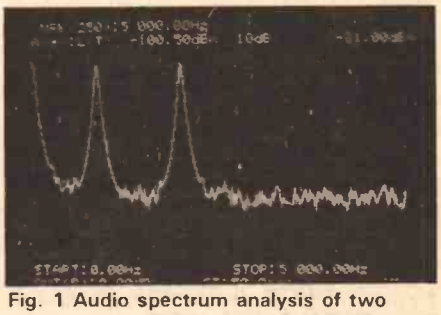


Fig. 1 Audio spectrum analysis of two tone input to TS440 (horiz 0.5kHz/div).

rather than preceding it.

The signal is not excessively widened because of the audio filtering which follows the mic amplifier stages. In any case, the human voice is filled with harmonics and mixing products itself. However, it does explain the need to talk a reasonable distance from the mic.

The photos below show the effects on a typical transmitted signal from the set. A permanent solution to the problem is simply to reduce the output level from the microphone to a low level — eg by lowering the amplifier output level from a desk mic — and increasing the mic gain on the set substantially. There was little problem on a single tone, just a slight amount of output at ½ and 1½ times audio frequency. This should not cause problems in communicating on AFSK because only one tone at any time is being transmitted.

The RF harmonic output levels were a bit on the high side, these would normally however be reduced to a lower level by a resonant aerial or aerial tuner. The third harmonic of 10m could cause problems to VHF broadcast reception and I would advise a further low pass filter to be fitted if possible. (I use one with more than 100dB rejection of 89MHz as a matter of course in my home station.) Low level spurii varying in sympathy with the transmitter frequency were noted. These are due to the amount of internal mixing taking place and are sufficiently low level to only cause problems in exceptional circumstances.

Conclusion

A lovely little set, very small and versatile but packing in a high level of performance, the only teething problem of note concerns the transmitted audio which is easily overcome. The basic transceiver performs reasonably well and can be improved (in real terms rather than with 'convenience' additions) if required — or when funds allow — by buying the optional filters. If you're thinking of buying a TS440 remember to make possible allowance for these plus a suitable power supply and microphone. Using the rig for transverting to other bands is made awkward since there is no transverter input/output, however, on the whole it is very good for general HF amateur use.

TRANSMITTER

Transmit frequency range as supplied in MHz

1.6	-	2.0
3.0	-	4.0
6.5	-	7.5
10.0	-	10.5
13.5	-	14.5
18.0	-	19.0
20.5	-	21.5
24.0	-	25.0
27.5	-	30.0

Transmitter Maximum Power Output
Measured in watts

Freq (MHz)	SSB (PEP)	CW/AFSK/AM/FM
1.9	114	117
3.6	112	116
7.05	110	114
10.1	115	116
14.2	114	116
18.1	114	115
21.2	112	115
24.9	111	113
28.5	109	111
29.5	109	110

Transmitter Harmonics
Measured in dB

Freq (MHz)	2nd	3rd	4th	5th	Higher Order
1.9	−51	−72	<−70	<−70	<−70
3.6	−54	−65	<−70	<−68	<−70
7.05	−49	−48	<−70	<−70	<−70
10.1	−46	−54	<−59	<−70	<−70
14.2	−51	−55	<−70	<−70	<−70
18.1	−42	−58	<−70	<−70	<−70
21.2	−43	−56	<−70	<−70	<−70
24.9	−46	<−70	<−70	<−70	<−70
29.0	−45	−54	<−70	<−70	<−70

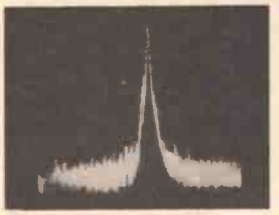
Transmitter Spurii
None above −60dB rel max output

Carrier Suppression
USB, no audio, −59dB rel max PEP output
USB, 1kHz tone, −58dB rel max PEP output
USB, two tone, −47dB rel max PEP output

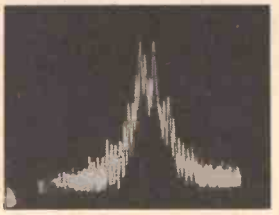
Sideband Suppression
USB, 1kHz tone, −57dB rel max PEP output

Intermodulation Distortion
See nearby photographs

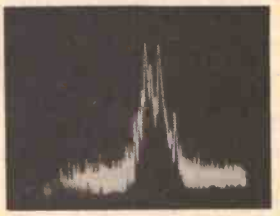
FM Deviation
Tested at 29MHz
Max 5.7kHz, peaking at 350Hz audio, 4.5kHz at 1kHz audio
6dB/Octave +/−1dB pre-emphasis response from 300Hz-1.7kHz, tailing off above this to 5dB down at 3kHz



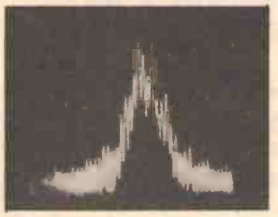
Rig 1 — Single 850Hz tone on USB at the onset of ALC (scale: 10dB/div vert, 2kHz/div horiz).



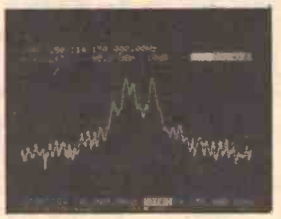
Rig 1 — Two tone output, 850Hz/2kHz on USB 3dB below ALC (same scale).



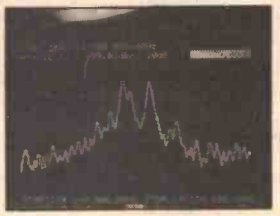
Rig 1 — Two tone output, 850Hz/2kHz on USB onset of ALC (same scale).



Rig 1 — Two tone output, 850Hz/2kHz on USB 3dB into ALC (same scale).

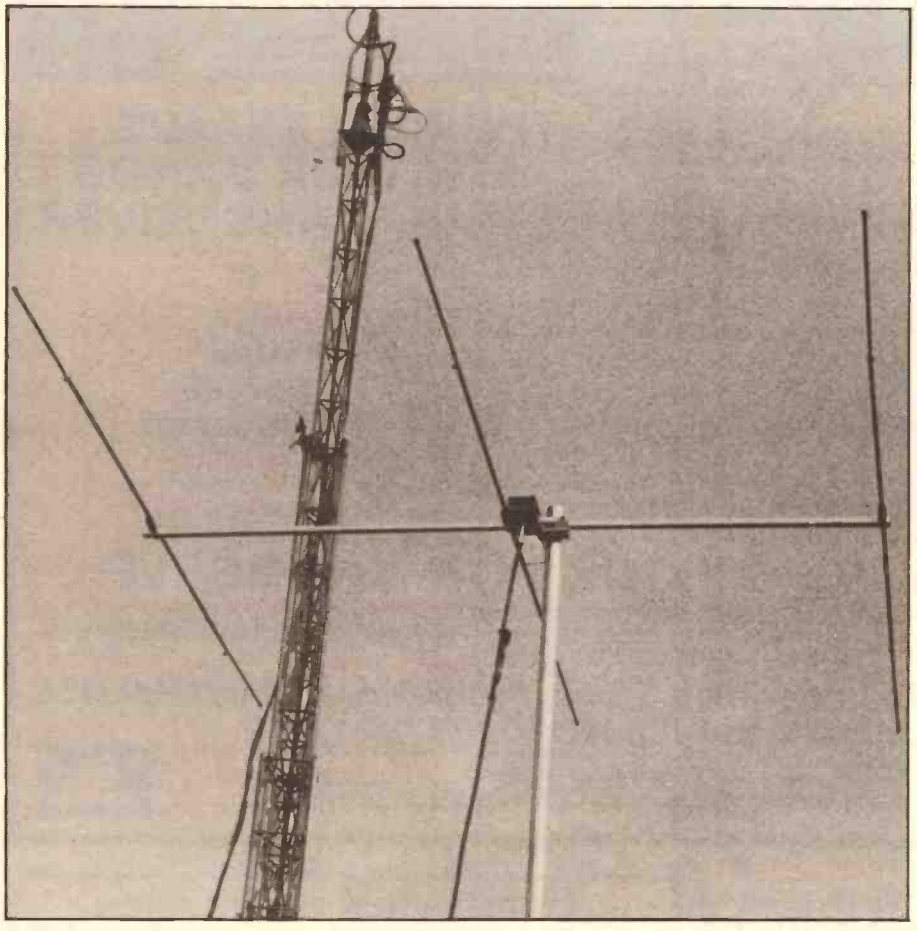


Rig 2 — Two tone output, 850Hz/2kHz on USB 3dB below ALC (scale: 10dB/div vert, 1kHz/div horiz).



Rig 2 — Two tone output, 850Hz/2kHz on USB 3dB into ALC (same scale).

6m Beam Antennas



6m beams may be the size of bedsteads, but they are a definite improvement over a dipole, giving directivity and gain — if you have the space. Commercial ones can be expensive but these designs from Mick Senior, G4EFO, were made from scrap TV aerials and rescued aluminium tubing.

Six metres is now available to class A licence holders in the UK, albeit with certain restrictions on aerial height, polarisation and an ERP limit. Having recently purchased a Yaesu FT690 with a limited output of about 2½ watts, it soon became apparent that a 6m aerial with a certain degree of directivity and gain would be a useful asset. Over the years, I have horded bits of aluminium and old 405 line TV aerials and now seem to have amassed a huge pile of junk. This provided the perfect components for the two 6m beam designs described here. No originality of design is claimed, although the use of junk for building aerials may be new to some amateurs.

Of the two aerials detailed, the first is a two element constructed from salvaged Band I aerial pieces; the second is a three element yagi made using pieces of aluminium and fixings. If you have no horded supply of these, they can be purchased from some of the many traders at mobile rallies, or amateur retailers. Alternatively, aluminium can be obtained from any of the non-ferrous metal foundries found in larger towns and industrial estates.

The Old TV Aerial

It is worth noting at this point that our 6m allocation is almost in the middle of the old Band I TV allocation which covered from 41.50-66.75MHz. The amateur allocation at 50.00MHz is almost equivalent to the old vision frequency of channel 2, so any aerials designed to cover Band I channels will need only a small amount of modification.

To make a two element beam, you need a Band I/III TV antenna, which are generally about 15 years old. The boom of most old aerials was of 1" tubing with the Band I and III elements using ½" and ⅜" tubing respectively, as shown in **Fig. 1.** All of the elements must be removed carefully from the boom using a can of penetrating fluid such as WD40 or similar. You will need to salvage four of the Band I elements and four of the Band III ones and as well as

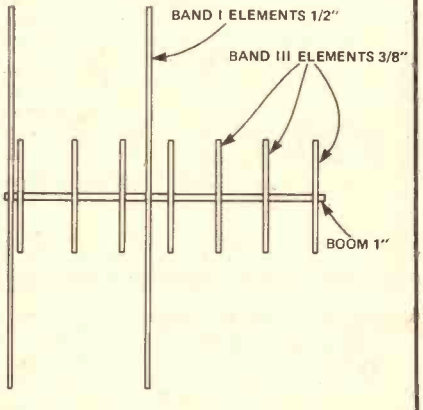


Fig. 1 The old 405 line TV aerial. An ideal subject for a 6m beam.

	2 element beam	3 element beam
Gain	4.5db	7.0db
E plane beamwidth +/–	45 deg	+/– 30 deg
Front to back	14 dB	18 dB
Reflector	10′ 1″	10′ 0″
Driven elmt	9′ 4″	9′ 4″
Director	------	8′ 10″
Element spacing		
Reflector to driven	42″	42″
Driven to director	------	42″

Table 1 The driven element lengths may vary slightly. For this reason, all the element lengths are easily adjustable by the user.

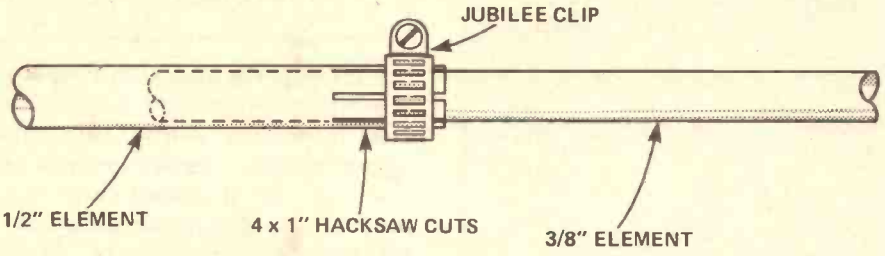


Fig. 2 How to adjust the element lengths. Once adjusted they should be fixed in position with jubilee clips.

the boom, you should save the insulated dipole centre piece. This will need thorough and very careful cleaning. Finally, the centre support for the Band I reflector should be retained, whilst the remaining elements and pieces are scrapped.

When stripping down the aerial, care should be taken not to break the element supports. On early aerials, these were often cast alloy and with time they tend to become very brittle. If it is impossible to salvage the nuts and bolts, they can easily be replaced at your local hardware store.

Taking the boom, drill a 3/16″ hole about 3″ from one end; then measure along the boom 42″ and drill a second hole in the same plane. The first hole will take the new driven element, the second is for the reflector. With the four Band I elements, measure from the end that was attached to the boom — distinguishable by a 1/8″ fixing hole — making sure each element is 54″ long. If these elements were saved from a channel 1 or 2 aerial, they will be longer and need cutting back. If they are from channel 3, 4 or 5, they may be slightly shorter — this does not matter as the elements will be of adjustable length.

Cut four 1″ slots in each of the four Band I elements at the opposite end to the fixing hole. This will allow the 3/8″ Band III elements to be slotted in and used as element length adjusters. Once adjusted to the correct length, they will be fixed into position using jubilee clips (see Fig. 2). The element lengths for both the two and three element aerials are given in Table 1.

Using a 3″ × 3/16″ bolt, secure the insulated dipole centre to the boom and in the same way secure the reflector support to the second hole. Attach the Band I elements with 1/8″ nuts and bolts to the newly fitted dipole centre and reflector support. You can use the existing holes for this. At this point insert the Band III elements into slots and using the measurements in Table 1, roughly set the lengths of the driven element and reflector.

The Feeder

Next take a length of UR76 coax which should be in excess of about 8″ long. Strip back one end and leave two tails each of 2″ as illustrated in Fig. 3. At this end make 6-8 turns of coax in a 6″ diameter coil and tape lightly together with insulating tape. This forms a choke to stop current from flowing on the outside or braid of the feeder and thereby acts as a balun. The two tails can be attached to the insulated driven element and the coil taped tightly to the underside of the boom adjacent to the feed point. Attach a suitable plug to the other end of the feeder.

A source of 6m RF is required for the next stage along with a VSWR bridge. Attach the bridge to the coax and then take a length of feeder to the RF source. Apply only a small amount of RF and turn up the gain of your VSWR bridge, which will give a more accurate measurement. Only the length of the driven element should be adjusted, remembering to tune both halves equally. It may be

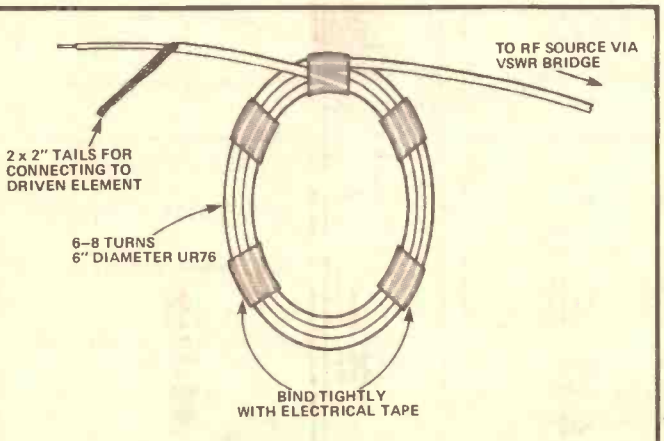
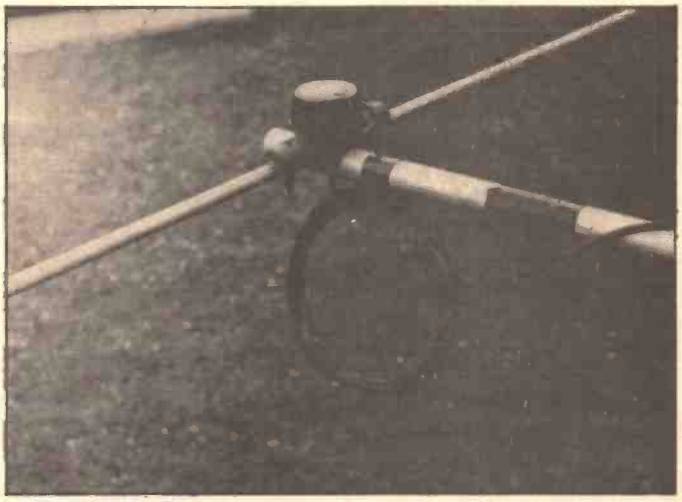
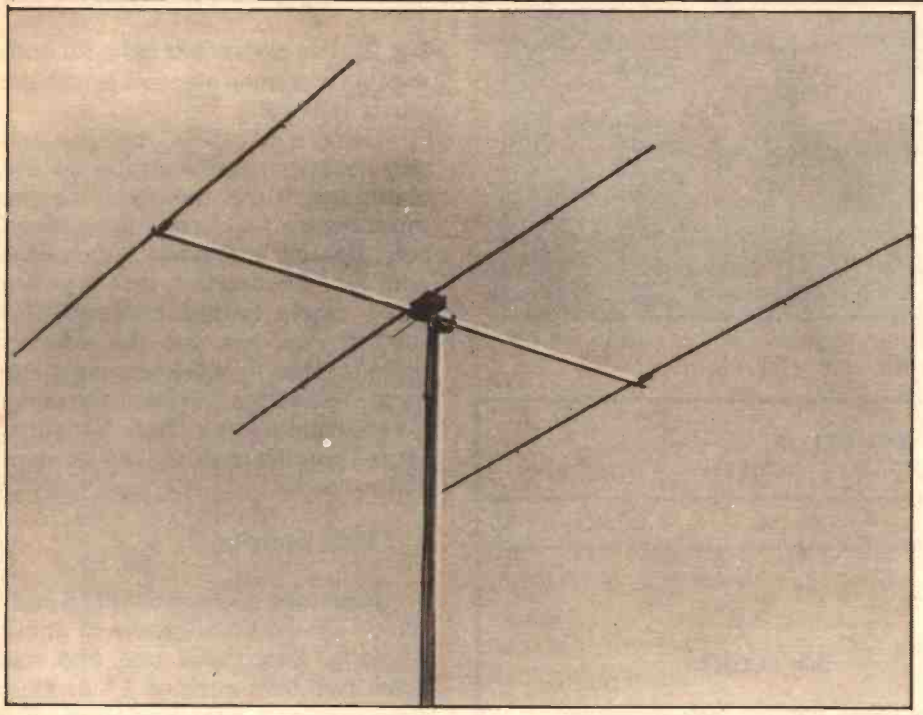


Fig. 3 The balun/coaxial coil feed for the 2 element beam.





necessary to make minor adjustments to the length of the reflector but remember to check the VSWR after these adjustments as they will affect the impedance at the feed point. All VSWR adjustments should be made with the aerial at least one wavelength above ground if possible.

Three Element Beam

The construction of the three element beam is similar to that of the two element, the major difference being the gamma match used to feed the array. Therefore, the driven element does not need insulating from the boom. In the author's case, a 7'6" length of 1" square aluminium was used as the boom, although if you have round tube there is no reason why this should not be employed.

The spacing between the director and driven element and the driven element and reflector is 42" in each case. Therefore three 3/16" holes need to be drilled through the boom starting 3" from one end. Now take the three lengths of ½" tube (shown in Table 1) and drill a 3/16" hole in the centre of each piece. With just one of these lengths, measure 12" from the centre hole and drill an ⅛" hole at right angles to the centre hole. This is for attaching the gamma match.

Next cut four 1" long slots at each end of the three lengths of tube. Using the element support brackets, mount the three ½" elements on the main boom. Take the lengths of ⅜" tube and insert into each element. Using the recommended dimensions, adjust each element length accordingly.

The Gamma Match

Returning to the gamma match, I chose to use this form of matching for several reasons. The first, and in my opinion the most important, is that the driven element is grounded. This is a nice safety precaution against static — insulating the driven element from the main boom does present constructional problems if you are unable to obtain an old 405 TV aerial insulator/feed point. When the gamma match system is used, it is always possible to get a near perfect match by adjusting the variable capacitor at the feed point. This kind of feed system is very popular with American amateurs and features a lot in ARRL publications.

The construction of the gamma match can be seen in **Fig. 4a** and **4b**. The rod is made of ⅛" brass or alloy rod. If brass is used, a nut, bolt and

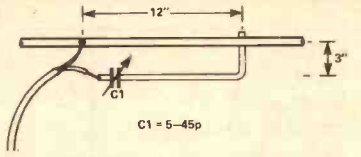


Fig. 4a The gamma match.

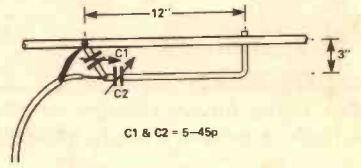


Fig. 4b The omega match.

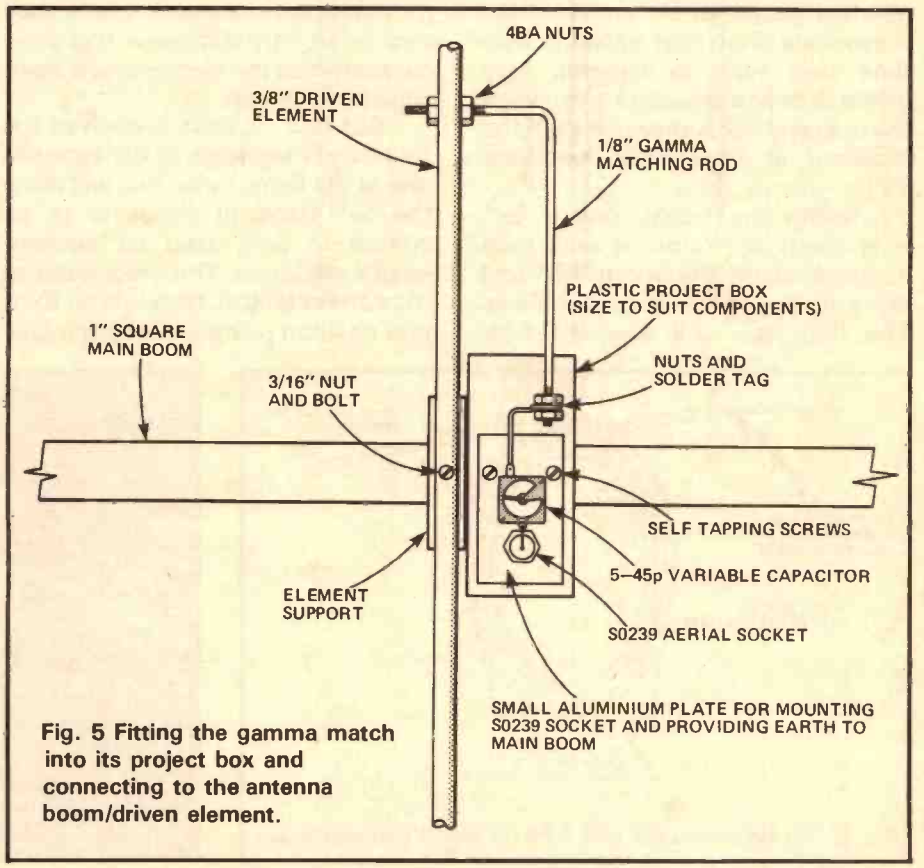


Fig. 5 Fitting the gamma match into its project box and connecting to the antenna boom/driven element.

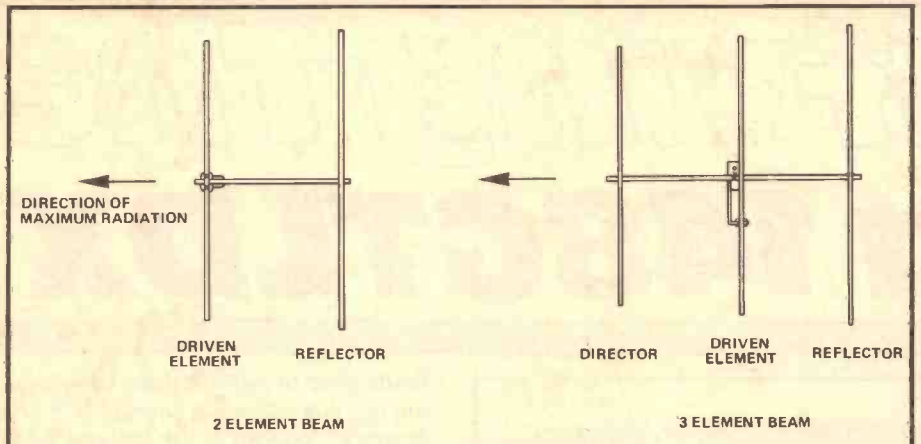


Fig. 6 A schematic diagram of the two aerials.

solder tag arrangement can be used to secure the match to the driven element. If only alloy is available then the ends of the alloy rod need to be tapped with a die. One end needs about ¾" of thread turning on and the other about ¼". The thread size that I used was 4BA.

Mount the plastic project box next to the driven element as shown in **Fig. 5**. The size of the hole for the aerial connector depends on the type used but construction and layout details for the gamma matching assembly are not that critical and as long as the basic recommendations are adhered to a good match will easily be obtained.

Once the gamma match has been fitted to the driven element and the element lengths adjusted, RF can be applied via a VSWR bridge and the tune capacitor adjusted for a minimum VSWR. If tuning is found to be difficult, a second capacitor can be fitted as shown in **Fig. 4b**. This helps to tune out the reactance of the aerial and the feed system is now termed an 'omega match'. With either of these feed methods, careful adjustment of the variable capacitors will give a good match. As in the case of the two element beam all VSWR checks should be made with the aerial over one wavelength above ground level.

Parts List

2 Element Beam
old 405 aerial
can penetrating fluid
4 jubilee clips

3 Element Beam
7'6" × 1" square boom
3 of ½" × 69" seamless alloy tube
6 of ⅜" × 62" seamless alloy tube
3 of element support brackets
plastic project box (2" × 3" × 5" approx)
5 - 45 pF variable capacitor
1 of 16" × ⅛" alloy rod
4 of 4 BA nuts
solder tags
small piece 16swg alloy (2" × 3")
SO239 socket
6 jubilee clips

Modifying The Cobra 148GTLDX

Do you have a pet Cobra in the cupboard? Well Albert Jolly, GM4JML has devised some modifications that could make it a lot more useful by putting it onto the 28MHz amateur band.

Since this transceiver is a three band multimode including CW, it is worthwhile doing a bit of work to put it onto 10m. This article describes two conversions — a simple and a more complicated one depending on how much of the band you want to cover. The simpler method will cover 1.35MHz of the band (and surrounding area!) allowing you to chose which section you prefer to operate in. The more difficult conversion involves building a diode matrix to give you an extra 80 channels and coverage of the top part of the CB band.

Firstly though the binary count must be altered which ever modification you chose to do. This can be done while you wait for a crystal for one of the other mods. Before doing anything, we need to find out the binary count that needs to be applied to pins 9 to 17 of IC5, the MC145106, to obtain a specific frequency on 10m. To calculate this, we take 29.595 (the operating frequency) minus the IF of 10.695MHz to give a variable crystal oscillator frequency (VCO) of 18.900MHz. From this, subtracting the reference oscillator frequency of 15.000MHz gives the downmix of 3.900MHz. Since our downmix is to be divided into 10kHz steps, our binary count is therefore 390.

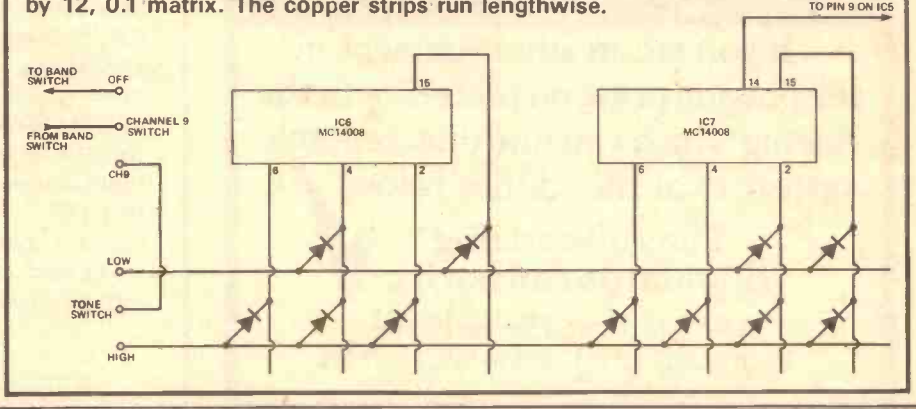
At present the binary count on the rig goes from 82 on channel 1 on the low band to 216 on channel 40 on the high band. The binary count will, therefore, need to be increased. This is attained by "holding up" pin 9 of IC5 and increasing the binary count by 256 which will result in the required binary count of 390 being found in channel 7 of mid band. The holding up of pin 9 is done by removing the link between pin 9 of IC5 and ground. Connect a 10k resistor from pin 9 to pin 16 of IC7 (MC14008) as this is a suitable 8.4V supply. Now switch the rig to channel 7 mid band and set up a receiver on 29.600 MHz. Turn the clarifier control of the Cobra fully clockwise and whilst transmitting into a dummy load and listening on the nearby receiver, retune L18 (the VCO coil) to 18.900MHz where it will lock on frequency.

There are some frequencies missed out on these rigs. These are channels 3 and 4, 7 and 8, 11 and 12, 15 and 16, 19 and 20 and channel 23 is out of sequence. The frequency count goes 22, 24, 25, 23, 26, the rest being in sequence. We can obtain the missing channels on the FM band by moving up one channel in frequency and turning the clarifier fully anti-clockwise.

The Simple Conversion

This is just as easy as the binary count alteration but requires a crystal of 16.845MHz which enables channel 1 of low band to become 28.360MHz and channel 40 of the high band 29.700MHz. Obviously, we cannot use channel 40 as this would put us outside the amateur band but it makes it easier to count the frequencies, ie channel 39=690,

Fig. 1 The diode matrix circuit made on veroboard of dimensions 10 holes by 12, 0.1 matrix. The copper strips run lengthwise.



channel 38=680 etc. If you would rather have the extra 10kHz at the bottom end of the band, use a 16.835MHz crystal. If you prefer the CW section of the band this can be obtained by fitting a 16.490MHz crystal and making full use of the clarifier giving coverage from 28.000MHz to 29.350MHz. Again retune L18 until lock is obtained at both ends of the band.

The Second Method

This is a little more complicated since it involves adding a further 80 channels and changing the crystal to 15.945MHz. However, this will give us coverage from 27.460 to 29.700MHz — although we won't be using it below 27.60125MHz!

The first step is to build a diode matrix shown in **Fig. 1** and **2**. The diodes used were 1N4148's, although almost any small diode will do. The veroboard size is 10 holes by 12, 0.1 matrix, with the copper strips running lengthwise. Mount the diodes vertically with the anodes to the board. There is no need to cut any of the tracks.

Before wiring the new board into circuit, we must first make an alteration to the main printed circuit board. As can be seen from Fig. 1, on the new "high" band we need pin 15 of IC6 (MC14008) and pin 15 of IC7 to be at different logic levels. On the main PCB, these two pins are linked by a printed circuit track. Cut this track and locate and remove the wire link from pin 15 of IC6. This wire is partially underneath the IC, but can be removed from the printed circuit side with a bit of care. We now solder DC blocking diodes between the hole left by the wire link and each pin 15, as in **Fig. 3.** Fit an insulated wire link from the unused pin 14 of IC7 to pin 9 of IC5, which was the subject of our attention when altering the binary count.

Solder six inch (15 cm) lengths of thin insulated wire to each of the ten connections of the vero board, preferably using a different colour for each. Fit the board using double sided tape to the metal side, just behind the channel change switch, place it vertically to clear the hole for the rig's mounting bracket. Now push/pull the wires under the channel change switch and attach to the main board.

The wires to pin 15 on IC6 and IC7 should be soldered directly to

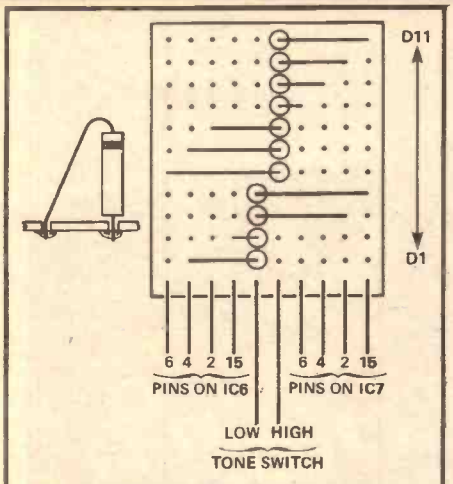


Fig. 2 View of the diodes from above, the anodes are to the board.

the pins. For the rest. we look for the track nearest to the front of the rig which leads to the required pin of the IC. The two remaining wires go to the unused side of the tone switch, on to either end, with the centre tag of the switch connected to the channel 9 position on the unused side of the channel 9 switch. The original wires on the switch can either be soldered together for low tone, or solder the grey wire to the unused tag for high tone.

On the channel 9 switch we must remove and insulate the yellow wire, and solder together the white and pink wires to maintain normal operation.

We now move to the band change switch. There is a yellow wire link across the top with one end soldered to tag 4, the one on the left looking from the rear of the set. Detach this and solder a wire to this end. Take the other end of the wire to the centre tag on the unused side

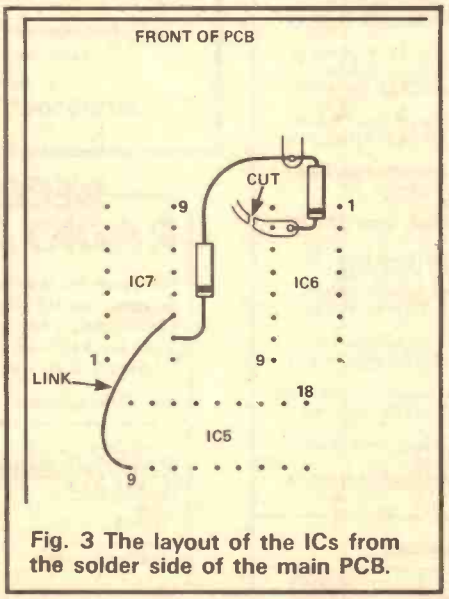


Fig. 3 The layout of the ICs from the solder side of the main PCB.

of the channel 9 switch. Connect a wire between the OFF position of this switch and tag 4 on the band change switch.

If you prefer not to have the CB band included, then the only modification that has to be done to the main PCB is the link from pin 14 of IC7 to pin 9 of IC5. This is no need for the blocking diodes etc. We would only need D1 to D3 on the matrix board and, instead of using the tone switch, we would take the "low" wire from the matrix board straight to the unused channel 9 position on the channel 9 switch, the rest of the wiring being as described. We now need a crystal of 16.395MHz, which will give us coverage from 27.910MHz to 29.700MHz, returning L18 as before.

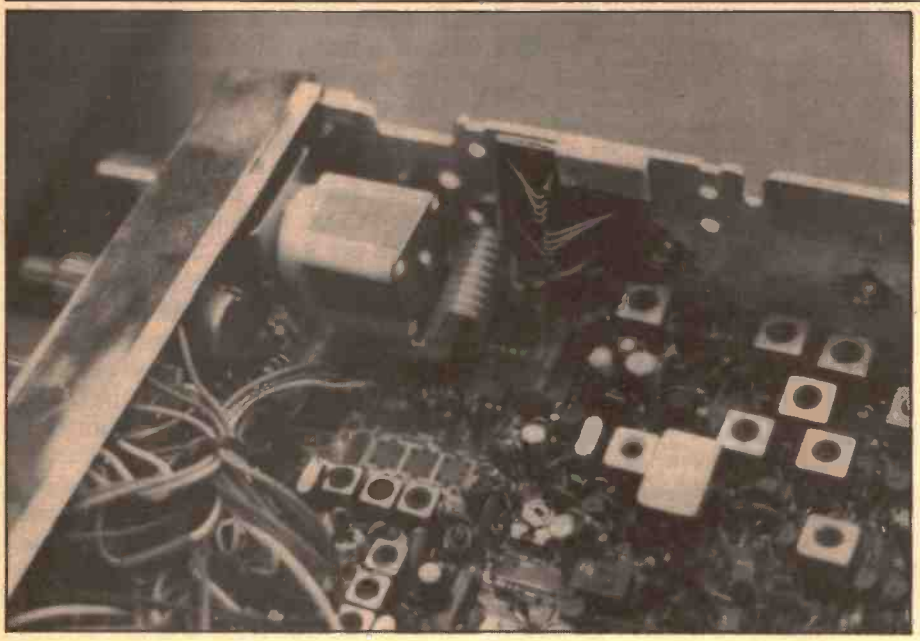
If you still have a spare switch you can connect a 10k resistor between the centre tag of the channel 9 switch, the 8.4 volt supply, and one end of the spare switch. The other end of the switch goes to ground. The centre tag goes to pin 9 of IC6 having first removed its ground link. This will give us a 10kHz up-shift when we operate this switch, to give us the missing frequencies. Finally, we can get rid of the "Roger Beep" by removing the orange wire behind the 'S' meter marked "Peep" on the board.

The crystal that I used was supplied by McKnight Crystal Company Ltd, and on their advice, in order to get the clarifier control to operate fully, they supplied me with a special low inductance crystal on their commercial service at £10 plus VAT. When I fitted the crystal, before retuning, I found that it was exactly 10kHz low, with the clarifier giving me +/− 7.5kHz shift.

Retuning The Rig

So now we get down to the retuning. The figures in brackets are for those only interested in the ten metre band using the three diode matrix. At this point though it is a good idea to fit the top cover.

1. In Rx mode, AM with the clarifier controls in centre position on high band channel 23, 28.650MHz (high band channel 4, 28.850MHz) connect a 'scope or diode probe to TP4, the top bare lead of R124 — 1cm inboard from L17. Tune L17 which is located just behind the channel change switch for maximum indication.



2. Connect a DC voltmeter to TP2, the top bare lead of R126 which is 1cm forward of R124. Adjust L18, the one sealed with wax, for 2.14 volts (2.49 volts).
3. Connect the probe again though this time to TP3, the top bare lead of R84 — found beside L12 and L54. Tune L19 for maximum indication.
4. Remove the probe and connect a frequency counter to TP3. Find L21, 22 and 23 beside the crystal and whilst still on AM, adjust L21 until you get a frequency readout of 17.955 MHz (18.1575MHz). Switch to USB and adjust L22 for 17.9575MHz (18.1575MHz) then go to LSB and adjust L23 for 17.9525MHz (18.1525MHz). Staying on LSB, but in Tx mode with a dummy load fitted or the mic gain off, adjust VR6 at the edge of the board behind the band change switch to get 17.9525MHz (18.1525MHz).
5. Switch to Tx mode, AM, and fit a wattmeter and dummy load. Tune coils L55, L54, L53, L52 and L44 for maximum indication on the meter.
6. Then move to receive but still on AM. If you have a signal generator, set it to 1uV otherwise use a weak off air carrier only signal. Tune coils L7, L8 and L9 for maximum indication on the S meter.
7. Repeat step 6 but with the noise blanker switched on. Adjust L1 and L2 for maximum DC voltage at TP1, the top end of D2 which is located next to L2.

That ends the retuning. Step 7 is optional — I have included it because the noise blanker on my own rig did not work very well as L1 and L2 were off tune. I hope the information will be of some use to those that have a pet Cobra in their cupboard! Hope to hear you on '10' sometime.

An LED RTTY Indicator

An RTTY tuning indicator that's almost as good as an oscilloscope? This design by Robert Penfold using a 9 by 9 matrix of LEDs, seems to be!

Normally when tuning in a signal, it is simply a matter of adjusting the tuning control to obtain an intelligible audio output of good quality. The situation is somewhat different with RTTY signals where few people have an adequate sense of pitch to permit spot on tuning with the tuning control to get the correct warbling sound. In fact few people can consistently get anywhere near the correct setting when tuning by ear.

Most RTTY tone decoders have some form of visual tuning aid — the most common being the twin tuning meter. This merely shows the strengths at which the two tones of the signal are received, the idea being to tune for the maximum simultaneous reading from both meters. In some designs, the meters are replaced by some form of LED tuning indication, but they are used in exactly the same way. LED tuning indicators are usually reasonably accurate and easy to use, although not totally accurate and reliable. They offer little help when band conditions are such that there is a lot of QRM or QRN and can even be misleading. Unfortunately it is under these conditions that really accurate tuning is of greatest importance.

Scope Indicator

The most effective form of RTTY tuning indicator is an oscilloscope. In this application the X input is fed from the output of one filter and the Y input from the output of the other. Some RTTY tone decoders, the filter type and those using a combination of filter and PLL, have an output socket for an oscilloscope and others can easily be modified for it.

With the 'scope and decoder connected, and RTTY signal can be accurately tuned in, giving a cross shaped display as in **Fig. 1**. This is perhaps not what one would expect — feeding the same signal into the inputs of a 'scope normally produces a diagonal line with the angle of the line depending on the relative deflections provided by the two inputs. Here the two signals are not quite identical though, as the filters provide differences in phase as well as in amplitude.

The vertical part of the cross is produced when the input signal is at the centre frequency of the filter which feeds into the Y input. The Y input is then fed with a strong signal giving a large vertical deflection. The X input receives a much weaker signal and gives a much lower horizontal deflection. The phase shifts provided by the filters open out the display into a horizontal elipse rather than a diagonal line. The horizontal part of the cross is produced in much the same way, but when the input signal is at the centre frequency of the filter which feeds the 'scope's X input. The cross shape is only obtained when the signal is being modulated and the display is rapidly switching between the horizontal elipse and the vertical one. With no modulation only one or other of the elipses will be obtained.

Any lack of accuracy in the tuning is immediately obvious as the cross is rotated slightly, as in **Fig. 2.** The direction of rotation depends on which way the tuning is out. If the tuning is well off the correct setting then the display just degrades into a random jumble of lines. This makes it very quick and easy to first roughly 'home in' by obtaining a cross display of some kind, and then fine tune for the correct '+' shape. If the decoder is set for the wrong frequency shift, this is immediately obvious. With the horizontal part of the display at the correct angle the vertical part will be at the wrong angle, or vice versa **(Fig. 3)**.

Although the display is shown as two narrow elipses, the exact shape depends on the 'Q' of the filters and the frequency shift in use. With an 850Hz shift, they are usually quite narrow, but with the 170Hz shift normally used by amateur stations the elipses can be quite broad. Broader elipses make the system just that bit less accurate and easy to use.

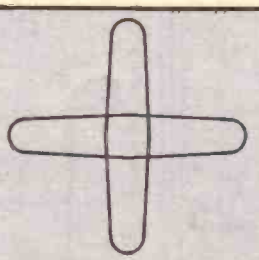


Fig. 1 A correctly tuned signal gives a display like this on an oscilloscope.

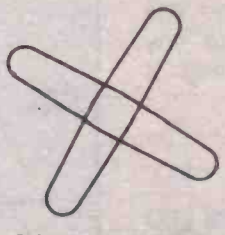


Fig. 2 Inaccurate tuning produces a rotated and distorted display shape.

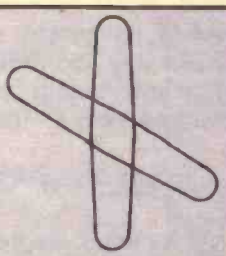


Fig. 3 A display like this indicates a transmission and reception shift mismatch.

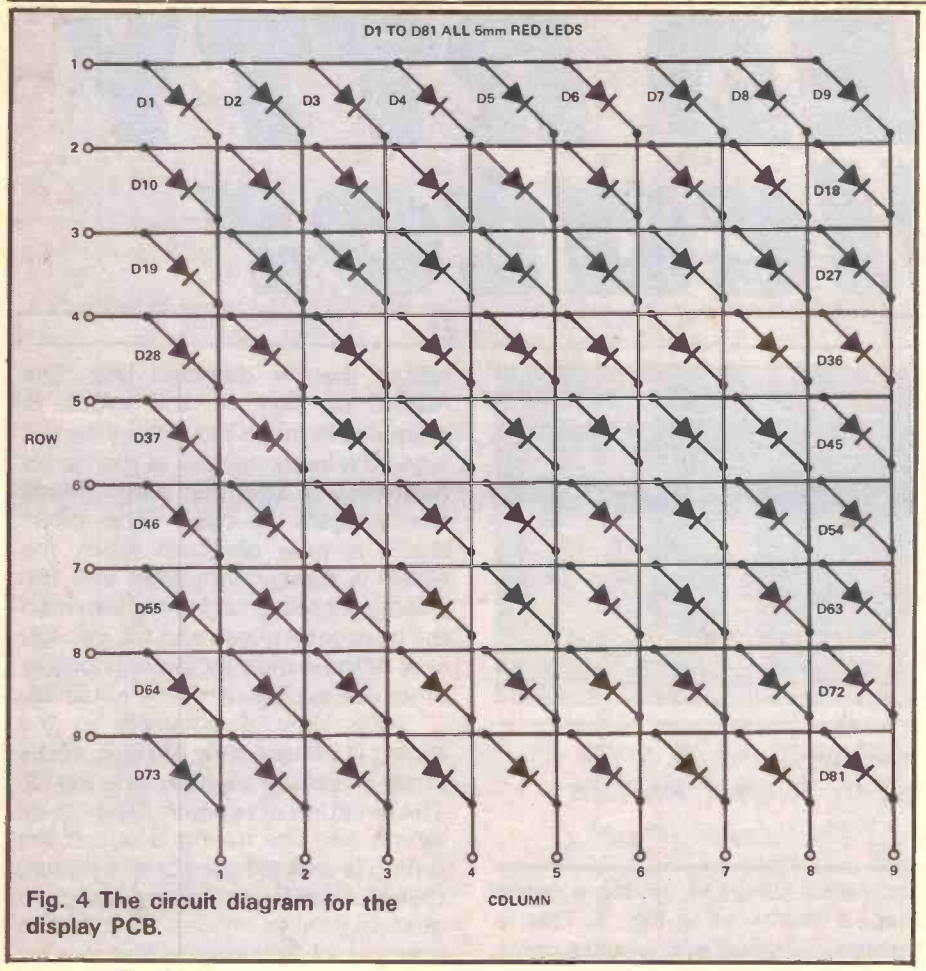


Fig. 4 The circuit diagram for the display PCB.

An LED Scope

One obvious drawback of a 'scope indicator is that it implies you have a 'scope. Even then it tends to be inconvenient as it makes it difficult to use the oscilloscope for its intended purpose as a test instrument. A relatively inexpensive alternative to a 'scope would be to use the same basic idea but replace the cathode ray tube or liquid crystal display with a 9×9 matrix of LEDs.

Although this only gives a very low resolution display, this is not important in this application where only broad shapes are of interest, not precise waveforms. The prototype was used to tune in some RTTY signals, and a "proper" oscilloscope checked its tuning accuracy. The LED display did not lead to any significant tuning errors, and it proved as easy to use.

Circuit Operation

The circuit diagram of the LED display appears in **Fig. 4**. Ready made dot matrix LED displays of suitable size do not seem to be widely available, so this was made from a PCB and some 81 LEDs. It uses the standard matrix arrangement: to light the LED in row five, column seven for example, the row five input would be fed with the positive supply while the column seven input would be connected to the negative supply. Any inputs that are not to be driven must be left open circuit.

The main circuit shown in **Fig. 5.** is based on two LM3914N bargraph drivers. Each device has ten outputs and, when used in the dot mode, one output is connected to earth via a constant current generator while the other nine are left open circuit. Which of the outputs is activated depends on the input voltage, and the LM3914N has a linear response. If, say 1V switched on output 10, then 0.9V would activate output 9, 0.8V would activate output 8, and so on. We therefore obtain the desired effect by driving the column inputs from one device, and the row inputs from the other.

IC2 drives the column inputs directly. RV3 gives a bias to the input of the device that activates output 6, and drives column input 5. Note that only nine outputs of each driver are used, output 1 in both cases is left unconnected. The input signal is coupled to IC2 via C2 and preset sensitivity control RV4. About 1.2V peak to peak is needed in order to fully drive the circuit when RV4 is set at minimum resistance, but at maximum resistance this increases to over 20V peak to peak. This is not particularly sensitive, but the output level from the filters of an RTTY decoder is normally in the region of 7V peak to peak and no preamplification should be required. R4 sets the LED current and the specified value gives a drive current of about 30mA, which is quite high. Remember though that in normal use any switched on LEDs will only be so for a small percentage of the time and this current is effectively shared between a number of LEDs.

The other driver circuit is basically the same, but the row inputs have to be driven from the positive supply. Accordingly, they are driven by way of inverter transistors Q1 to Q9. These only require a low drive current and the value of R2 gives an output current of just over 1mA.

A stabilised 5V supply is required and a suitable mains power supply circuit is shown in **Fig. 6.** This is a straightforward design using

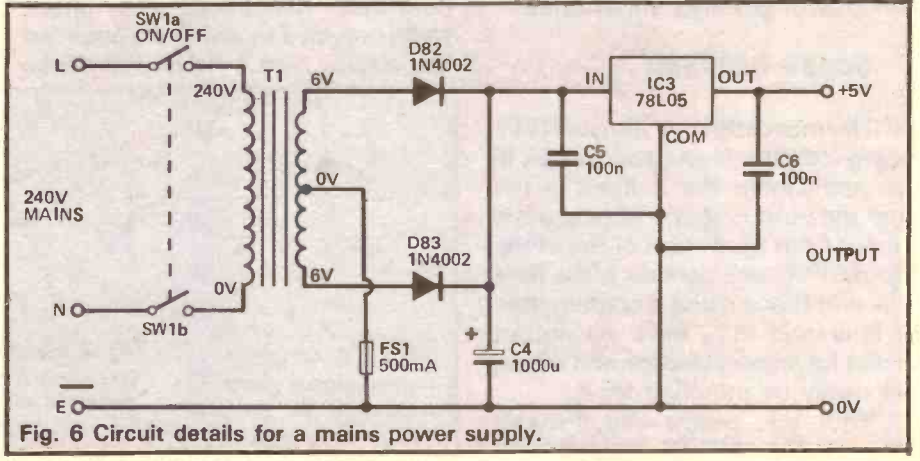


Fig. 6 Circuit details for a mains power supply.

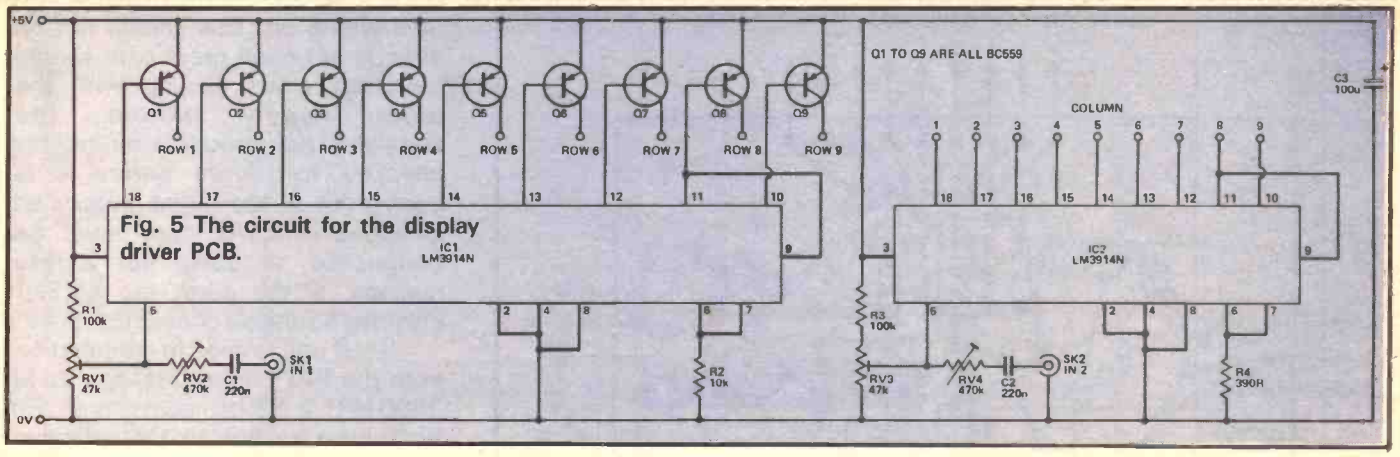


Fig. 5 The circuit for the display driver PCB.

push-pull rectification and monolithic voltage regulator IC3 to give a well smoothed, stabilised output. Fuse FS1 is an antisurge type, otherwise it would be prone to blowing on switching on as C4 charged up.

If battery operation is prefered, omit FS1, D82, D83, C4 and T1. IC3 is then fed from the battery via the on/off switch. The current consumption of the unit is quite high, about 40mA and a large battery such as a PP9 would have to be used.

Construction

Start with the display, whose details are given in **Fig. 7**. Fit the link-wires first and then add the LEDs. There are a lot of link wires and LEDs to connect, so try to make the display as neat as possible, with the LEDs protruding a consistent height above the board. Their leadout wires should be trimmed quite short so that they do not protrude far above the board. Avoid rushing the construction of the display — spread it over several short sessions if necessary.

With the exceptions of T1, SW1 and SK1, the other components are mounted on the main PCB as in **Fig. 9**. The holder for FS1 is a chassis mounting type, but here it is bolted to the PCB and connected using pins or pieces of tinned copper wire. Pins are used at the points where connections to the display, T1, and SK1 will be made.

A metal instrument case which has approximate outside dimensions of 150×100×150mm is suitable for this project. SK1 and SW1 are mounted well to the right of the panel leaving sufficient space for the display to the left of these. The panel must be drilled with four 3.3mm diameter mounting holes to take the mounting bolts for the display. The positions of these can be marked by using the display itself as a template. A large rectangular cutout is required to form a "window" through which the LEDs can be viewed. This can be cut using a coping saw or a miniature file. The display is bolted in place behind the front panel, but

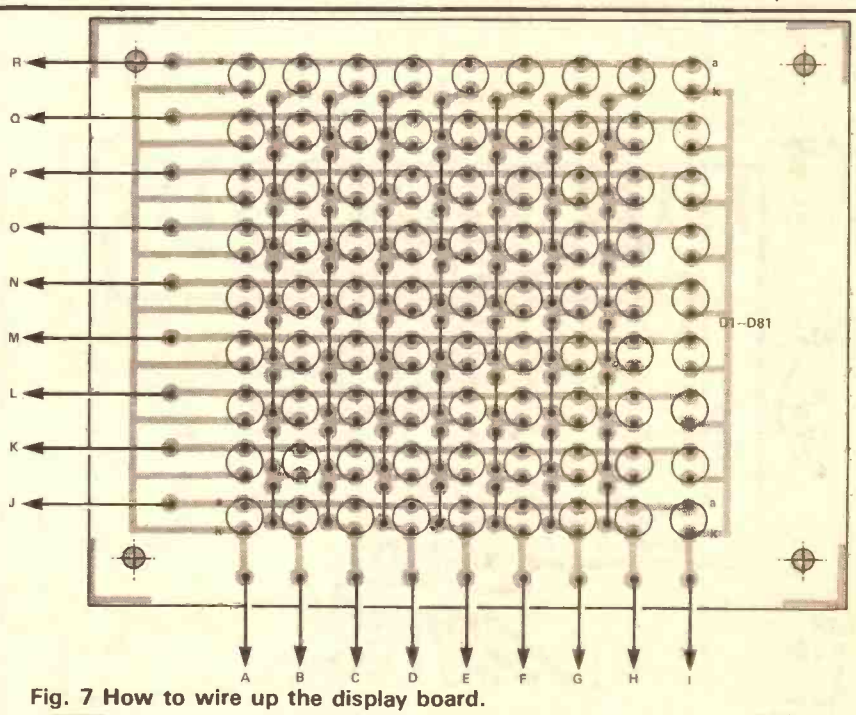


Fig. 7 How to wire up the display board.

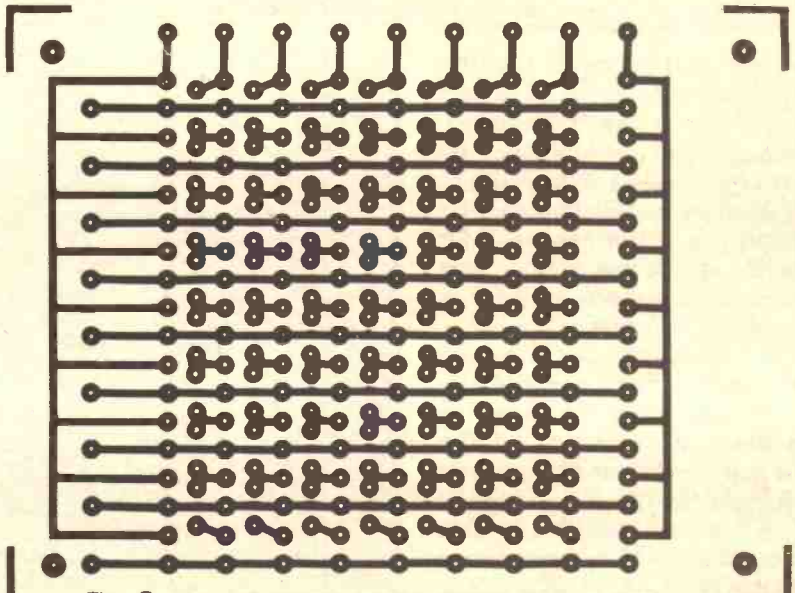


Fig. 8 The foil pattern for the display PCB, at size.

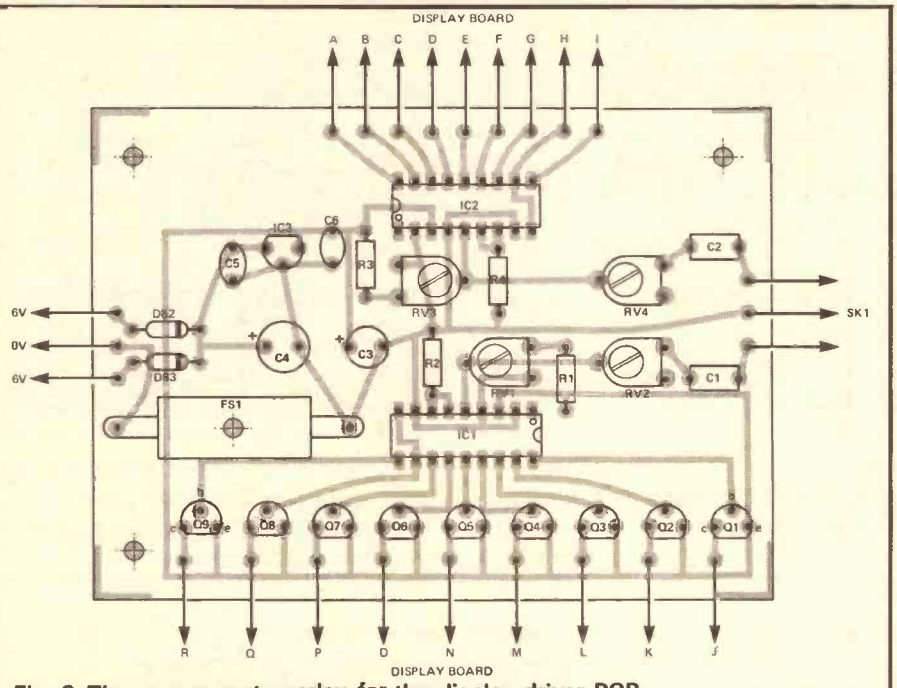


Fig. 9 The component overlay for the display driver PCB.

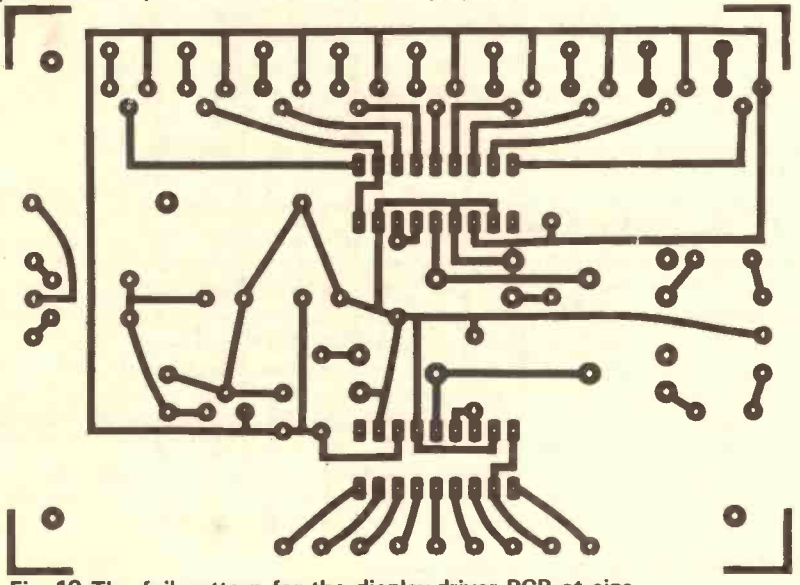


Fig. 10 The foil pattern for the display driver PCB at size.

spacers are used to ensure that the LEDs are flush with the panel, or only penetrate it by a few millimetres. Neat results can be obtained by fitting some perspex or red tinted display window material behind the cutout but this is not essential. Fit two lengths of nine way ribbon cable to the inputs of the display prior to finally bolting it in place.

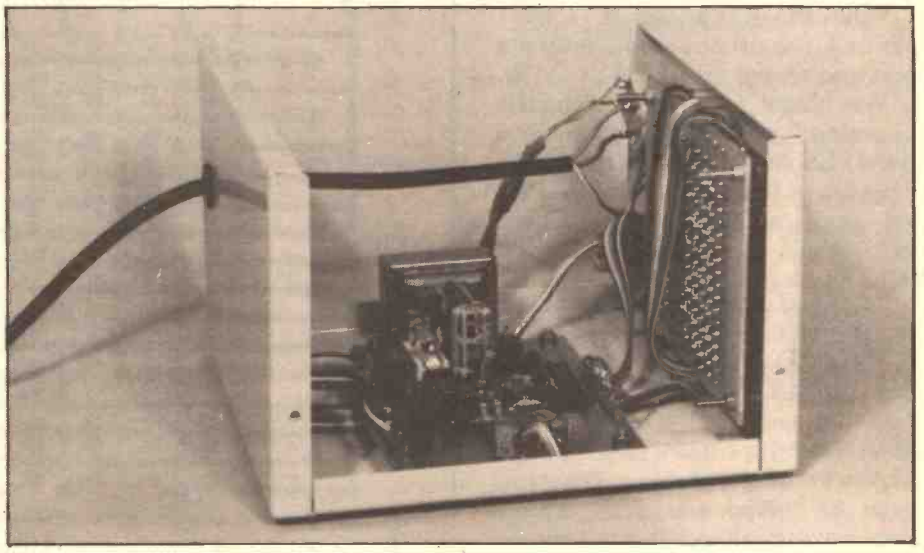
T1 and the main circuit board are mounted on the base panel of the case. Spacers must be used to ensure that the underside of the board is kept well clear of the metal case. A hole for the mains lead is drilled in the rear panel and this should be fitted with a grommet to protect the cable.

The unit is then ready for the final wiring up. This should not be difficult although great care should be taken when dealing with the power supply section. The completed unit should be thoroughly checked for errors before it is connected to the mains supply an switched on. The case must be connected to earth for safety reasons — the earth tag of SK1 provides a suitable connection point.

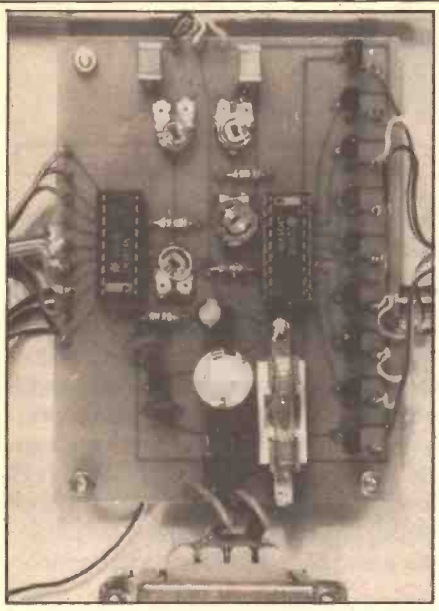
If the unit is used in conjunction with the RTTY Tone Decoder, June 1986 HRT, it will be necessary to add an output socket to the decoder, which can be a stereo jack socket mounted on the rear panel. The take-off points from the circuit are pins 1 and 7 of IC2 (plus earth of course). The connections to the board can easily be made to the appropriate pads on the underside of the board, but take care not to produce accidental short circuits between the pins of IC2.

Adjustment And Use

Start with the four preset resistors all at a roughly midway setting. At switch on, one (and possibly two or three) of the display LEDs should light up. By adjusting RV1 and RV3 it should be possible to move the "spot" to the centre of the display as these function as the X and Y shift controls. Although it might appear that only one LED at a time could light up, it is in fact possible for up to four LEDs to be switched on, as each driver activates two LEDs when it is at the transition from one LED to another. This is to avoid the possibility of having no LEDs activated and it is of no real



Inside the completed unit.



The populated main PCB.

consequence in this application. Also, any stray noise picked up at the inputs will tend to blur the static display. If necessary this can be avoided during the initial setting up by setting RV2 and RV4 at minimum resistance and short circuiting the inputs to earth. By adjusting RV1 and RV3 carefully it is possible to have only the centre LED of the display lit up.

In order to adjust the other two presets correctly, the unit must be coupled to the filter outputs of the tone decoder — you will have to make up a suitable twin screened lead for this purpose. Find a strong RTTY signal and tune it in as accurately as possible. The amount of horizontal and vertical deflection can be varied by adjusting RV2 and RV4. Optimum results will be obtained with these adjusted so that the sensitivity is essential if the appropriate display shapes are to be obtained, especially when dealing with a signal which has a 170Hz shift.

After using the unit for a while you should soon recognise the display shapes and find it easy to tune signals accurately. With any type of RTTY tuning indicator, signals with a 170Hz shift and a high noise content represent the most difficult type to tune in properly. With this unit they do not seem to represent any great difficulty, with all the display LEDs switching on at the optimum tuning setting.

Components List

RESISTORS

R1,3	100k
R2	10k
R4	390R

All resistors 0.25W 5%

POTENTIOMETERS

RV1,3	47k sub-min hor preset
RV2,4	470k sub-min hor preset

CAPACITORS

C1,2	470nF polyester layer
C3	100uF 10V radial elect

SEMICONDUCTORS

IC1,2	LM3914N
IC3	78L05
Q1 - Q9	BC559 or similar
D1 - D81	5mm red LEDs
D82,83	1N4002

MISCELLANEOUS

SW1	rotary mains switch
SK1	stereo jack
T1	mains primary, 6V - 0V - 6V 100mA secondary
FS1	20mm 160mA antisurge type

Instrument case about 150 × 100 × 150mm; two 18 pin DIL IC holders; two printed circuit boards; 20mm chassis mounting fuseholder; Veropins; mains lead; connecting wire, etc.

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A FRESH LOOK AT THE FT101ZD
By Harry Leeming, G3LLL.

Interference

Part 2

Transmitter interference is perhaps the first cause of conflict between you and your neighbours. Steve Price, G4BWE, describes the nature of this interference and how to cure some of the effects it has on nearby home entertainment systems.

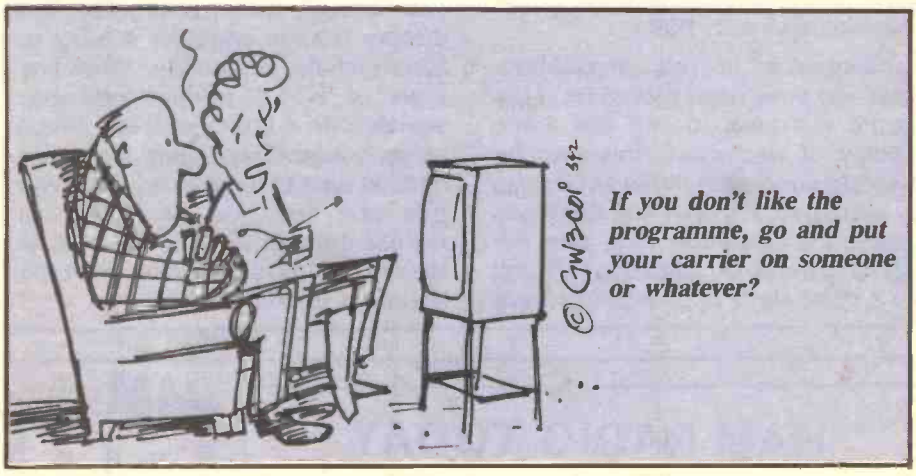
Last month, we took apart the receiving side of an amateur station to see where interference is caused and how to cure it. Turning the tables now, let us consider how an amateur's transmitter can generate interference.

It is difficult, and indeed inadvisable, to make too many generalisations about the causes of, and cures for, transmitter interference. Nevertheless, as an aid to understanding the mechanisms involved we can justifiably categorise these forms of interference under two broad headings.

Frequency Dependent Interference

This form of interference is best illustrated by an example. A VHF FM broadcast receiver suffers interference from a nearby amateur radio transmitter when the amateur operates his station on 10MHz band. Investigations reveal that this is the only band that gives rise to any problems, operation on 3.5, 7, 14, 21 and 28MHz, plus 144MHz, having no effect whatsoever. Also, when the broadcast receiver is switched to AM, for medium and long wave reception, the interference disappears completely.

Eventually, the reason for the interference is put down to poor screening of the broadcast receiver's FM IF amplifier. The intermediate frequency employed is 10.7MHz (pretty well a universal standard for VHF FM broadcast receivers) and so amateurs' 10MHz transmissions are sufficiently close in frequency to cause a response. However, transmissions on other bands are rejected completely by the receiver's FM IF filter. When the broadcast receiver is switched to AM, a different and much lower IF of 445kHz is used. This explains the absence of interference with long and medium wave reception.



If you don't like the programme, go and put your carrier on someone or whatever?

This shows us that it is sometimes the frequency or frequencies involved that dictate when, and exactly how, interference occurs.

Frequency Independent Interference

The second type of interference is that which occurs irrespective of the transmitter's frequency. Let's examine the interference caused when a high power SSB transmitter is operated in close proximity to a domestic 'music centre' stereo system. The owner of the music centre complains that whenever a nearby amateur uses his HF transceiver, peculiar thumping and groaning noises are emitted by both loudspeakers.

As a test, the transmitter is operated on all HF bands and it is noted that each time the operator speaks into the microphone, the noises appear, irrespective of the band in use. Furthermore, reducing the volume setting on the music centre has little effect and the interference persists whether the function switch is set to radio, disc or tape. However, when the two loudspeakers are unplugged and stereo headphones used instead, the noises become far quieter.

From this information, we can deduce that it is the long and probably unscreened loudspeaker leads which are acting like receiving aerials. The RF voltages induced into the loudspeaker cables are fed directly into the music centre's audio output circuitry. Each audio amplifier has a negative feedback loop which, in essence, forms a connection between the output and input of the amplifier. The relatively large RF voltage which consequently appears at the input of each amplifier is partially rectified by the diode action inherent in the base/emitter junction of the first transistor. This rectification provides a degree of envelope detection and accounts for the 'thumping and groaning' noises generated in sympathy with speech.

They are identical to the sounds produced when an AM receiver having an envelope detector, as opposed to a product detector, is tuned to an SSB transmission. It is interesting to note that a continuous carrier will not necessarily generate interference because there is no varying 'envelope' for the music centre, or similar equipment, to detect. This explains why FM causes less problems than AM or SSB and partly accounts for the choice of FM as the mode for legalised CB.

In practice, there is not always a clear boundary separating interference which is frequency depen-

dent or frequency independent and in many cases a complex mixture of the two is responsible. Bear in mind though that frequency dependent interference will be caused by a correlation between the fundamental frequency of the transmitter (or possibly a harmonic of the fundamental), the pass band of stages and frequencies of signals within the equipment being affected. Where the equipment contains an oscillator, eg the local oscillator in a radio or TV receiver, beat frequencies may be generated which give rise to audible heterodynes (ie whistles) and also 'patterning' (wavy lines) on TV screens. Conversely, frequency independent interference occurs because of some non-linearity which results in envelope detection and also the blocking of overloaded amplifiers. The precise effects are therefore rather dependent on transmission mode and power level.

It's all very well knowing how the interference is generated, but what can we do to make equipment immune to it? Fortunately, there are a number of tried and tested remedies which can be explained by looking at their application to various home entertainment systems.

Audio

We live in the age of 'hi-fi separates' and music centres, those who can remember the days when virtually every record player had a built in loudspeaker will soon be queueing up, along with the author, to collect their pension books!

Unfortunately, the plethora of interconnecting leads found in a typical hi-fi system constitutes a major bugbear, because these cables tend to behave like receiving antennas and so form a path for RF voltages to gain entry into the equipment itself. Loudspeaker cables are particularly troublesome because they are frequently long and often completely unscreened. Loudspeaker lead interference can be attenuated by introducing a suitably high value of series inductance to the cable at the point where it is wired or plugged into the amplifier. The most obvious way of achieving this would be to connect separate RF chokes of low DC resistance in series with each loudspeaker cable. However, a far more elegant approach is to make the loudspeaker cable itself inductive by winding it around a high

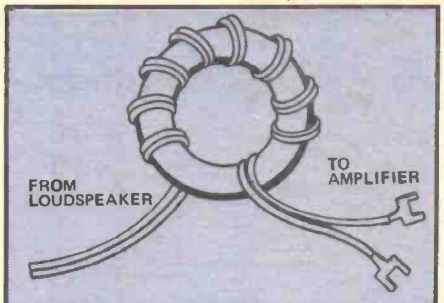


Fig. 1 Winding loudspeaker cables around a high permeability ferrite toroid reduces RF currents.

permeability ferrite toroid. Such toroids are available in fairly large sizes and for this application a toroid of about 1½" outside diameter is ideal. **Fig. 1** shows how the result should look, the object of the exercise being to get as many tightly wound turns as possible onto the toroid, thereby obtaining the highest inductance (in Fig. 1 a small number of turns is shown purely for clarity).

While discussing inductance, it is important to realise that the higher the permeability of the toroid material, the greater the inductance is for a given number of turns. This is why high permeability ferrite toroids are best, particularly at lower frequencies. Dust iron toroids tend to have much lower permeability and, therefore, are unlikely to prove as effective as ferrite types, except at very high frequencies, where typical ferrites begin to lose their effectiveness.

Another way of reducing the interference induced into loudspeaker leads is to replace unscreened, flat twin cable with reasonable quality coax. The screen of the coax must obviously be connected to the grounded side of the amplifier loudspeaker outlet (this is normally colour coded black, the other connection being red). Great care must be taken to avoid short circuits. The coaxial cables may also be wound around toroids as this will attenuate RF currents flowing in the screens. Signal leads, which connect peripherals such as turntables, cassette decks and radio tuners to the amplifier inputs, may also be filtered using toroids.

But before winding every cable in sight around a separate toroid, which could prove rather expensive, it is best to carry out tests so as to isolate the particular cables and/or pieces of equipment which are proving susceptible to interference. In cases where a neighbour's hi-fi system is suffering interference, it is a good idea to enlist the help of a fellow amateur who can operate the transmitter on various bands and modes etc while you listen for the interference caused to the hi-fi. It is then a simple matter to test the separate items of hi-fi gear by unplugging leads and switching amplifier inputs during each transmission.

Interference may also be induced into mains supply cables and the best way of removing this is to interpose a special RF filter between the mains outlet socket and the hi-fi equipment. Such filters are available commercially but can also be home constructed. **Fig. 2** shows the circuit diagram of a mains RF filter suitable for general use. L1 and L2 consist of a length of thin, twin core mains cable (3 amp lighting flex or similar) which is tightly wound onto a large ferrite toroid (T1), thus forming a single layer inductor having two insulated windings of about 10 to 15 turns. The four capacitors are identical 10nF polypropylene types with a voltage rating of at least 750V. L3 consists of a length of single core PVC covered cable or, alternatively, 18 swg enamel copper wire, wound as a single layer coil of about 20 turns onto a separate ferrite toroid, T2.

The filter should be enclosed in a sturdy plastic case with lengths of tag strip used to support the components and provide interconnections (warning — if nuts and bolts are employed to mount the tag strip(s) these must be nylon or similar plastic types). A mains 13A, three pin socket may be mounted onto the top of the case, thus providing a filtered outlet into which the equipment may be plugged. A holder must be provided for the anti-surge fuse which may be either a chassis or panel mounted type, depending on choice. If the equipment does not have an earth lead, don't worry — the filter will still function. Finally, when connecting the twin flex which forms L1 and L2 be very careful to avoid getting the 'live' and 'neutral' connections reversed. If in doubt, check the wiring with an ohmmeter or continuity tester. If the equipment has a long mains lead, this should be 'shortened' by bunching it up. The filter's input cable will serve as an extension lead.

Unfortunately, some stereo and

hi-fi products are still being built into unscreened plastic cases. Therefore, no matter how well filtered and screened the various cables are, RF fields may still attack the equipment directly and in these cases the only solution will be to modify the internal circuitry by adding filter networks decoupling capacitors and ferrite beads etc. Such work can only be carried out by those who have a thorough understanding of the problems involved and it is also important to remember that tampering with the offending equipment will almost certainly invalidate any guarantee or service warranty. However, the service departments of the larger hi-fi companies may well be able to offer expert help, so if all else fails it is definitely worth making enquiries.

TV and Video

As we shall see, the interference caused to TV and video equipment is not necessarily frequency dependent but it will nevertheless help to have knowledge of the frequencies and also the modulation techniques involved.

TV Transmission

1. The 625 line colour service utilises frequencies in the range 470 to 582MHz (designated band 4) and 614 to 854MHz (band 5).
2. Two carriers are transmitted — one for sound (FM +/– 50kHz peak deviation) and the other for vision (AM). The two carriers employed for each channel are separated by precisely 6MHz, the sound carrier having the highest frequency.
3. The video, or 'picture' information occupies a bandwidth in excess of 5MHz and synchronising pulses plus a chrominance subcarrier of 4.43MHz are also modulated onto the vision carrier. The chrominance subcarrier, which is both amplitude and phase modulated, contains the colour information.
4. Fifty or so high power, 'main station' TV transmitters (eg Crystal Palace) provide broad coverage and utilise horizontal polarisation. The many small areas where reception from a main station is impossible due to the shielding effect of terrain (eg the valleys of South Wales) are served by small relay stations which function as repeaters by picking up an off-air signal from the nearest main station. The signal is merely frequency converted, amplified and then re-broadcast, often using vertical polarisation.

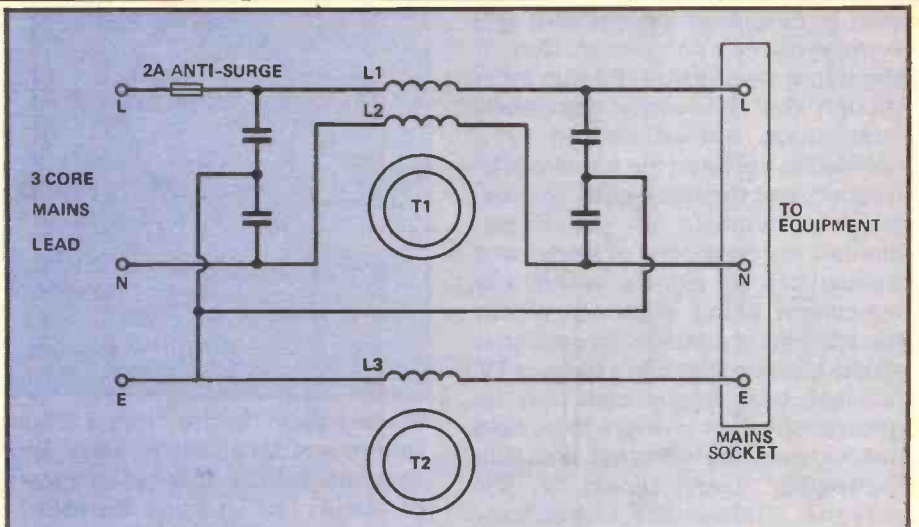


Fig. 2 A mains filter for home construction.

Cable TV

There are two distinct types of cable TV system. The first is the original cablevision systems developed over 30 years ago by companies such as Rediffusion and British Relay utilise HF carriers in the range 4 to 15MHz with amplitude modulation of the video. The sound is either distributed as demodulated high power audio (thus making it possible to simplify the cable receivers sound section) or, alternatively, it may also be modulated onto an MF or HF carrier.

Although some coaxial cable is employed in these systems for primary distribution (ie the linking of the 'head end' conversion equipment to initial repeater installations) most of the network consists of specialised multi-core cable which contains separate twisted pairs for each TV channel. Repeater amplifiers are employed at regular intervals to boost the signal, thus compensating for cable attenuation and other distribution losses.

The newer 'wideband' cable systems employ carrier frequencies of between 40 and 300MHz with a single coaxial cable used to distribute a number of TV channels at different frequencies. Repeater amplifiers are also employed extensively in wideband systems.

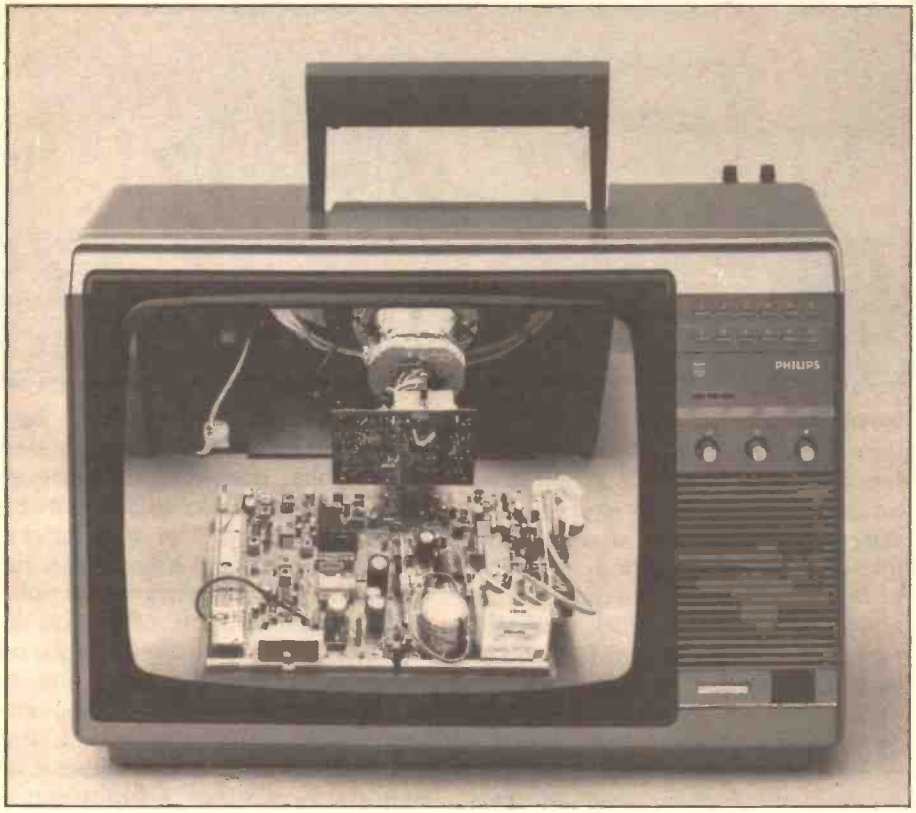
There is much talk of utilising fibre optic cables in future systems, although it appears unlikely that fibre optics will be used for anything other than primary distribution. In consequence individual subscribers will continue to be fed via coaxial cable for the forseeable future. This is unfortunate because fibre optic cables are totally immune to RF interference and, of course, they cannot radiate RF either!

It will be apparent from the above descriptions that amateur transmissions, at either HF or VHF, may cause interference to particular cable TV systems. Conversely, radiation from 'leaky' cables and less than perfectly screened distribution equipment could affect reception of amateur transmissions. If such problems are experienced it would be advisable to liaise with the cable company concerned.

TV Receivers and VCRs

The domestic 'off air' television receiver front end consists of a tuner module containing an RF amplifier, mixer and local oscillator. The sound and vision carriers emerge from the tuner at intermediate frequencies of 33 and 39MHz respectively. The vision is demodulated following amplification and filtering at the IF. The chrominance subcarrier of 4.43MHz is also demodulated, thus providing red, green and blue (RGB) drive signals for the cathode ray tube.

In order to achieve filtering, limiting and additional amplification of the sound prior to the FM



The inside story of the TV.

discriminator, the two IFs are allowed to 'mix', thereby generating a second sound IF of 6MHz (39-33MHz). The FM discriminator therefore operates at this frequency.

The video cassette recorder also has a tuner module and an IF system similar to that contained within the TV receiver. As part of the recording process, the picture information is frequency modulated onto an MF carrier. This technique reduces the ratio between the lowest and highest frequencies that need to be recorded onto the tape. Also, the use of FM renders the system less sensitive to amplitude variations caused by imperfections in the tape etc. The sound is generally recorded as demodulated audio onto a narrow track running along one edge of the tape, using a conventional tape head.

Curing TVI

We said earlier that TV interference will not necessarily prove to be frequency dependent. This has not always been the case, however, because before the advent of UHF, 625 line TV broadcasting, VHF frequencies were utilised for the monochrome (that's the posh way of saying 'black and white') 405 line service. The band 1 frequencies allocated to the BBC stretched from 41.5 and 45MHz (channel 1 sound and vision respectively — radiated by Crystal Palace) to 63.25 and 66.75MHz (channel 5 — Wenvoe etc). These frequencies are comparatively low with respect to the amateur HF allocations and so harmonic radiation from amateur transmitters once caused significant interference to Band 1 TV. For instance, the third harmonic of a carrier at 21.083MHz (15m band) has precisely the same frequency as that utilised for channel 5 sound — oops! It is understandable, therefore, that 20 years ago, great emphasis was placed on the need for effective harmonic filtering as a means of avoiding TVI. Indeed, the re-allocation of Band 1 frequencies to land mobile services as well as our bit at 50MHz), harmonic interference may once again become a 'hot topic'.

Because the frequencies used for UHF TV are so much higher, harmonic radiation from amateur HF transmitters rarely presents any problems (although it must be stressed that the amateur has a clear obligation to keep harmonic radiation to a minimum at all times). Taking a worst case example we can calculate that the lowest harmonic emitted by a transmitter operating on 29.4MHz which is likely to cause frequency dependent TVI will be the 16th — $29.4 \times 16 = 470.4$MHz. At the other extreme, it is the 121st harmonic of a transmission on 7.05MHz which might cause interference to the highest channel in Band 4! Clearly, even with only a rudimentary low pass filter at the output of an HF transmitter, these higher order harmonics will be satisfactorily attenuated in most cases. Therefore, the low pass filters built into commercial HF rigs should suffice under normal conditions.

Harmonic radiation could, however, give rise to interference in the case of 144MHz operation, particularly where high transmit power is employed. It will be either the fourth or fifth harmonic that causes frequency dependent interference to TV channels 34 and 52 respectively, although if the 2m transmitter is operated above 145MHz, channels 35 and 53 may also be affected. It is important to realise that if none of these channels are employed in your area then 2m harmonic interference cannot occur (the only exception is where the 2m harmonic corresponds to the frequency of an image response in the TV receiver). Also, it is self evident that in any areas, reception of only one of the four TV channels will be impaired.

In practice, most present day TVI caused by amateur transmissions of HF and VHF is frequency independent and occurs as a result of blocking, cross modulation and envelope detection within the tuner, IF stages and more rarely the audio and video amplifiers of the TV receiver. It is seldom necessary to analyse the complex mechanism which determine exactly how a strong RF field can exert such an influence on the TV receiver, for we only need to know by what means the interference finds its way into the receiver and then proceed to add filters which will block its path.

TVI is usually the result of RF voltages being induced into the receivers coaxial aerial cable. These voltages cause the tuner module to be overloaded which results in impairment of both sound and vision on all four channels. Winding the receiver end of the aerial coax around a ferrite ring (ie the same technique described earlier in relation to audio equipment) will sometimes do the trick as this gets rid of RF currents flowing in the coax screen. A more effective method, however, is to break the coax

altogether and introduce a high pass filter just before the TV receiver. The high pass filter is designed to allow passage of the UHF TV signals with only minimal attenuation, but signals at HF and VHF will be blocked.

Fig. 3 shows the circuit diagram and physical layout of a suitable TVI filter. L1 and L2 are identical, self supporting UHF chokes which consist of about four turns of 18 to 22 swg enamel copper wire. The inside diameter of each coil is approximately 3/16" (4.5mm). L1 and L2 may initially be wound on a removable former of suitable diameter (ie a large knitting needle or drill shank) as this will help to keep the coils in shape during winding. The pitch of the turns should be adjusted so that the inside spacing between adjacent turns is equal to about two wire diameters. C1 and C2 consist of short lengths of the same enamel copper wire twisted together as shown by varying the number of twists (a good starting point is four twists). It is possible to adjust the capacitance and this provides a method of optimising the filter's performance - the greater the number of twists, the higher the capacitance and therefore, the lower the through loss. Remember that it is the coating of enamel on each wire that forms the capacitors dielectric and so this must not be scraped off!

The filter may be housed in a small plastic box with four solder tags bolted inside to support the

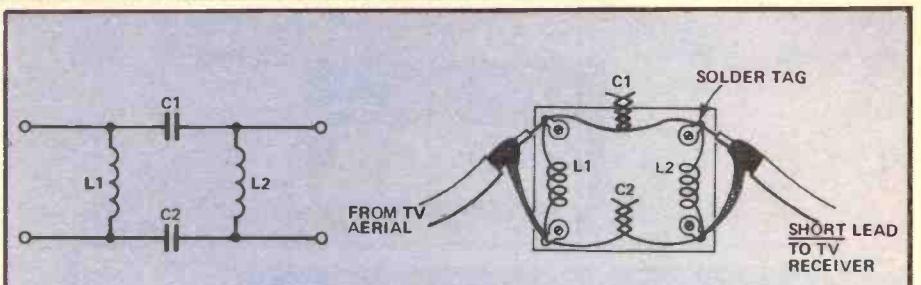


Fig. 3 This easy to build high pass filter will help combat TVI.

interconnections. The output lead which connects the filter to the TV receiver must be made as short as possible. Indeed, as an alternative it may be possible to fix an aerial plug into the filter's casing, thereby eliminating the output lead altogether. Where a video cassette recorder is installed, the filter must be placed ahead of the video's aerial input socket. Video recorders contain a sensitive UHF preamp which compensates for losses in the splitting and combing networks used to route signals through the machine. This preamp, which could easily be overloaded, is operational at all times — even when viewing off-air programmes that are not being simultaneously recorded.

If interference persists it may be due to RF that is induced in to the cable linking the VCR to the TV. In order to overcome such a problem a second filter may be added, as shown in **Fig. 4**. Although the addition of high pass filters is a legitimate means of reducing susceptibility to interference, it is also worthwhile considering improvements and/or repairs to the existing aerial installation. The connections to the aerial should be checked for corrosion as poor joints can act like diodes causing rectification of RF currents and subsequent intermodulation. The coax should also be examined and if it appears that moisture has got into it, the whole cable should be replaced. It may be worthwhile substituting a higher quality cable such as that which would normally be used to feed an amateur VHF or UHF antenna. The fact that the cable which comes to hand may be 50 ohm, rather than the 72 ohm variety normally employed for TV down-leads is of no real consequence.

Where interference is being induced into the mains lead of the VCR or TV receiver the mains filter described previously may be employed.

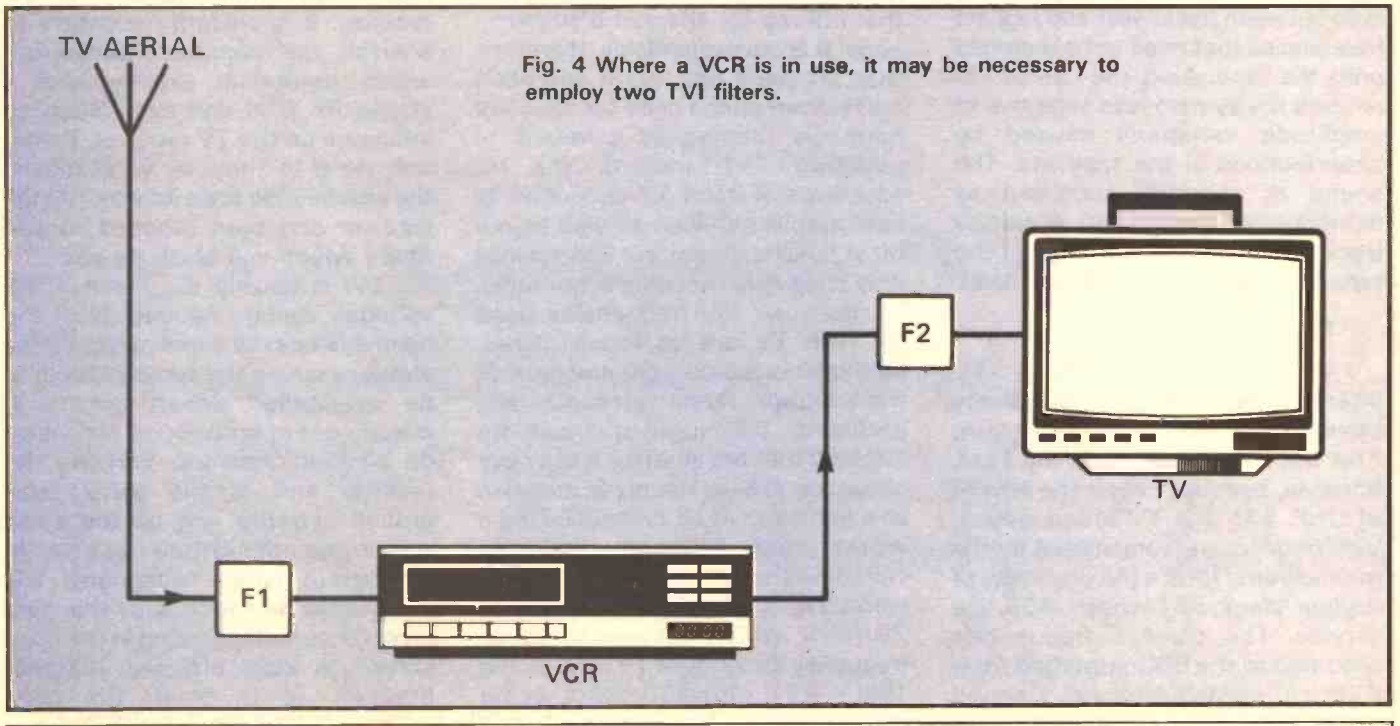


Fig. 4 Where a VCR is in use, it may be necessary to employ two TVI filters.

The Amateur Station

Although the various methods of curing interference caused to audio and video equipment should prove at least partially effective in most cases, the amateur must be aware that much can be achieved by correctly planning and operating his or her station. Listed below are some useful pointers to bear in mind.

1. The use of indoor transmitting antennas, eg loft mounted dipoles should be avoided. The problem here is that the radiating elements are bound to be in close proximity to mains wiring and so RF currents will be induced into the mains supply.

   Outdoor antennas should be sited as far away from buildings, overhead mains supply cables and telephone wires as conditions allow.
2. Remember that the low pass, harmonic suppression filters built into commercial transceivers are only fully effective when the antenna is properly matched to the rig. The use of an ATU will not only improve transmitting efficiency when loading random lengths of wire etc, it will also act as an effective harmonic filter. Bear in mind, however, that interference is not necessarily generated by harmonic radiation.
3. Avoid overdriving the transmitter and/or linear amplifier. This causes SSB signals to spread outside the normal voice bandwidth due to the generation of third order products. the resultant adjacent channel interference will not be appreciated by other operators.
4. Always use the minimum transmitter power necessary to establish effective communication. Interference of all kinds is to a large extent field strength dependent and in the case of certain frequency independent interference there will often be a threshold below which the interference disappears completely. This is indeed one of the strongest arguments in favour of QRP CW, RTTY and AMTOR operation as an alternative to high power SSB.

It's always better to adopt a positive attitude towards interference by accepting the problems created as both technological and sociological challenges. Amateur radio would, after all, become a rather boring complacent past-time if receiver interference, the woodpecker, home computers, TVI and other menaces suddenly and inexplicably disappeared from the scene altogether.

It can be argued that the development of better receivers having higher dynamic range and improved filters is merely the embodiment of a response to adjacent channel interference blocking and cross modulation.

When the amateur receives a complaint from neighbours that a particularly captivating episode of 'Dallas' has been wiped from the screen by his 200W of SSB, the amateur radio operator must become a diplomat for the hobby: explaining, sympathising and exercising skills in pursuit of social harmony.

RADIO Tomorrow

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

1 July
Bourne ARS: meeting at the Village Hall, Edenham, Bourne, starting at 7.30 pm.
Chichester DARC: annual summer social at Goodwood.
Dartford Heath DFC: pre hunt meeting.
E Lancashire ARC: meeting.
Warrington ARC: meets every Tuesday at the Grappenhall Community Centre, Bellhouse Lane. Tonight an open forum.
Wolverhampton ARS: junk sale.

2 July
Fareham DARC: Weather Satellites by G8VOI.
Fishguard DARS: meets every Wednesday at the Club Shack, Further Education Centre, Ropewalk, Fishguard.
SE Kent (YMCA) ARC: natter night.

3 July
Barry College of FE RS: meets every Thursday at the College Annexe, Weycock Cross, Barry.
Bredhurst RTS: construction and natter night.
Hastings ERC: barbeque.
Horndean DARC: A G6NZ Lecture.
Horsham ARC: HF Aerials and Feed Systems.
N Wakefield RC: natter night.
Preston ARS: preparation for VHF NFD.
Salop ARS: natter night.
Worksop ARS: visit to Newark RC.

4 July
Aberdeen ARS: junk sale and VHF NFD preparations.
Borders ARS: meeting.

Clifton ARS: meeting.
Coventry ARS: preparing for VHF NFD at Burton Dassett.
Loughton DARS: The Story of Laser 558.
N Bristol ARC: natter night.
S Manchester RC: meets every Friday, ring PRO for details.

5-6 July **VHF National Field Day.**

6 July Dartford Heath DFC: DF hunt.

7 July Basingstoke ARC: An Introduction to Packet Radio by G4NNS.
Morecambe Bay ARS: night on the air.
Sheffield ARC: summer junk sale.
Southdown ARS: barbeque.
Surrey RCC: meeting at TS Terra Nova, 34 The Waldrons, South Croydon, at 8pm with calibration evening, details from John.
Todmorden DARS: chat night.
Welwyn Hatfield ARC: informal and NFD analysis.

8 July Chester DRS: The FT726R by G4UXD.
Delyn RC: meeting starts at 8pm at the Daniel Owen Centre, Mold.
Harpenden ARC: VHF NFD aftermath at the Silver Cup pub, St Albans Road, Harpenden.
Keighley ARS: informal.
Kidderminster DARS: Lowe Electronics Lecture. Visitors welcome but starting at 7.30pm.
Newbury DARS: Satellite Operation by AMSAT UK.
Verulam ARC: activity evening.
Wakefield DARS: junk sale.
Warrington ARC: visit by Microwave Modules, Eric, G3WOH.
Wolverhampton ARS: Aerial Rotators.

9 July Crawley ARC: informal.
Fareham DARC: on the air natter night.
Havering DARC: informal.
SE Kent (YMCA) ARC: treasure hunt.
Stockport RS: slide show by G4FFW.
Stourbridge DARS: informal.
Stroud ARS: meeting.
Three Counties ARC: The History of UOSAT by G8VLY.
Wirral DARC: annual barbeque.

10 July Bredhurst RTS: CM Howes Communications visit.
Edgware DRS: Microwaves by G6ODA.
N Wakefield RC: visit to Kirkstall Road Fire Station.
Salop ARS: fox hunt.
Southgate ARC: Homebrewing (Alcohol!) by G3DKZ.
Stirling ARS: meeting at the Argyle Centre, Princes Street, Stirling.

11 July Aberdeen ARS: rag chew night.
Clifton ARS: meeting.
Coventry ARS: night on the air.
N Bristol ARC: 27-28MHz by G4TRN.
Wimbledon DARS: The Great Western Railway.

12-19 July **GB2CHI special event for the Chichester 911 festivities.**

12-13 July **BATC Summer Fun ATV contest from 12 noon on Saturday to 1600 Sunday (BST). All bands and modes, ie 70cm, 23cm, 3cm on FSTV and 2m SSTV. Further details from Mike, G6IQM.**

13 July **Sussex Mobile Rally at Brighton Racecourse. Aberdeen ARS operating GB4BGG at Beechgrove Gardens open day.**

Photo courtesy Wimbledon DARS

'Mr Morse' of SW London

Reg Baker, G6QN, learned morse in 1911 listening to the sounder in the telegraph office at Tooting, SW London, where he was employed as a messenger. He became an army signaller during the 1914-18 war, was later employed as a wireless technician in the Metropolitan Police force and helped to re-form the Wimbledown DARS in 1963.

Now 87 and a white stick operator, Reg prefers the simpler things in life and so has restored his 1932 one valve CW transmitter to full working order. It now boasts a mains power supply and a PX25 valve replacing the original Triotron ZD2. His companion receiver is a World War II Eddystone 358X (not shown in the photo) and the morse key is a genuine Post Office 1898 model.

G6QN's distinctive brand of morse can be heard on 7010 kHz, where he has stimulated growing interest in the area.

14 July Coulsdon ATS: Cellular Radio Update by G6UYT.
Felixstowe DARS: social.
Milton Keynes DARC: Triffid UKTRC471 Radio Relay Vehicle.
Sheffield ARC: DF hunt and pub meeting.
Southdown ARS: meeting.

15 July Biggin Hill ARC: computer night.
Bourne ARS: meeting.
Chester DRS: treasure hunt starting at 7pm.
Chichester DARC: meeting.
Midland ARS: RRD by G4PZA.
Warrington ARC: Direction Finding by G8TRY and G6SNO of the Wirral club.
Wolverhampton ARS: visit to BBC transmitting site at Droitwich.
Worksop ARS: Packet Radio by G4KAL.

16 July Fareham DARC: junk sale.
Hastings ERC: Converting CB Equipment.
Havering DARC: DF hunt.
SE Kent (YMCA) ARC: natter nite.
Stockport RS: informal.

17 July Bredhurst RTS: construction and natter night.
Greater Peterborough ARC: junk sale.
N Wakefield RC: on the air night.
Preston ARS: informal.
Salop ARS: natter night.

18 July Ayr ARG: summer natter night.
Borders ARS: meeting.
Bury RS: junk sale.
Clifton ARS: meeting.
Coventry ARS: night on the air.
Winchester ARC: topical quiz by G6DIA.

19-20 July **Loughton Hall GB2LRS to celebrate 25th anniversary of Loughton DARS. From 9am till 9pm both days on 2m, 6m and 70cm on phone and RTTY.**

20 July **McMichael Mobile Rally at the Haymill Centre, Burnham, near Slough. Trade stands, flea market, demonstrations and much more besides.**
Morecambe Bay ARS: VHS evening.
Stourbridge DARS: treasure hunt.
Todmorden DARS: chat night.
Welwyn Hatfield ARC: fox hunt.

22 July Chester DRS: visit to British Aerospace at Broughton.
Delyn RC: meeting.
Dorking DRS: informal at the Plough, Coldharbour.
Harpenden ARC: informal natter night.
Kidderminster DARS: on the air night plus G4LVK.
Verulam ARC: Running Hot and Cold DXpeditions by G3RFS and G4OBH.
Wakefield DARS: pitch and putt competition.
Warrington ARC: treasure hunt by G8HLB and G0CPD.

23 July Crawley ARC: members evening at the Leisure Centre.
Fareham DARC: on the air night.
Havering DARC: informal.
Stockport RS: Home Processing of Colour Slides by G4RLD.
Stroud ARS: meeting.
Three Counties ARC: CW Operating by G4RRA.
Wirral DARC: Eileen Medley DF hunt.

24 July Bredhurst RTS: meeting.
Edgware DRS: informal.
N Wakefield RC: rally meeting.
Salop ARS: Oscilloscopes by G3VZG.

25 July Clifton ARS: meeting.
Coventry ARS: night on the air.
N Bristol ARC: meeting.
Wimbledon DARS: general activity evening.

26 July **RSGB 432MHz low power contest.**

27 July **RSGB 144MHz low power contest.**

28 July Felixstowe DARS: Hospital Radio by Pam and Bryan Hoyer, Ipswich Hospital Radio.

29 July Chester DRS: A Journey Around the Western Isles by Paul, GM3TZO/MM.
E Lancashire ARC: informal.
Keighley ARS: fox hunt.
Warrington ARC: Lord Howe Islands — RSGB video.
Wolverhampton ARS: night on the air.

30 July Fareham DARC: portable planning.
Havering DARC: meeting.

31 July Bredhurst RTS: construction and natter night.
Coulsdon ATS: a general morse/RAE help night.
Preston ARS: informal.
Salop ARS: natter night.

1 Aug Clifton ARS: meeting.
N Bristol ARC: natter night.

2 Aug Worksop ARS: barbeque at Clumber Park,

3 Aug Wolverhampton ARS: DF hunt.

4 Aug Basingstoke ARC: natter night.
Southdown ARS: meeting.
Welwyn Hatfield ARC: Model Radio Controlled Aircraft by G0AII.

5 Aug Dartford Heath DFC: pre hunt meeting.
Delyn RC: meeting.
Kidderminster DARS: meeting.
Warrington ARC: open forum at the Grappenhall Community Centre, Bellhouse Lane.
Wolverhampton ARS: visit.

6 Aug Fareham DARC: portable operation.
Havering DARC: informal.
Three Counties ARC: HF and VHF stations on the air.

7 Aug Horndean DARC: Special Stations — Another Angle by G4RLE.
N Wakefield RC: natter night.
Salop ARS: discussion night.

8 Aug Clifton ARS: meeting.
N Bristol ARC: G3TCO Lecture.
Wimbledon DARS: briefing for summer camp.

10 Aug **Hamfest '86 organised by Flight Refuelling ARS and RAIBC at the Flight Refuelling Sports and Social Club in Wimbourne. Items of interest for all the family as well as the radio amateur. Further info from Ashley Hulme, G0CDY, on 0202 872503.**
Dartford Heath DFC: DF hunt.

11 Aug Felixstowe DARS: social.
Milton Keynes DARC: Lundy Island DXpedition.
Sheffield ARC: one hour club contest and social.

12 Aug Bury RS: fox hunt.
Dorking DRS: informal at the Star and Garter pub.
Harpenden ARC: The 62 Set by G0CXP.
Keighley ARS: informal.
Newbury DARS: DF hunt.
Warrington ARC: barbeque.
Wolverhampton ARS: Black Box or Homebrew — a discussion.
Worksop ARS: darts and dominoes with the sub aqua club.

13 Aug Fareham DARC: portable operation.
Stockport RS: Official Natter Night.

14 Aug N Wakefield RC: on the air.
Southgate ARC: open evening.

15 Aug Clifton ARS: meeting.
N Bristol ARC: VHF activity night.

17 Aug **Aberdeen ARS operating GB4BGG from Beechgrove Gardens open day.**

18 Aug Welwyn Hatfield ARC: RTTY station and informal.

19 Aug Biggin Hill ARC: evening DF hunt.
Dartford Heath DFC: DF night hunt starting at 7.30pm.
Delyn RC: meeting.
Kidderminster DARS: meeting.
Warrington ARC: Winter Hill Station by G4YZE from the IBA.
Wolverhampton ARS: visit to the Wireless School at RAF Cosford.

20 Aug Fareham DARC: portable operating.
Stockport RS: informal natter night.
Three Counties ARC: 50MHz Operation by G3TCV.

21 Aug Edgware DRS: SSB FD briefing.
N Wakefield RC: The History of Amateur Radio by G3VTD.

22-26 Aug **Barry College of Further Education RS will be establishing a station on Flat Holme Island in the Bristol Channel to commemorate Marconi's achievements. All bands will be worked, 160m to 3cm. Skeds available.**
Clifton ARS: meeting.
N Bristol ARC: natter night.

23-25 Aug **Harewood Steam Rally with special event station being operated by N Wakefield RC.**

24-25 Aug **Bassetlaw Show, Kitton, Worksop, with GB2BTF special event station run by Worksop ARS.**

25 Aug Felixstowe DARS: projects evening.

26 Aug Chester DRS: pre SSB field day meeting.
Dorking DRS: social evening with a barbeque at the Fox Revived.
Harpenden ARC: informal natter night.
Keighley ARS: lecture.
Warrington ARC: Melbourne RC video.
Wolverhampton ARS: night on the air.
Worksop ARS: DF hunt.

27 Aug Crawley ARC: pub hunt.
Fareham DARC: portable operation.
Farnborough DRS: Propagation by G3LTP.
Stockport RS: Use and Abuse of VHF Antennas by G4HK.

28 Aug Edgware DRS: informal.
Felixstowe DARS: visit to Radio Orwell.
Glossop DARG: Japanese Morse.
Greater Peterborough ARC: social.
Salop ARS: final arrangements for the Telford rally.

29 Aug Clifton ARS: meeting.
Dunstable Downs RC: The Lundy Expedition.
N Bristol ARC: lecture.

31 Aug Wolverhampton ARS: DF hunt.

1 Sept Basingstoke ARC: Surface Mounted Devices by G4OXK.
Sheffield ARC: SSTV demonstration and discussion by G8RWV.
Southdown ARS: meeting.
Stourbridge DARS: informal.
Welwyn Hatfield ARC: meeting.

Will club secretaries please note that the deadline for the October segment of Radio Tomorrow (covering radio activities from 1st September to 1st November) is 27th July.

Contacts

Aberdeen ARS	Don	04676251
Abergavenny & NH ARC	GW4XQH	0873 4655
Aberporth ARC	GW0DPR	023987 274
Alyn and Deeside ARS	GW4RKX	0244 660066
Amateur Radio & CC	Trevor	04895 81032
Atherstone ARC	Roy	0203 393518
Axe Vale ARC	Bob	029 74 5282
Ayr ARG	GM3THI	Ayr 42313
Barking RES	R. Woodberry	01 594 4009
Barry College RS	John	065679 710
Basingstoke ARC	Dave	07356 5185
Bath DARC	G4UMN	Frome 63939
Biggin Hill ARC	G0AMP	0689 57848
Borehamwood Elstree ARS	Tony	01 207 3809
Braintree ARS	G6CJA	0376 45058
Bredhurst RTS	Kelvin	Medway 376991
Brighton DARS	Peter	0273 607737
Bristol ARC	G4YOC	Bitton 4116
Bristol (Shirehampton) ARC	Ron Ford	0272 770504
BT (Reading) ARC	G4MUT	0734 693766
Bury RS	Allan	0204 706191
Cambridge DARC	D. Wilcox	0954 50597
Cheshunt DARC	G4VMR/G4VSL	092084 250
Chester DRS	Dave	0244 336639
Chichester DARC	C. Bryan	0243 789587
Clifton ARS	RA Hinton	01 301 1864
Conwy Valley ARC	G4VVW	0492 636376
Coulsdon ATS	Alan	01 684 0610
Coventry ARS	Robin	0203 73999
Darenth Valley RC	Sec	0322 63368
Dartford Heath DFC	Pete	0322 844467
Denby Dale DARC	G3SDY	0484 602905
Derwentside ARC	G1AAJ	0207 520477
Donegal ARC	EI3BOB	074 57155
Dorking DRS	John	0306 77236
Droitwich DARC	G4HFP	0299 33818
Dudley ARC	John	0384 278300
Dunstable Downs RC	Phill Morris	0582 607623
East Kent ARS	Stuart	0227 68913
East Lancashire ARC	Stuart	0254 887385
Edgware DRS	John	Hatfield 64342
Exeter ARS	Roger Tipper	0392 68065
Fareham DARC	Alan	0329 288139
Farnborough DRS	Mr Taylor	0252 837581
Felixstowe DARS	G4YQC	0473 642595
Fishguard DARS	Bernard	0348 872671
Fylde ARS	PRO	0253 737680
Galashiels DARS	GM3DAR	0896 56027
G. Peterborough ARC	Frank	0733 231848
Halifax DARS	D. Moss	0422 202306
Harpenden ARC	G1BJC	0582 72455
Harrow RS	Tony	01 861 0419
Hastings ERC	Dave Shirley	0424 420608
Haverhill DARS	Rob Proctor	0787 281359
Havering DARC	G0BOI	04024 41532
Hornsea ARC	Norman	0262 73635
Horsham ARC	Pete Head	0403 64580
Inverness ARC	Brian	0463 242463
Keighley ARS	G1IGH	0274 496222
Kidderminster DARS	Tony	0562 751584
Kingston DARS	G3ODH	Epsom 26005
Lagan Valley ARS	Jim	0846 682474
Leeds DARS	G1EBS	0274 665355
Leighton Linslade RC	Pete Brazier	052 523 270
Lothians RS	Robin	0506 890177
Loughborough ARC	Philip	0509 412043
Maidenhead DARC	John	0628 28463
Maidstone YMCA S/C ARS	G4AYD	0622 29462
Maltby ARS	Ian Abel	0709 814911
Medway ARTS	Tony	0634 578647
Midland ARS	G8BHE	021382 0086
Mid Sussex ARS	G1FRF	0791 82937
Mid Ulster ARC	Sam	0762 22855
Mid Warwickshire ARS	G4TIL	Southam 4765
Milton Keynes DARS	Dave	0908 501310
Morecambe Bay ARS	G3PER	Heysham 52659
N. Cornwall RS	J. West	0288 4916
N. Staffs ARS	G6MLI	0782 332657
N. Wakefield RC	Steve	0532 536633
Newbury DARS	G3VOW	0635 43048
Oswestry DARC	Brian	0691 831023
Plymouth ARC	G4SCA	0752 337980
Pontefract DARS	G0AAO	0977 43101
Preston ARS	George	0772 718175
Rhyl DARC	GW1AKT	Nantglyn 469
Salisbury RES	Neil	0980 22809
Salop ARS	Simon	0743 67799
Sheffield ARC	John	Sheffield 581766
Shefford DRS	G4PSO	Hitchin 57946
S. Bristol ARS	Len Baker	0272 834282
S. Cheshire	Chris	07816 73185
S. Lakeland ARS	Dave	0229 54982
S. Manchester RC	Dave Holland	061 973 1837
S. Tyneside ARS	G4XWR	S. Shields 543955
S. E. Kent (YMCA) ARC	John	0304 211638
Southdown ARS	P. Henly	0323 763123
Southgate ARC	G4YLL	0992 30051
Stevenage DARS	G4ISO	0462 892765
Stockport RS	G4FFW	061 224 7880
Stockton DARS	John Walker	0642 582578
Stourbridge DARS	G3ZOM	K/ford 288900
Stowmarket DARS	M. Goodrum	0449 676288
St Helens DARC	A. Riley	051 430 9227
Surrey RCC	John	01 657 0454
Swale ARC	B. Hancock	0795 873147
Telford DARS	Tom Crosbie	0952 597506
Three Counties ARC	Keith, G0BTU	0730 66489
Tiverton (SW) RC	Alan	0392 881569
Todmorden DARS	G1GZB	070 6817572
V White Horse ARS	Ian White	Abingdon 31559
Verulam ARC	Gerry	St Albans 52003
WACRAL	G4NPM	0795 873147
Wakefield DRS	G4VRY	0532 820198
Warrington ARC	Paul	0925 814005
Welland Valley ARS	J. Day	0858 32109
Welwyn Hatfield ARC	Dave	07073 26138
West Kent ARS	B. Guinnessy	0892 32877
Westmorland RS	G. Chapman	0539 28491
White Rose ARS	G4YEK	0423 884481
Willenhall ARS	G4LWI	0902 782036
Wimbledon DARS	G3DWW	01 540 2180
Winchester ARC	Gordon	0703 772191
Wirral DARC	Peter	051 677 7376
Wolverhampton ARS	Keith	0902 24870
Worcester DARC	D. Batchelor	0905 641733
Worksop ARS	G4ZUN	0909 486614
308 ARC (Surbiton)	Dave Davis	01 399 5487

Starting Young —The Journal of a Teenage Amateur

Whether you feel too young to take the RAE or merely young at heart, the journal of Geoff Petit, GU0BGP, aged now 15, should be required reading.

One night at scouts our leader read out an invitation to go along to the Jamboree-On-The-Air event which would take place the following weekend. Nobody else seemed interested, so I didn't raise my hand. But, afterwards I managed to find out where the event was to take place, and on the following Saturday afternoon I put on my scout uniform and went along to the Guernsey Amateur Radio Society HQ.

When I got there I found some scouts from other Guernsey groups, posters about amateur radio on the walls, and some radio club members trying to explain what was going on. I think that what impressed me most of all was that the member who was doing all the operating was not so very much older than myself. 15 year old Andrew Hamon, GU6TDE, was having a great time operating the club station GU3HFN. He was making contacts with scout groups all over, including places like Denmark, Portugal, Cyprus, Pennsylvania and Antigua in the West Indies. Then he changed frequency band, and contacted a lot of stations using the GB prefix who were at scout groups in England.

I became pretty interested in what was going on, so Andy asked some others and myself to come back the next day. On the Sunday afternoon I turned up at the radio club again, and Andy worked a whole lot more scout stations. One of the other members showed me how to build a crystal set — this was the first time I had ever learned anything about electricity or electronics. I found out how to join the club, and managed to borrow a beginners' book about amateur radio. (The Guide To Amateur Radio published by RSGB) from the club's library.

Junk Sale

One of the first events I attended on joining the radio club was an auction sale of equipment belonging to a member who had died. I couldn't afford to bid for expensive things like transmitters or receivers but I managed to get boxes and boxes of components and old broken radios for about 10p each. Afterwards, when my Dad came to collect me, he was hopping mad when he saw the pile of stuff that we had to put in the back of his van and take to fill up the spare bedroom in our house! There were lots of useful bits and pieces, but I still haven't managed to sort all of them out.

RAE Class

In January, about three months after my visit to JOTA, the Guernsey ARS announced a class for the Radio Amateurs' Examination the following May. I went along to enroll, and I am glad to say that nobody tried to tell me that I was too young to be attempting the RAE syllabus at age 12! Our instructor, John Morris, GU6BGI, was quite well known because he had started teaching RAE classes when he was only 16. With GU6BGI you really had to work hard because nearly everybody elsewhere in the country had started their classes the previous September.

John was a bit concerned that with only being in the second year at school I might not know enough maths, so for a few Sunday afternoons I went along to the house of a Guernsey ARS member who was a maths teacher. He showed me things about algebra like substituting values in formulae and transposing equations. But I found that I had already learned some of what he was trying to teach me when I was fiddling around with my Sinclair ZX-81 computer.

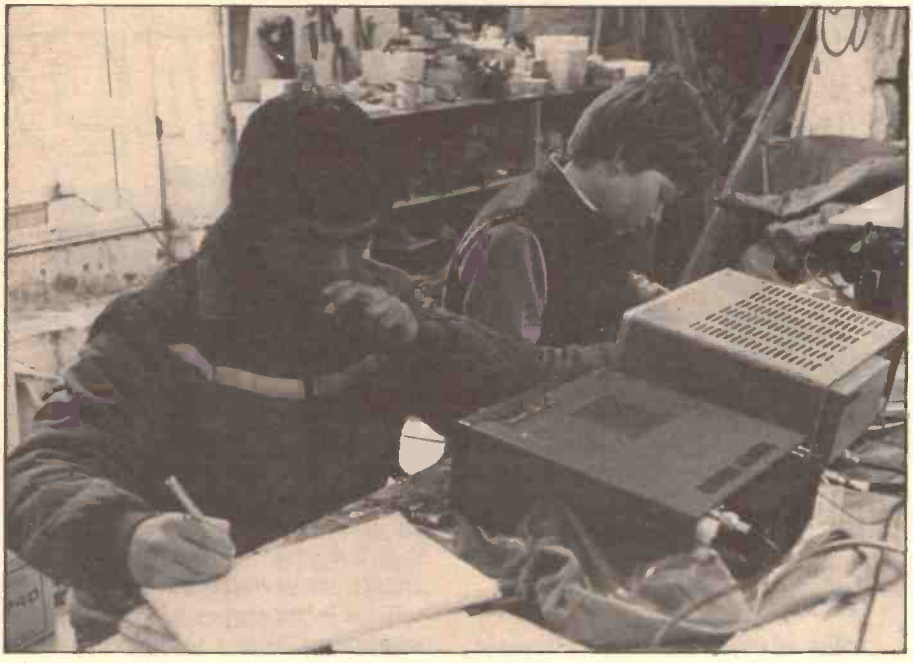
The textbook we used for the course was the RAE Manual (an RSGB publication) and John gave us a lot of his own notes. One of the other students in the class who had a university degree thought he knew a great deal and kept interrupting, so John had quite a job getting us through the syllabus in the 15 weeks available.

DXpedition To Herm

About three miles from Guernsey's East coast there is the tiny Channel Island of Herm, 1 ½ miles long. There has hardly ever been any amateur radio activity from there and Andy, who now had a class A licence GU4WTN, asked me to go along with him on a DXpedition to put Herm on the air. One Sunday morning in May we took a boat over to Herm, carrying all Andy's radio equipment.

The Herm estate manager said we could operate from a dungeon in a house called "Le Manoir" which looks like a castle. He told Andy to haul up his dipole aerial on the flagpole which stands on the battlement. While we were doing this, there was a shout from below. It was Major Wood, the fearsome tenant of Herm, and he was *really* angry! After a while we managed to calm him down so that we could keep our aerial on his flagpole.

As soon as we got the station on the air there were lots of calls from



The first DXpedition to Herm in May 1984. I'm copying stations' callsigns into my SWL log as Andy, GU4WTN, contacts them on 7MHz.

amateurs who were very anxious to make their first contact with Herm. I sat beside Andy and noted all the callsigns into my SWL log. Major Wood came along to visit the station and was so impressed that he provided Andy with some Herm postcards that could be turned into GU4WTN QSLs. Major Wood even agreed to pay the postage!

Radio Amateurs' Examination

The day after our trip to Herm, I went along to take the RAE at the Guernsey College of Further Education. It was three weeks after my 13th birthday, and the exam invigilator seemed a little surprised to see someone so young! I went through each question marking the most likely answer and tried to remember all the formulae I had swotted up. I found that they gave you plenty of time to answer and I had some time left over at the end of both papers.

National Field Day 1984

This HF event is held every June with clubs setting up an HF radio station in a field and operating for 24 hours. I went along to help put up the great big aerials. Our club had won the event the previous year, and this year we had two Americans from the North Texas Contest Club in Dallas to help us. They seemed quite confident that they could help us win again, but we only came fifth (ha ha!).

One of the Americans told me he he had become a radio amateur when he was only 11 years old! He promised to send me a baseball cap with my name and callsign if I could learn morse and get myself a class A licence. He also taught me how to hold a morse key properly, and said that I could be operating in the club's team in next year's field day if I really got down to learning morse. I didn't think that I could be good enough by then!

RAE Result

One Summer's day I came back home from scout camp to find a letter waiting for me. It was the result of the RAE. I had passed both papers! The other people from our RAE class who had passed all quickly sent off for their class B licences (all except the university graduate who had done so much interrupting, because he had failed one paper!) I couldn't get any kind of licence because I was not yet 14, so I just had to concentrate on learning morse.

I managed to borrow an old receiver, a Drake R-4A (it was so old that it had valves inside which glowed when the power was switched on!). I did quite a lot of short wave listening and used to try to find morse stations that were sending slowly enough for me to copy them.

RSGB Man

One day an RSGB Council Member visited the Channel Islands, and he came along to see all the young members at our club (we made sure that nobody over 20 could get in!). He told us what the RSGB is going to be doing for young people, but nothing much seems to have happened, even though last year was supposed to be International Youth Year (IYY)! I told him that I thought that it was really unfair that I couldn't get a licence even though I had passed the RAE. He said that he would try to get something done by RSGB, but that I would probably be 16 before anything happened!

After the meeting for the club's young members we went on to another meeting for all the Island's RSGB members held at a hotel. The RSGB man gave quite an interesting talk and answered lots of questions.

JOTA 1984

Andy, GU4WTN, got himself issued with a special event callsign GB4GU so that I could use the "talking" privilege to send greetings messages to other scouts. Our club invited the rest of the Island's scouts along to the station as well. There must have been some confusion because not a single one showed up except for me — and the local scout commissioner who presumably came along to see how I was getting on!

I pretty soon got bored with sending greeting messages to other scouts using voice, so Andy looked in his licence, and couldn't see anything to stop me sending messages using morse code! We made out a message which went something like this:

Greetings from Geoff age 13 = I am assistant patrol leader Kestrels Ninth Guernsey Scout Group and I have passed the RAE = hope to see you on the air when I have my own licence = 73 Geoff

After Andy made initial contact with each station, I sent the message in very slow morse code to GM3HBT, G3FXB, GB2JNC, G4OEC, GB2FNS, GU4XEA, G3BTA, G4SGI, GB4STA (Gerry, Deputy Scout Commissioner for Hertfordshire), G4MSN/QRP, G4CCR, G4DMC, G4PIP, G3IGU and GI3CVH. I bet some fell off their chairs when they found out who was sending to them!

Morse Test

In the Channel Islands you only get one opportunity a year to take the morse test, when the radio

inspector comes over from Southampton, and this happened in March 1985. There were nine candidates from Guernsey, and one chap flew in specially from Jersey. We were split up into two groups of five, and we had to do sending first. One candidate was so nervous that he couldn't even hold the morse key, he had to leave the room. However I managed to scrape through my sending and receiving.

No Amateur Radio Certificate

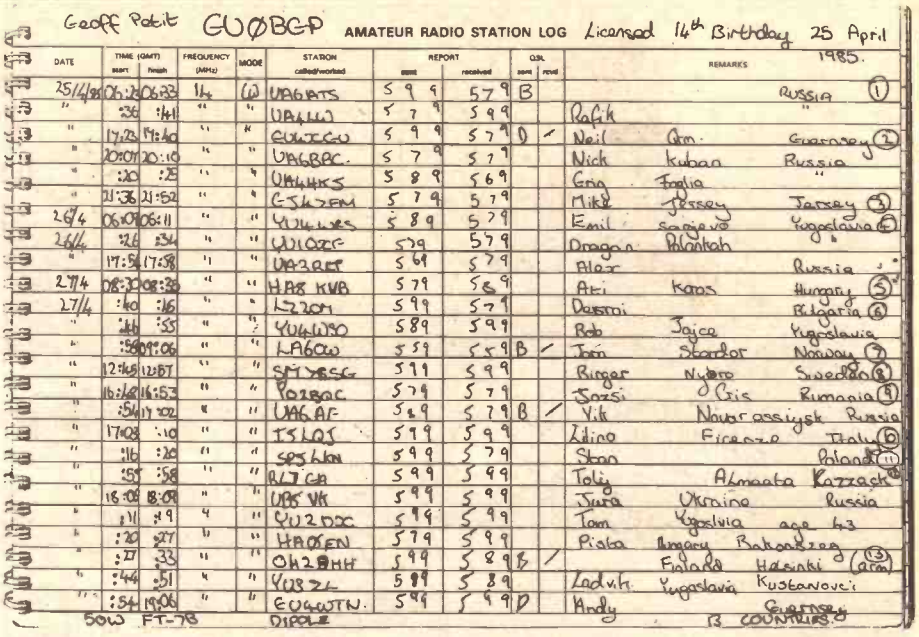
After I received the morse test pass slip I still wasn't 14 but our club secretary noted that the Department of Trade and Industry does not publish a lower age limit for the issue of the Amateur Radio Certificate. This certificate allows you to operate from a club station or someone else's station without having your own callsign. I sent off the application, but they turned me down! All of a sudden they had invented an age limit, when there wasn't one there before! So I would have to wait until my 14th birthday and get a licence in the normal way. I am glad to say that the RSGB has now sorted this matter out with DTI, and there is now a lower age limit of 10 for the issue of an Amateur Radio Certificate, thanks to yours truely, Geoff.

Setting Up My Station

Although I had boxes and boxes of components from the junk sale, I hadn't managed to build a transmitter for my own station. However, I was able to borrow a little Yaesu FT7B mobile transceiver which worked on SSB and CW on five HF bands: 3.5, 7, 14, 21 and 28 MHz. This rig needed a 12-volt supply so I fixed up an old car battery and a battery charger which worked off the mains. This set-up gave about 50 watts output. I only wanted a simple aerial, so I slung up a 14MHz dipole from the chimney-pot above my bedroom window down to a pole at the side of our garden.

Andy came along and checked the aerial SWR and he told me that I would be able to work plenty of American stations. I also managed to borrow a Yaesu FT290R rig so that I could chat to local stations on 144MHz FM and SSB, using a little vertical aerial that I fixed up.

There was something very mysterious about these two rigs because they didn't have microphones! In fact microphones couldn't be found anywhere in Guernsey! So it looked as if I would be stuck on morse code when at last my licence came through! I think that this was a conspiracy.



Geoff Pobjoy GUØBGP AMATEUR RADIO STATION LOG Licensed 14th Birthday 25 April 1985.

DATE	TIME (GMT) start	TIME (GMT) finish	FREQUENCY (MHz)	MODE	STATION called/worked	REPORT sent	REPORT received	QSL sent	QSL rcvd	REMARKS		
25/4/85	06:28	06:33	14	CW	UA6ATS	599	579	B				RUSSIA (1)
"	:36	:41	"	"	UA4LW	579	599			Rafik		"
"	17:23	19:40	"	"	GW1CGU	599	579	D	✓	Neil	Gm.	Guernsey (2)
"	20:07	20:10	"	"	UA6BAC	579	579			Nick	Kuban	Russia
"	:20	:25	"	"	UA4HKS	589	569			Greg	Foglia	"
"	21:36	21:52	"	"	G3LHZFM	579	579			Mike	Jersey	Jersey (3)
26/4	06:07	06:11	"	"	YU1LWES	589	579			Emil	sarajevo	Yugoslavia (4)
26/4	:26	:34	"	"	UA1OZC	579	579			Dragan	Murmansk	"
"	17:54	17:58	"	"	UA3AEF	569	579			Alex		Russia
27/4	08:30	08:36	"	"	HA8 KWB	579	569			Ati	Kaos	Hungary (5)
27/4	:40	:46	"	"	LZ2OM	599	579			Dessni		Bulgaria (6)
"	:48	:55	"	"	YU1WBO	589	599			Bob	Jajce	Yugoslavia
"	:58	09:06	"	"	LA6QW	559	559	B	✓	Jan	Skardar	Norway (7)
"	12:46	12:57	"	"	SM7BSG	599	599			Birger	Nybro	Sweden (8)
"	16:42	16:53	"	"	YO2BQC	579	579			Jozsi	Cris	Rumania (9)
"	:54	17:02	"	"	UA6AF	569	579	B	✓	Vik	Novorossiysk	Russia
"	17:08	:10	"	"	IS1QJ	599	599			Zdino	Firenze	Italy (10)
"	:16	:20	"	"	SP5HKN	599	579			Stan		Poland (11)
"	:55	:58	"	"	RL7CA	599	599			Toli	Almaata	Kazzach (12)
"	18:08	18:09	"	"	UA6VK	599	599			Jura	Ukraine	Russia
"	:11	:19	"	"	YU2DZC	599	599			Tom	Yugoslvia	age 43
"	:20	:27	"	"	HA0EN	579	599			Pista	Hungary Balaton	
"	:27	:33	"	"	OH2BHH	599	589	B	✓		Finland Helsinki	(13) (Aerial)
"	:44	:51	"	"	YU3ZL	599	589			Ladvik	Yugoslavia Kustanovici	
"	:54	19:06	"	"	EU4WTN	599	599	D		Andy		Guernsey

50W FT-78 DIPOLE 13 COUNTRIES

The first page of my log book. I started operating using my callsign of GU0BGP on my 14th birthday.

Getting On The Air

I had sent off my licence application and someone from the club made special arrangements with the Post Office for me to have a callsign with my own initials, which could be used as soon as I turned 14 on my birthday. So there was I, listening on 14MHz CW at midnight, but the band was dead, I couldn't hear any any other stations! Even Andy, who was supposed to be keeping a schedule with me, had gone to sleep! My aerial wouldn't work on any other band. So there was GU0BGP, Britain's newest, youngest and keenest radio ham, with nobody to talk to!

Next morning I woke up early and tuned across the 14MHz band again. I heard some signals, so the band was beginning to open up. I sent out a morse code CQ call, and when I finished there on the frequency was somebody sending my callsign! It was a Russian station, and he was calling me! I managed to copy his callsign down, and when he finished calling, this is what I sent:

UA6ATS DE GU0BGP = TKS FOR UR CALL = RST 599 599 QTH GUERNSEY GUERNSEY ES NAME GEOFF GEOFF = UA6ATS DE GU0BGP KN

He came back and I managed to copy my signal report but he must have been sending a bit fast because I did not get his name or QTH.

Before I had to close down and go to school I had time to have one more contact, this was also with a Russian but this time I did managed to get his name, Rafik. When I came home from school I managed to have four more contacts, bringing up my total for my first day on the air to six, all on morse. In the next couple of days I managed to finish off the first page in my log, making a total of 25 morse contacts in 13 countries.

My log book was carefully inspected and then, surprise, surprise, the microphones missing from the rigs I borrowed were suddenly found! This meant that I could now work on 'phone, but in fact most of my operating continued on morse.

Back To Herm

A few days after I had got on the air, Andy and I went over to reactivate the little island of Herm. This time we decided to camp for two nights, so we used the callsigns GU4WTN/P and GU0BGP/P. Andy is keen on DXing, he had gained the DXCC certificate for getting QSLs for contacts with 100 countries, even though he was only 16 at the time. We took along the club's three element triband beam for the 14, 21 and 28MHz bands, and rigged this alongside the W3DZZ dipole for 3.5 and 7MHz.

Andy was very busy on the bands and when it was my turn I had a few contacts on 3.5MHz CW. On

A demonstration at Guernsey Scout HQ, August 1985. A visiting scout from Windsor is listening to GU0BGP operating on 80m.

the Sunday morning I managed to contact RSGB Vice President G2MI, just after he had finished reading the GB2RS news on 3650kHz. This was only the fourth 'phone contact that I had had, and my first on HF. I did a bit more operating on 80m and then Andy got himself very involved with a contest, so I didn't see much more of his rig!

Locked In The Castle!

On 9th May, three days after we got back from Herm, Guernsey celebrated its 40th anniversary of liberation from German occupation — Liberation Day is always a public holiday in the Channel Islands. Some local radio amateurs got permission to operate a special event station GV4LIB from Castle Cornet in St Peter Port harbour and I went along to help them. I found myself on the 80m band trying to deal with a whole pile-up of stations trying to contact GV4LIB — this was quite an experience!

In the evening there was nobody in the castle except those of us at GV4LIB. The other operator had gone down to the main gate to let someone out, leaving me by myself operating GV4LIB. I did not know that the gate had blown shut, and that I was trapped all alone in a great big ancient castle full of dungeons and ghosts!

I just carried on trying to deal with the pile-up of stations who were still calling me. The operator who had been shut out called me on his walkie-talkie, but it was a long time before I happened to take off my headphones and heard him on the two metre rig at GV4LIB! I had to go down and open the castle's gate. I wish I had not heard him, then I would have been able to carry on operating GV4LIB all night!

Contest

One weekend when I was operating on 14MHz CW I noticed a lot of stations sending numbers to each other very fast. I couldn't figure out what was going on so I telephoned one of the local amateurs to find out. I discovered that there was a Russian contest happening that weekend. He told me how to send and receive serial numbers, and how to make the really fast stations slow down so that I could read what they were sending to me.

After a while I found that I got on all right and that I could copy what was being sent to me. The other stations were all very pleased to make contact with GU0BGP, because there was no other Guernsey station operating in that contest, and I managed to work about 55 stations, all over Russia and Europe, plus nine in USA! This was the furthest that my little station had got so far.

Later on that month there was another CW contest (CQ WW WPX CW) and I managed to contact 127 stations. I was getting some pretty good practice during my first month on the air!

NFD 1985

People seemed quite surprised to hear me operating morse in contests and beam to contact me, so I found myself in the Guernsey ARS team to operate our club station GU3HFN/P during HF NFD. When we got to the site we found a terrific wind blowing, so we couldn't put up all our aerials. Our big TH6-DXX beam is supposed to have six elements, but we could put up only three of them and operated just on the 14MHz band.

When the contest started I was put on to operate the first hour. I was getting plenty of advice and suggestions as to what I should or should not be doing. In the end I plugged my headphones into the rig so that the only person who could hear what was going on was me!

In my hour I managed to contact 24 other stations, and this was more than our station's operators averaged for the contest as a whole! I am glad to report that GU3HFN/P was the leading station on the 14MHz band, and we were awarded a trophy called "The Frank Hoosen (G3YF) Trophy" by the RSGB. I bet there has never been another RSGB member so young in a trophy winning team! By the way, I must thank K5MM who had promised me the baseball cap, because it turned up just in time for NFD, and you can see it in the picture nearby.

Space Shuttle

One day I read in the American magazine QST that Tony England, W0ORE, was going to be operating his amateur radio station in orbit aboard the space shuttle Challenger. He was going to be looking especially for contacts with amateur radio youth groups on the ground. I reckoned that I qualified as a youth group so I wrote a letter to Astronaut England at his home address in Houston which I found in the Radio Amateur Callbook, USA Edition. I asked in my letter if he could listen for GU0BGP any time he happened to be passing over Guernsey!

I did not receive any reply from Astronaut England, but he must have got my letter because I received a big packet of youth group shuttle information from the American

Radio Relay League. The information included things like orbital parameters, press releases, and best of all, a secret list of non-published frequencies for youth groups to use when calling the astronaut. This frequency list gave me a big advantage over nearly every other radio amateur in Britain who didn't have the information.

So when the shuttle was launched I was listening on the spacecraft downlink frequency of 145.550MHz and was ready to transmit on one of my secret uplink frequencies. Lots of local amateurs wanted to know what they were, but I wouldn't tell them! I heard shuttle Challenger a couple of times on my FT290R, but W0ORE in space did not seem to be hearing the 2½ watts that Guernsey youth group GU0BGP was sending up to him.

I realised that more power would be helpful, so I went along to the station of another young local amateur, Keith le Boutillier, GU6EFB, who had more power and a special tracking aerial system. On this occasion we heard W0ORE well, but we could not get through to him because he was busy sending slow scan television (SSTV) pictures. Keith managed to receive the pictures using a special SSTV interface and his Sinclair ZX Spectrum computer.

Scout Camp

One weekend my scout group went camping so I took along the battery operated FT290R two metre VHF rig and a 2m beam which I borrowed from the radio club. Because of all the scout activities GU0BGP/P didn't manage to get on the air very much and I only contacted a few Channel Islands stations on FM.

At Guernsey Scout HQ there is a big camping site and lots of scouts come from England during the summer. One Saturday I borrowed an aerial and some equipment from Guernsey ARS and set up a demonstration station for the visitors. I got there early in the morning so that I could join the UK Scout Net which takes place at 9.00 am each Saturday on 3740kHz. One thing about the UK Scout Net is that there is hardly ever any really young scouts like me on it! Just a group of scout leaders who organise radio jamborees without actually getting very

Dick Taylor, GU8HT, is our club's most senior member and is 69 years older than me! In the background is our field day aerial which was supposed to have six elements.

many young scouts to pass the RAE. I think I have said enough now!

Later on in the day quite a few of the visiting scouts came along to the station to see what was going on. One scout leader from Windsor wanted his group to take part in Jamboree-On-The-Air, so arrangements were made for the necessary information to be sent to him. That day I managed to contact 140 stations, nearly all from England except for two Japanese stations on CW who were my first contacts with that country.

JOTA 1985

Because of the success of my trial run for visiting scouts, I got permission to set up a station for the October 1985 Jamboree-On-The-Air at Guernsey Scout HQ. There is no other licensed radio amateur in the Guernsey scout movement, so it was up to Patrol Leader Petit to organise things myself! I sent off for a special event callsign GB2GU, RSGB sent a pack of publicity material and posters, and I sent out letters inviting all the scouts in Guernsey to come along. Once again I borrowed equipment and aerials from Guernsey ARS and my dad helped me put up posters and information on the operating room walls.

On Jamboree day I once again checked into the UK Scout Net, but even on this day there were still no other teenage scouts operating! I cannot say that my GB2GU operation was a big success because although I contacted quite a few stations, only ten scouts from the whole of Guernsey came along to visit and none became particularly interested in amateur radio.

How To Get Started

If you have ready this far you will see that there is quite a lot that must be done before you can get a licence, but that once you are on the air, there are plenty of different activities to keep you busy. Here is my advice on what to do:

1. Send off for the Guide and Manual I mentioned and a leaflet published by the DTI called How To Become A Radio Amateur. There is in addition a new book, How To Pass The RAE which gives useful examples of question papers. Once you have these books, you will be able to decide for yourself if you can tackle the RAE. My advice is not to mess around, and certainly do not believe anyone who might tell you to serve a two year apprenticeship as a short wave listener! Just get started as soon as you can, before GCE or other exams get in the way.

2. Join your local radio club and get them to give you as much help as possible. If there are no club RAE classes and you are too young to enroll in classes at a college of adult education, you will find it pretty difficult to learn by self-tuition, so it would be best to fix up tuition with an individual local radio amateur.

3. I think that it is a good idea to learn morse because it is easier when you are young. In addition, when you are talking to people using morse, they won't realise that there is a big age gap unless you happen to tell them!

Finally

I hope that readers of *Ham Radio Today* can show this article to people of my age so that they can get on the air. Then I won't always have to be talking to radio amateurs who are so much older than me!

Rubbish Tips

The CM1, MD108, SBL1 series of double balanced ring mixers provide a simple and efficient heart for the popular homebrewed direct conversion type of receiver, but there have been several reported cases of construction errors — fatal to the mixer which are not cheap items! Having been fortunate enough to acquire a CM1 at a junk sale price, it was quickly wired into a prototype receiver circuit and double checked in view of the foregoing. The unit was not surprisingly faulty and this proved to be an open circuit winding on the input of the device. As you can see from Figs. 1 and 2, input and output connections are made via transformers wound on ferrite beads. This would be easy to correct, I thought, but for the fact that the mixer is enclosed in a sealed can.

After careful consideration, it was realised that the legal fees to sue the vendor, the club, or both would probably exceed the original 10p outlay. So with little to lose, it was decided to apply considerably more heat to the seal and prise off the screening can. The coils consisted of two turns of about 40 swg trifilar wound on ferrite beads as shown in Fig. 1. Examination with a magnifying glass revealed a break in the winding inside the bead which was obviously non repairable, so

Peter MacKrell, G3AEP, has been prising open some double balanced ring mixers and discovering that they can be rejuvenated. So don't discard your mixer!

three short lengths of enamelled copper wire were twisted together at about ten turns per inch and the complete winding replaced. The ends of the trifilar twist were identified with the aid of a test meter, the primary, in this case being connected to pins 1 and 2 and the other two wires being joined from points on the diode bridge to pins 3 and 4 respectively, as shown in Fig. 2.

Flushed with success, the opportunity was taken to make a closer inspection of the construction with the assistance of the magnifier — a decided asset — and it became apparent that the previous owner had either received a *very strong* signal indeed, or had attempted to charge his car battery via the diode bridge chip! At this stage it was decided to double the original investment by fitting a bridge of four 1N4148 diodes (at around 2½p each) in place of the burned out bridge because of their small physical size and the chance of obtaining a better matched set with the silicon variety. These mixers are fairly costly components but with a little patience, they can easily be restored to health — resulting in my case with no noticeable difference in performance between the re-build and an original in current use.

Fig. 1 The pin out and circuit details of a CM1.

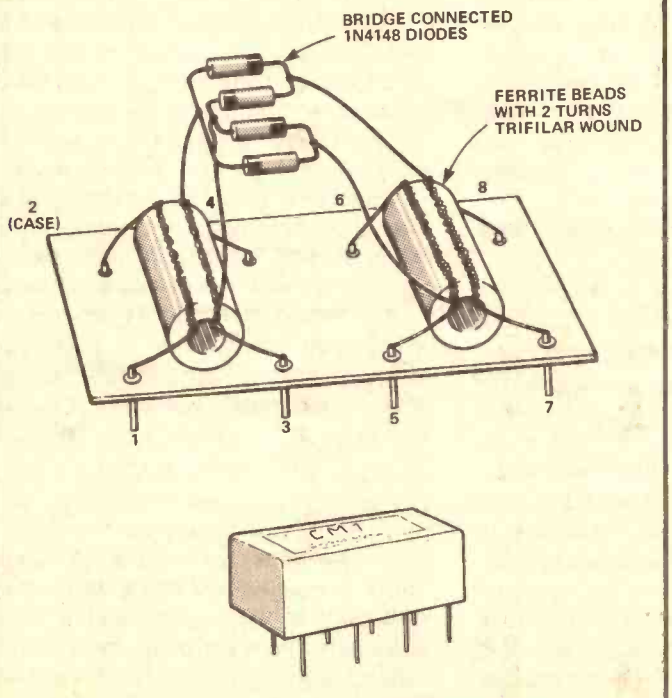
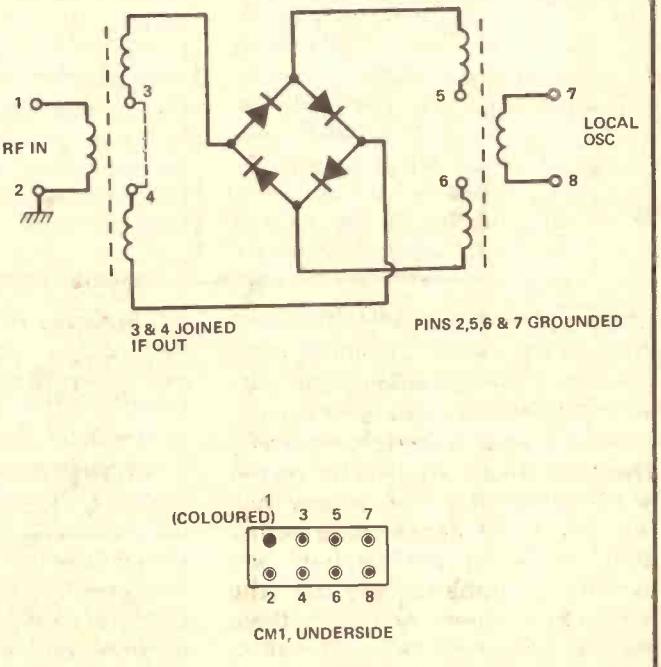


Fig. 2 How to revive the diode bridge chip with some 1N4148s.



Junk Circuits

Transistor Tester

How about a handy little transistor tester that could be made from almost anyone's junk box? Design from C R Neale.

This project is very simple and the circuit used must be about the most well tried one going — the multivibrator. So this is by no means an original design in its basic form!

I have been using this gadget for years and it has paid for itself over and over again. It is a quick tester for bipolar transistors (not FETs or unijunctions). Although most constructional projects these days centre around chips, I still think there is room for a simple project like this. It is extremely useful for checking all those surplus second-hand transistors on TV boards, etc. I also use it for checking the latest transistor buy before coming out of the shop.

I priced up a similar sort of thing in the Tandy catalogue and found that it costs £9.95 and has an LED indicating method. My unit doesn't cost anything (I built it from the junk box and used the case and speaker from a defunct tranny radio) and gives an audio indication, which I prefer.

Basically the circuit consists of two separate switchable halves of a multivibrator circuit; one is PNP and the other is NPN. The transistor under test forms the other arm of the multivibrator circuit, and there is a switch to change the polarity of the circuit to accommodate PNP or NPN transistors being tested.

The transistors used in the circuit are not at all critical, and virtually any small signal, medium to high gain devices will do, provided they work and are of the correct polarity. I think that one would be hard-pressed not to succeed first time with this circuit! The only complicated bit is the switching arrangement.

Using The Unit

As long as a quick press of the 'test' button is used, no harm should come to a transistor under test if it is connected wrongly or in the wrong polarity. So if a transistor doesn't appear to be working, take your finger off the button quickly, and check that you've got it connected properly. The tester has worked well with the transistor under test still in situ in another circuit (with the power turned off!). But beware — it may indicate a transistor as being 'bad' when in fact it is 'good' (it just depends what else is in circuit), so after you've removed a suspect transistor, check it again. Also, the circuit is unlikely to produce accurate results on power transistors, due to their usually low gains.

PARTS LIST

R1	2k2
R2,3	27k
R4	100R
C1,2	47n
Q1	NPN transistor (eg 2N2926, BC109, etc)
Q2	PNP transistor (eg OC71, BC212, etc)
LS1	3 to 16 ohm (not critical) small speaker
SW1	2-way 4-pole wafer or slider switch (check that contacts break *before* make)
SW2	Single pole push-to-make
B1	9V (PP3) battery

Croc clips (to connect to test transistor), Veroboard or tag strip, case as required.

NOTE: none of the resistor or capacitor values are critical — you could try values down to half or up to twice those given.

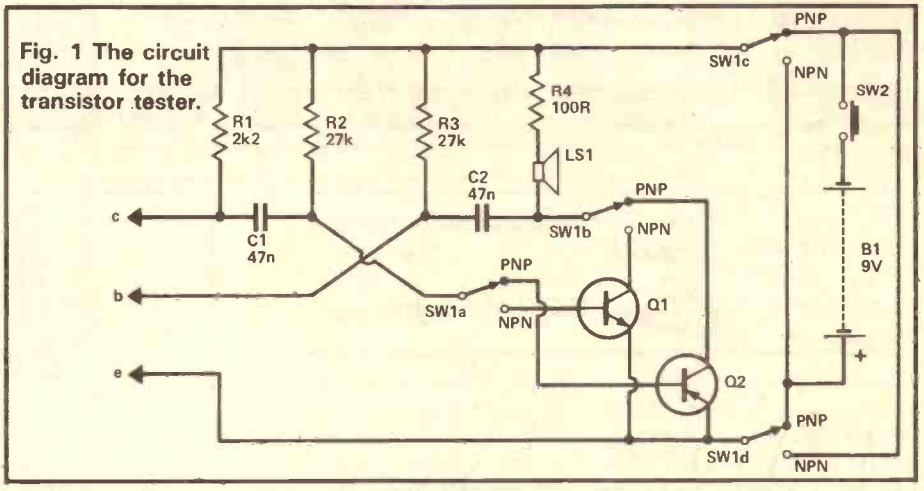


Fig. 1 The circuit diagram for the transistor tester.

Transmission Timer

Have you ever timed out on a repeater? Do you use a mobile mic with separate Tx switch? Then this simple circuit designed by Chris Lorek, G4HCL, is for you.

When discussing an interesting subject, it can sometimes slip your mind that two minutes is all you get without a break on certain repeaters. There are always stations timing out on repeaters, which can be very frustrating — and occasionally rather amusing — for the listeners and extremely embarrassing for the person concerned. And then, there are the stations running a mobile microphone who have left the Tx switch keyed without realising it . . .

Several designs for timeout indicators have been published, but these all require you to remember to switch them on. The better versions make a loud noise rather than just lighting a dim LED. In practise though, they don't tend to get used.

The beauty of this design is that it limits your transmission to just under two minutes then your rig stops transmitting and you hear a pip from the repeater, just as it was about to cut you off! By releasing the PTT for a fraction of a second, you can carry on nattering. The timer might, of course, cut you off in mid word but it is better that you do it

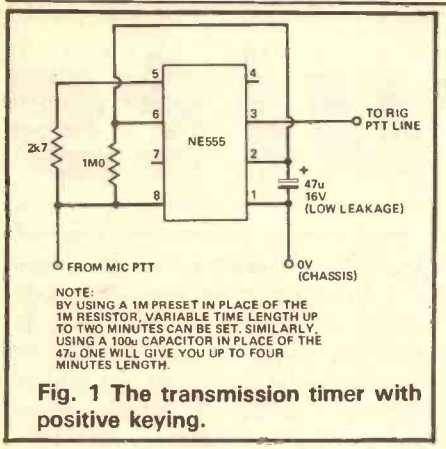


Fig. 1 The transmission timer with positive keying.

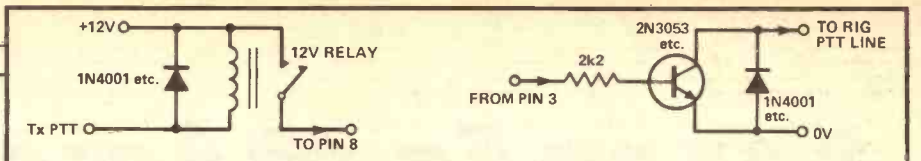


Fig. 2 Modifying the circuit for negative keying.

and know about it rather than the repeater doing exactly the same and annoying everyone — especially other amateurs waiting for your carrier to drop so they can get a call in.

Anyone who does run a mobile microphone system might like to fit this transmission timer — just in case. One manufacturer has had the sense to fit a five minute timer to their mic system as a standard design feature although the majority have not seemed to bother.

The circuit, shown in **Fig. 1**, fits in the transmit PTT line, and will operate from 5 volts upwards. The most common Tx key line is positive keying to 6V to 13.8V, although some older rigs and the occasional modern one use a ground contact to key Tx. Owners of these will have to add a relay, transistor switch, or whatever — an example of a suitable circuit is shown in **Fig. 2.**

The accuracy of the timing is almost entirely dependent upon the temperature stability of the capacitor and two resistors used. Over the typical mobile voltage range fluctuation of 10.8V to 15.6V and over the temperature range of −5° to 30°C, the stability of the chip itself gives less than three seconds drift in the timing of two minutes.

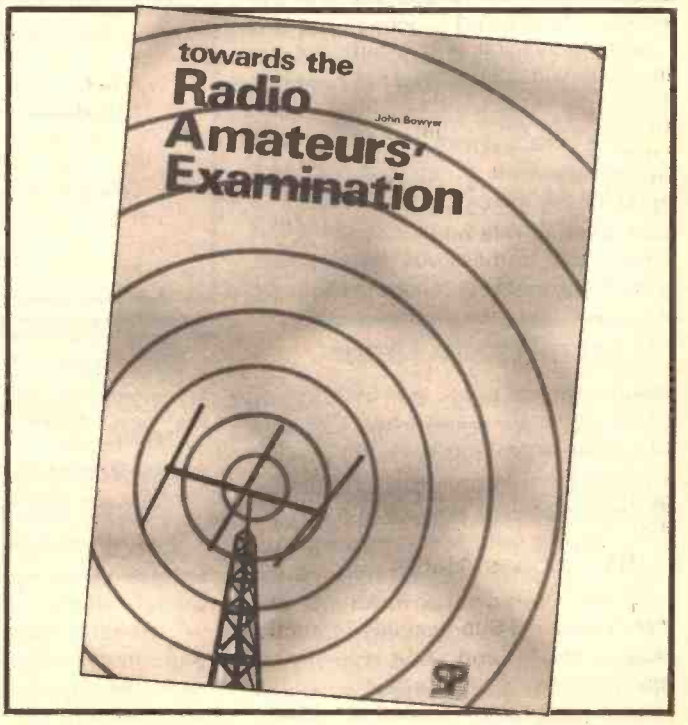
The values shown on the diagram will produce just less than two minutes and several have been built and tested. Changing the value of the 47uF capacitor and/or 1M resistor will give a coarse variation in timing, increasing either value giving an increase in period and vice versa. The 2k7 resistor increases the voltage switching level that is preset in the chip. This may be omitted totally if required, but the timing length is then considerably shorter. It was added so that a smaller (and cheaper) capacitor may be used. Varying the value of this resistor will give a finer variation in timing length.

Some amateurs may not like the idea of having a timer permanently in circuit when working simplex, hence it may be disabled if required by a switch or switching transistor straight across the capacitor, shorting it out when you want to disable the timer. This may be linked for instance to your rig's repeater shift switch — thus giving an open circuit condition when in repeater shift, a short circuit otherwise.

Remember, any modifications to your rig may invalidate the warranty. Alternatively, the author has his timer fitted in the microphone — not worrying too much about the mic warranty.

BOOKEND

Towards The Radio Amateurs' Examination
John Bowyer, G4KGS
Price £3.95
Stam Press Ltd, Raans Rd, Amersham,
Bucks HP6 6JJ



August 1985 saw the publication of yet another book whose title suggests that it will help you pass the RAE. If you are a prospective candidate I am sure that you would like to know more about it before parting with your hard-earned cash.

Towards the Radio Amateurs' Examination is published as a 70 page, A4 size paperback which was published "in response to many requests from students for a number of typical RAE problems and their worked solutions". The book is divided into three sections: the first gives a summary of the basic theory followed by questions on each topic, the second gives the answers to each question, while the third gives a summarised explanation of how the correct answer was arrived at.

The topics of the first section are arranged in the same order as the RSGB's Radio Amateurs' Examination Manual and you should be reasonably conversant with the theory contained there before approaching this book. Indeed the author states that the book will never replace other good textbooks. The pages of sections A and C are divided into two columns. At

the start of each new topic there is an outline of the necessary theory printed in red. For candidates with some prior knowledge, eg those completing an RAE course and about to take the exam in about a month's time, this book seems to give just the right sort of theory for last minute revision.

Guess The Right Answer

The theory of each topic is followed by multiple choice questions of the type set by the City and Guilds Institute. Remember, the ones given as 'sample papers' at the back of the RAE Manual are worded far too simply when compared to those that you will meet in the exam room. This book provides questions that are almost typical of the actual ones, since they are as devious as those set by the CGI.

A foreword, written by a City and Guilds examiner, suggests that not all the items conform to the strict house style of the Institute, but I think John Bowyer has hit surprisingly near the mark. The foreword also reminds you that although actual past papers are not available you can buy a sample of the questions for £1.35 when buying the syllabus booklet which costs £1.50. This is one study aid which is vital, although on a brief run-through we found at least six errors in the answers supplied.

A revision paper is included in the book to consolidate the first 11 topics of electrical theory. Knowing that this book was written with the 'new' syllabus (from May 1986) in mind, this emphasis may seem a little odd — the new syllabus has less on electrical theory than it used to have. But the author's comment that a good understanding is essential for later topics validates this emphasis to my mind. It will also help the amateur who wishes to take a serious interest in homebrewing their own equipment.

Bare Bones Maths

The topic entitled "Multiples and Sub-multiples, Abbreviations and Indices" gives a 'bare bones' explanation of the maths needed to use the various units used in the calculations. The statement that "the index indicates the number of places that the decimal point must be moved" may be all right if you are learning about indices from scratch; but schools now teach that you should move the numbers (in the opposite direction) while keeping the decimal point fixed. His last sentence is most valuable: "multiplication — add indices; division — subtract indicies (for a common base) although I couldn't help but wonder how many non-mathematical people would appreciate what a "common base" means. This may seem pedantic but there are precious few faults to pounce on!

The units are all metric and with powers of ten used as appropriate. For example, the speed of light, c, is given as 3×10^8 m/s. This follows the Institute exactly as do the symbols used in the circuit diagrams. Studying from older textbooks may cause some confusion with the differing circuit symbols.

The section B supplies the answers to each question in the book without any clue as to how it was arrived at. The intention of this is, apparently, for the students to attempt the questions again although if you haven't got a clue, you are rather stuck. However, the third section contains a worked solution or explanation of each question. This is again no substitute for reading the relevant theory as the answers given are necessarily short and are not always self-explanatory — some make logical leaps that may be hard to follow. Most of the explanations *are* excellent and give you enough information that you could find the relevant section in a textbook to cover any uncertainties.

No Errers Here!

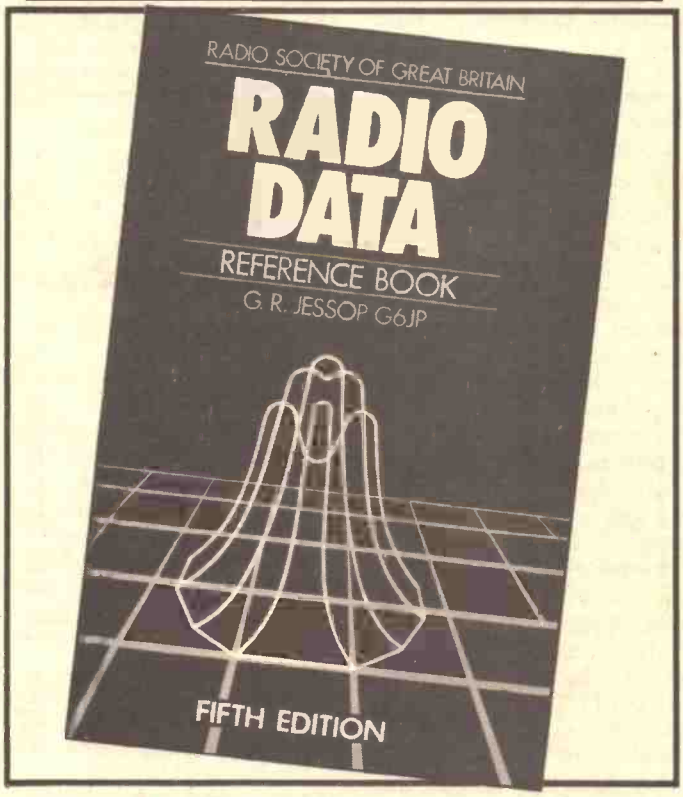
One problem even the RAE is fraught with is that of errors. There is only one major printing error (Measurement question 12) where an '0' is missing. 2000 /V is obviously meant to be used to get the answer given in the second section of the book. However it is odd that in the third section the explanation is given as "200×20=40000" with the error recurring.

My husband Pete, G8DCZ, as a teacher of the RAE was delighted with this book. Any instructor knows the problem of needing lots of questions for practice before entering an exam. Many of Pete's students sitting the December 1985 exam, immediately bought copies for themselves which gave the candidates a lot of confidence by the sheer amount of practice at realistic questions.

I can recommend this as an excellent book to test yourself on before taking the RAE. The universal comment seems to be that it is an encouraging book and is extremely valuable when preparing for the exam. I would not hesitate to recommend it to all prospective candidates — it is worth every penny! (Course organisers please note: some of our candidates managed to place a bulk order with the publisher and obtained a discount!)

Sharon Metcalfe, G6LCC

Radio Data Reference Book
G R Jessop, G6JP
Price to members £7.76, non-members £9.13
RSGB Publications (Sales), Lambda House, Cranbourne Rd, Potters Bar, Herts EN6 3JW



This reference work was first published in 1962, and had been revised several times since then. One of the most recent revisions has been to remove references to the old VHF TV transmissions which ceased in January 1985.

The content of the book is such that it will be useful to almost everyone designing high frequency analogue circuits and possibly those professionals who habitually use ECL (Emitter Coupled Logic). There are some sections which will probably only interest the radio amateur, rather than the professional, such as the amateur frequency allocation data. Equally, there is a certain amount of information, such as Planck's constant, which the amateur constructor will not find necessary.

Rapid Access Information

The majority of the information in the book is presented in the form of graphs and tables, and is fairly easy to use: if you need information on frequency allocations, physical constants, formulae, etc, then you are likely to be able to find it rapidly. However,

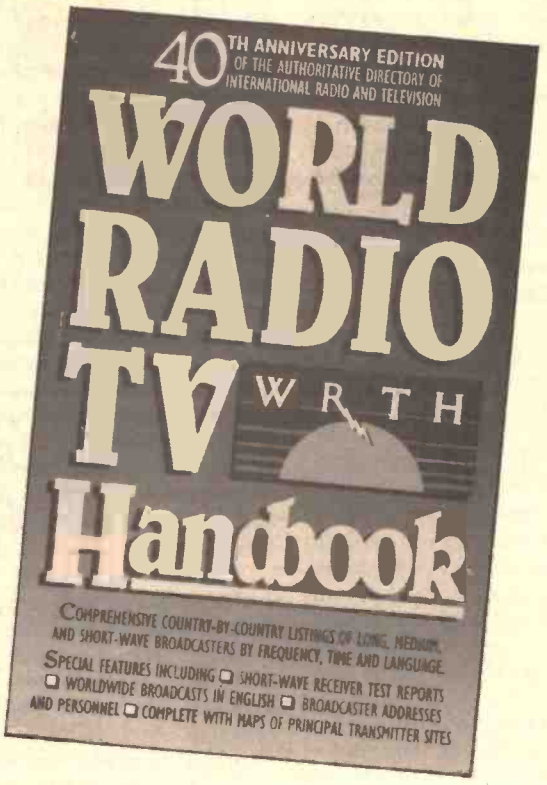
if there is a substantial gap in your knowledge of a certain area of radio theory then this book is not intended to remedy it. That being said, the author goes into sufficient technical detail in the sections covering aspects of design that those who have forgotten the *precise details* of a subject will find these a useful memory jogger.

The sheer range of data in such a small book is impressive. Under "Units And Symbols," for example, we find the usual units, conversions and physical constants, as well as information on the Pro Electron semi-conductor type-numbering system, and even on the Japanese semi-conductor numbering system. This last is no doubt useful when you consider the origin of most amateur equipment nowadays.

There is what appears to be a labelling mistake in the chart showing the characteristic impedance of PCB tracks. It seems that the labels on the 75R and 35R curves are exchanged — the impedance decreases as the track width increases, not vice-versa.

This book would be useful to any radio amateur or SWL who constructs or repairs his or her own equipment, whether aerials, linear amplifiers, or power supplies. It would also be useful to many professionals in the field of electronics; in fact, I cannot think of many professionals in the field of electronics to whom it would *not* be useful.

Andrew Armstrong, G3YZW



World Radio and TV Handbook
Editor in Chief JM Frost
Price £17.95
Published by Billboard Publications Inc., New York
Distributed in UK by Pitman Publishing Ltd.

Are you a keen listener or viewer, not just a DXer but someone who is always tuning around the broadcasting bands and catching glimpses of foreign programmes. If you are and you're never quite sure what station or country you are tuned to, the new edition of the World Radio TV Handbook could be a very useful asset to your station.

It contains 607 pages of very useful up-to-date information. I stress it is up to date because all too often you obtain lists of stations and other data only to find that they are hopelessly ancient and quite useless. An example of its accuracy and up-to-dateness appears on pages 139/140. It gives details on the new community radio stations that are about to be licensed by the government in the UK on an experimental basis. It even tells us their locations!

However, going back to the contents of the book. There are eight sections under the following headings.

1. User's Guide to the WRTH
2. World Radio
3. World Television
4. World Maps
5. Reference Section
6. Frequency Lists
7. Organisations
8. Information about the WRTH.

The first section is truly international with the guide being written in English, French, German and Spanish — the four most commonly used broadcasting languages. This section is an excellent insight to the contents of the book and as its name suggests a 'guide' to finding your way around.

Section Two contains information on all transmitters from each country and includes details of LW, MW, VHF and shortwave stations, their frequencies, power outputs and times of operation. I found the sections on Ireland and United Kingdom very interesting. This section is split into European, African, Near and Middle East, Asia, Pacific North, Central and South America sections.

Section Three on world television includes details of all transmitters, power outputs, frequencies used, transmission systems and times of operation. In addition, the addresses of the controlling authorities are listed, such as the IBA. Section Four, dealing with world maps, shows the locations of main HF and shortwave transmitters and how the different time zones operate. The reference section (5) contains details of the most suitable frequency bands to use for propagation paths and broadcast reception conditions. It illustrates the world time in all countries along with solar activity predictions and a country by country receiver count.

The frequency listings are in Section Six and these are split into long and medium waves and shortwave bands. Alongside the frequencies are the different transmitters operating on that channel. Section Seven deals with the various organisations that contribute to broadcasting in general such as religious, intergovernmental and international organisations. Also included is a very useful part of the keen DXer, a complete schedule of clubs for DXers and international listeners. Finally, Section Eight is more information on the WRTH from an editorial and advertising point of view.

Other good bits that deserve a mention are those that deal with broadcasts in English, programmes for DXers and shortwave listeners and the last chapter, called 'Is there still life at 40?'. The broadcasts in English lists all programmes transmitted in the English language giving the countries of origin, the times and frequencies used and also the target area for the transmissions. Programmes for DXers gives a country by country breakdown of all the DX programmes. It includes the times, frequencies and languages used. The last chapter that I would like to mention entitled 'Is there still life at 40?' (and the answer is yes!) is a 40th anniversary supplement of the handbook and it deals with . . .well I've told you the contents of a very excellent publication, perhaps you should buy a copy and find out the final chapter for yourselves?

In summary, this book is an oracle, written by experts, that is good enough to be used by the top broadcasting organisations it mentions. It provides in a single volume all you will probably want to know and more besides. Although an annual publication, it will really only begin to need updating after four years — more if you're a regular listener. A very good book, if you can afford to buy it.

Mick Senior, G4EFO

Keep It To Yourself!

The car journey had been a quiet one so far, the children in the rear being quite well behaved for a change. Maybe it was the idea of all that sun and sand at their favourite holiday resort which had them up very early and had tired them out now. Anyway with the wife dozing, it gave me time to find those distant repeaters that I had heard about. Turning the rig on and tuning around the band soon found the local one and in no time, I was having a pleasant QSO with the locals and fellow travellers. How time flies when you are kept occupied! It only seemed like minutes before the repeater faded out and it was time to find another one. Before long, with now wide awake children, we arrived at the resort. A very happy holiday was had by one and all, and we returned bronzed and healthy ready to face life yet again.

Walking through the front door, the mountain of mail and circulars greeted me, and whilst the kettle was put on for a refreshing cup of brew, the wife — nobly assisted by the children — carried the suitcases in and upstairs. The air was suddenly shattered by the screams from the wife, and rushing upstairs, the full force of her upset became apparent. The upstairs had been ransacked and as we flew from room to room, the stark horror of all the damage and mess was paralysing. Who could have done this? Who could have invaded our private domain in this manner? Opening the radio shack door, I could not believe my eyes. All the gear had gone, those transceivers that I had worked hard for and loved to play with, even the test gear. What was I to do?

After the police had departed, taking various statements and daubing the house with fingerprint powder, there remained the job of comforting an extremely distraught wife, finding alternate accommodation for the children with relatives, at the same time as fighting back the tears yourself. How could this happen? How did they know? After all, we had cancelled the milk and papers and had got the neighbours to keep an eye on the place — I had kept the fact that we were going on holiday reasonably quiet in the neighbourhood. Thank goodness the house was fully insured but a pity that all the gear was not. This will cost a fortune to replace.

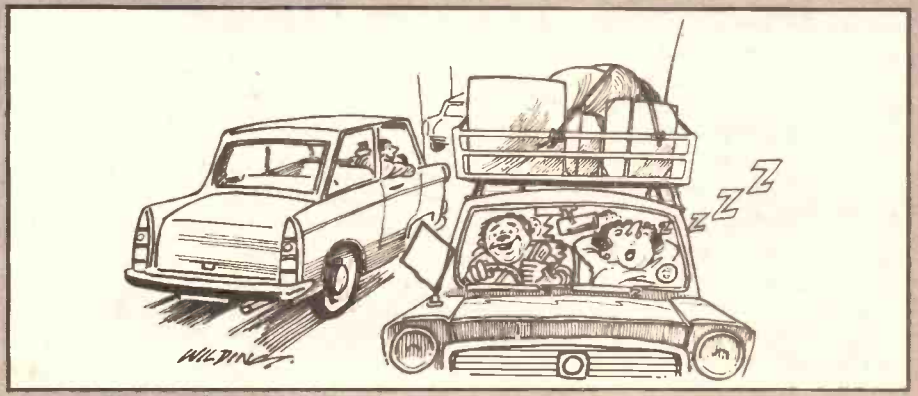
Just before the holiday season begins in earnest, a reminder of what not to say to your friends over the air.

I notified the local amateur radio traders and all the necessary insurance claims were forwarded. The house was put back in order and the local Crime Prevention Officer (CPO) was invited to inspect the premises. This was like shutting the stable door after the horse had bolted, but better safe than second time sorry. The Crime Prevention Officer was rather thorough about this inspection, and he soon discovered many things which needed attention.

Over a cup of tea we discussed the crime. The officer had noticed that I was a radio amateur and questioned me more deeply over my recent contacts — whether I had mentioned the holiday over the air. After much thought, I admitted that I may have done, but couldn't remember. He then asked whether I had used the rig on holiday and I told him how I had used the rig whilst travelling there. He then noticed that I, along with all other amateurs, had a unique callsign and asked whether anybody had access to a list with all the names and/or addresses of these callsigns. I went upstairs and fetched the current callsign book which hadn't been stolen.

The officer blanched when he was told that the book was readily available from various sources including local bookshops. Part of the crime was solved there and then. I had used my callsign as per the regulations on holiday and had broadcast to anybody that was listening my exact location. It was obvious to anyone that if I was at a holiday resort with the family, then almost certainly my house was empty. A quick look in the Callbook gave all my particulars.

On his recommendation, I decided to have my name removed from the Callbook and my first job was to write to the RSGB stating all the relevant facts complete with the CPO's recommendations. They replied very courteously that they would comply with my wishes and would leave my particulars out of the future editions of the Callbook. They also asked whether I had informed the Radio Amateur Licensing Unit at Chesterfield as my licence records would need altering. A similar letter was sent to the RALU, again giving the details of why I required such actions, and I received an acknowledgement that the records had been amended. This means that if anyone asks in future, I am now 'details withheld at Licensees request' as far as my name and address is concerned. If I move house, my new address will not be forwarded to the RSGB. This could cause problems with QSL cards, as most have the full particulars on them, but that problem can be



overcome depending on how far you wish to take your anonymity.

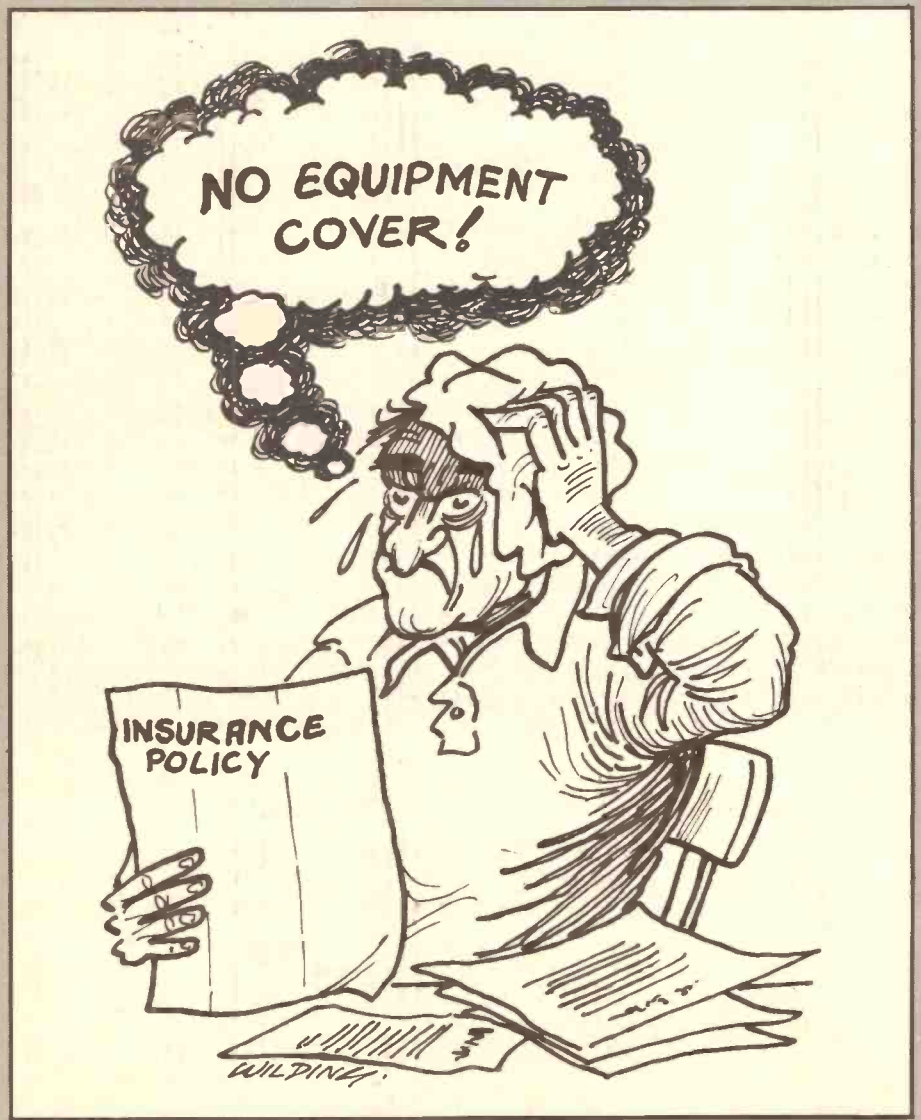
What Else Can You Do?

Insure all items for a start so that if the unthinkable happens again at least some, if not all, of the cost of the loss will be met. There are insurance companies that will cover your equipment and accessories. Some form of insurance cover is essential after all when you sit down and work out the current replacement cost of all your items in the shack, like I had to, the bill is shocking.

Without prejudice to any particular company, try the RSGB or Practical Wireless who operate as agents for large, well known insurance companies. They not only insure your transceivers but will also cover your gear when portable or mobile — as long as you obey certain requirements — your antenna and any other gear you own, complete with third party liabilities. However, it pays to read the small print with any insurance so that you know what you are covered for and when.

For the least cover, try your house contents insurance and have particular items added to the special risks part of the policy for an additional annual fee. Of course, this will not cover all items as would a full policy under a special scheme, but 'you pay your money, you takes your choice'.

You can also mark your gear with a special invisible pen with your postcode and house number. If the gear is stolen and recovered, the Police, as part of their investigations, will sweep the items with an ultra violet lamp and your special marks would stand out like a beacon. It would also be a good idea to mark all portable items in the house, including your video recorder and TV set. This pen is readily available in the High Street shops at a very modest price. You could also take photographs of all special items and keep them in a safe place to assist future Police enquiries complete with a written detailed description. Obviously, all this has to be done beforehand and now would be a good time to start.



What Not To Say

Always be prudent in your remarks if you are going away, as there are always people who could quite unintentionally give the game away, and the information can get into the wrong hands. Remember, for every QSO there are many listeners no matter what the band or mode. Amateur radio enthusiasts are almost without exception decent citizens but with everything in life, there could be a bad apple in the barrel.

It really amazes enthusiasts in the Midlands of the naivety of travellers on our vast motorway network, using the welter of repeaters around, giving away all their secrets, destinations and duration. Folk from the countryside seem to be the worst but even town people are no better and they should know different. Holiday Saturdays in summer are the worst, with all the repeaters full of happy, and gullible amateurs.

Walk down a line of parked cars and note how many motorists insist on leaving valuable goods on display. This equally applies to our hobby, for there are many instances where rigs are left in view by the unsuspecting. Don't think that a locked door will deter, since a favourite trick these days is to literally smash a side window with whatever comes to hand. The obvious answer is to hide it all from view, but how many really do? I would suggest that this also applies to rallies as well as normal life. Out of sight, out of mind, as they say.

So now is the time to act, a telephone call to your local Crime Prevention Officer could save a load of heartache later. The service is free and so is the advice. Why not take it? Obtain some quotations from insurance societies and get their protection. Or will you remain as I did and regret everything when its too damn late!

Finally, keep all of your personal secrets to yourself, you don't know who is listening!

Technology Roundup

There is a revolution going on in component manufacture. Called surface mount, it will change the face of PCBs. Ian Poole, G3YWX, describes what it is and what the future holds in store.

Surface mount technology (SMT) is fast arriving on the amateur radio scene. Over 60% of all new radio and electronics production in Japan has changed to surface mounting techniques and the USA and Europe will no doubt soon follow. What's more, it is the biggest revolution in constructional techniques since the introduction of printed circuit boards and will be more far-reaching in its effects.

What is Surface Mount Technology?

Although some surface mount components have been in use for some time, both in microwave and thick film application, it is only recently that new production techniques have made it viable to consider surface mount technology for economic reasons in mass production. Essentially, surface mounting entails using a printed circuit board which has pads on the top and the components are fixed to these, instead of their leads being passed through the holes in the PCB. Accordingly, the components do not have wire leads in the normal way but components such as resistors, capacitors and so forth are instead manufactured in the form of a chip — hence the name 'chip caps' and 'chip resistors'.

These chip components have a connection at either end, as shown in **Fig. 1**, so that they can be positioned onto the tracks on the board and then soldered, ie they are mounted on the surface of the board, hence the name. In addition to capacitors, resistors and various other chip components, special 'flat pack' type integrated circuits are also manufactured. Although these IC's still have leads coming out of their package, they are specially designed for surface mounting, with the leads at a 0.05 inch spacing, instead of the 0.1 inch spacing used on the standard DIL packages.

Despite the fact that surface mount technology is fairly new, there is a surprisingly large range of components available. Resistors, capacitors, small inductors and a wide range of ICs are currently used in mass production.

Some surface mounting inductors — perhaps suitable for an amateur radio project?

The Advantages of Surface Mounting

The main reason for the change to surface mount components is cost. The use of these components saves a great amount of board space, for example, a typical ⅛th

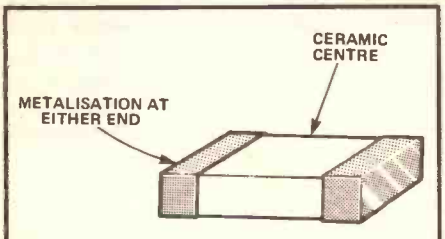


Fig. 1 A typical chip capacitor package. The resistors are similar but often have metalisation at either end which extends only a small distance down the length of the resistor.

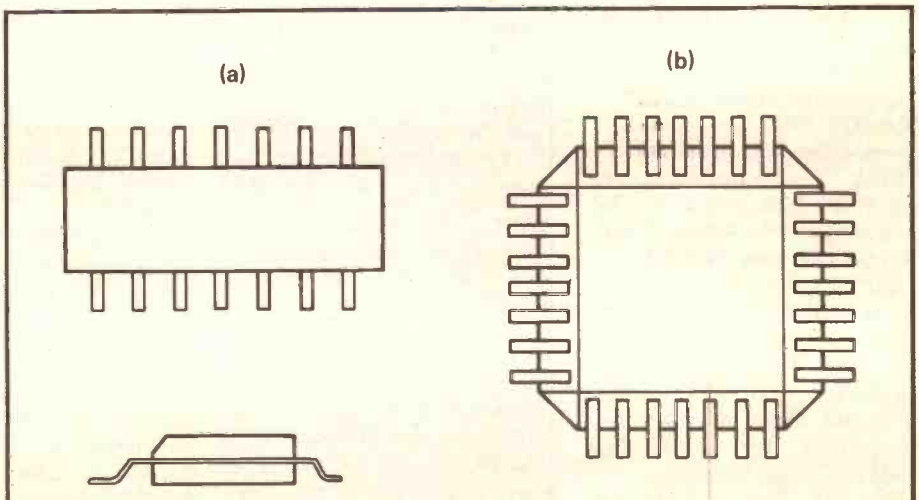
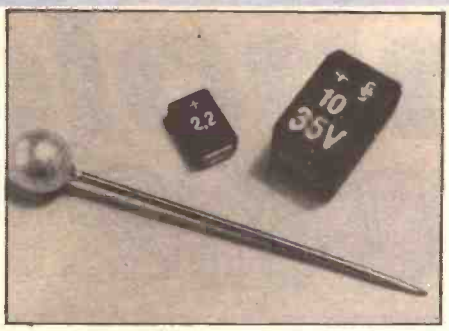


Fig. 2 Some typical IC packages for surface mounting.

watt resistor suitable for most small signal applications measures about 0.5×2×3 mm and many chip capacitors about the same. ICs also take up less space and so the finished unit will not only be smaller but requires a smaller case, which in turn costs less. However the main saving in cost comes about because these components lend themselves admirably to the use of various forms of automated assembly. Machines can be used to pick up the components from hoppers, or off bandoliers, and can place them straight onto the circuit board — with no requirement for preformed leads and no difficulties in getting wires or pins through holes in the boards.

One further advantage which is of great interest and importance to radio amateurs is the RF performance of these components. Owing to the fact that they are small and have no leads, their inherent inductance is much lower than that of the more conventional components and therefore they can be used to advantage at UHF. However, for higher frequencies or where exceptionally



These Siemens tantalum capacitors have (unusually) their values on the body of the component.

good performance is required, special microwave chip components are available — but at a price!

Outlook for the Future

It is obvious that the use of surface mount technology is rapidly increasing and it will be here to stay for some time. The first and probably most important question is that of serviceability of equipment using surface mount components. There is normally little difficulty in removing the SMT components from a PCB because once the solder at either end of the component has been melted, they can normally just be lifted off without the usual battle to remove wires from holes in the board. *However some manufacturers of equipment which use surface mount components, glue them to the board so that they remain in place during soldering.* Even if this is done, many of the adhesives are designed not to adhere after they have been heated during the soldering process.

The main problems are likely to be associated with identifying components on the board in the first place. Very few components have their values marked on them and unless every component is identified on the PCB itself, servicing is likely to be more difficult.

One Final Note

A plea to the manufacturers — as surface mount technology is here to stay and it will make boards and equipment smaller — please don't make the controls on equipment any smaller because they are difficult enough to use even now!

Free Readers' ADS!

FOR SALE

FOR SALE. Two matched pairs of 6JS6C PA valves for Yaesu FT101 series transceiver, brand new £10 per matched pair. Southend 525569, G4ENW QTHR.

FOR SALE. Ham International Jumbo multimode 26.965 to 28.305 £150. Leson DT251 base mike £20. Realistic DX 100L communications receiver £20. All VGC. Mr Hawkings, 4 Albert Road, Cinderford, Glos. Wanted, Colt 1200 DX manual.

FOR SALE. Yaesu FV101B external VFO, mint, £50. Pye W15FM 6ch Westminster, 50MHz, mint, £55. Pye FM10B 6ch Cambridge, extralled 2m, £30. Pye AM25T 1ch Vanguard, 2m FM, £15. Pye PF1 Rx £5. Codar T28 £5. Tel Mark, 021 747 4570.

FOR SALE. Yaesu FLZ100Z linear £425. Capco SPC300 ATU used once £160. Daiwa CN620A 1KW SWR meter £65. Trio TS8305 + matching speaker £650. Kenpro KR400 rotator £70. 2 ele Western quad £100. 35' Aitron tiltover magt £80. 50mtr reel heavy duty coax £20. Daiwa DL600 dummy load new £30. Emigration forces sale of above. Contact G0ABY not QTHR (0642 580536), Stockton on Tees.

RACAL RA117 receiver + Racal RA121 SSB adapt + **RA137 LF** convter all in cabinets, leads + manuals + 15" speaker £315 or exchange AR20021 scanner or similar or Icom R70. Also Sony TC645 3-motor 3-head r/reel, orig packing £150. Basingstoke 882/825.

FOR SALE. Racal RA17-W general coverage receiver + 2 spare sets of valves + manual + fittings £120. Telephone (0543) 373384 (Brownhills).

MUTEK GDIF 107UR 10GHz Gunn diode board £45. Solfan 10GHz head unit £15. Icom SP3 extension speaker £45. HM7 microphone (new) £15. Rank Xerox 400 telecopier £20. Phone Paul, G4XHF, (0293) 515201.

FOR SALE. Trio JR310 communications receiver including service manual £70 ono. Or swap for Cobra 148GTL or similar. Tel 0623 (Mansfield) 552639.

TRIO TS530S transceiver complete boxed with extras including Trio workshop manual £500. Weltz SP-200 power meter £60. Weltz CT150 dummy load £30. Spacemark squeeze keyer ETM-3C £45. All equipment as new. Very little use. G4AQZ, Clacton-on-Sea 435700 evenings.

FT101ZD mark III with FM FB condition cash "offers" over £375. 01-987 2296, G4WIE QTHR.

CENTURY-21 communications Rx 0.5-30MHz (Lowe SX30 with different badge), perfect £115. Sony Betamax recorder SL8080 (piano key model) fully working, good heads, ideal shack machine £75. Telephone 0763 44038, Alec, G8YCI.

CIRKIT DFM plus prescaler kits unopened cost £75 accept £50. Sinclair 16K ZX81 £15. Computer compatible cassette player unopened £10. Adapter kit allows Yaesu YO100 monitorscope to be used with receiver IFS of 9MHz. Phone St Albans 39333.

FT790R 70cm multimode with nicads, case and strap, £250 ono. Mike, tel Saffron Walden 27155.

OSCILLOSCOPE Tektronix model 2215 60MHz dual trace, probes and manual, as new, £750 ono. Tel 01-949 2317.

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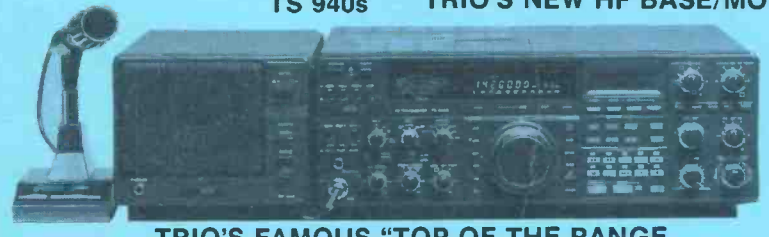

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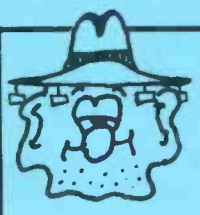

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