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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.
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, SP6 and SP10 external speakers, HS15 flexible mobile microphone and PTT switchbox.

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.
The IC-R7000 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 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 keyboard. 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.

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.

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.

These receivers are available separately 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.

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 HC/25/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 rammers 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 preferring 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

6 please mention HRT when replying to advertisements. 73 G4NXV

HAM RADIO TODAY AUGUST 1986
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, G8ORM

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

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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 even 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 appointing 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 within 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 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 N1 2BR.

The latest issue of Probe, The Midland ARS journal, is devoted to the imminent departure of their S Pacific correspondents G4AAI 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 Samos 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.

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." 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".

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 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".

In Brief

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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 had written to a number of amateurs from 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 of any other looks for duty within 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 murmurs of discontent from within the bellowed 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 it is BTI’s prerogative to make any rules it wishes, but is it in the best interests of amateur radio? Surely it is in everyone’s interest to conduct contact on a fair and reasonable basis. To do otherwise is merely to prejudge the outcome at the expense of the amateur movement.

Come off it, BT! 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 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 keypad 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 136-174MHz 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 on the frequency range 2 to 20MHz and has reception from 300kHz 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 TK70IS and TK80IS. The 70IS covers the frequency range 141-147MHz 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.
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 in three sections that are: 1. A member of a club or society who is using his own call sign counts as 1 point; if he is using the club call sign, it counts as 2 points. A member of Wythall RC using the club call sign 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 to 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.

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, computers, 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 12th July, listen out for the callsign GWOEJP 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 Ramsey. The WAB square is SM62G. 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.

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 is available from JEP at New Road Complex, New Road, Kidderminster.
**B. BAMBER ELECTRONICS**

Pye Base Station Type F30AM
High Band & Low Band ........................................... £220

Pye Base Station Type F30FM
High Band & Low Band ........................................... £250

Pye Base Station Type F401 AM
High Band & Low Band ........................................... £300

Pye Reporter Type MF8AM
High Band & Low Band ........................................... £90

Pye Europa Type MF8FM High Band & Low Band ........ £90

Pye Olympic Type M201 AM High Band & Low Band .... £95

Pye Motofone Type MF5 AM High Band & Low Band ... £45

Pye Westminster Type W15AM
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The Yaesu FT29OR 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 FT29OR 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 FT29OR 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 FT29OR 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 FT29OR 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 FT29OR 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
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 ¼ 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 deemphasis 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 in 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 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
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.
**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 "0" 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.

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**PB-2236C VIEWED FROM COMPONENT SIDE**

PB2236-2236B VIEWED FROM COMPONENT SIDE

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**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.

---

**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.
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HAM RADIO TODAY AUGUST 1986
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 at 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 10Hz. 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) x 96mm (H) x 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 listen-

The block diagram.
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 of the DX chaser and ragchewer and the simple IF shift control available. 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.

The manuals suffer 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 SSF 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 ineffective 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 Icom SM10 mic tailored to my hand mic and my main station rig. Good quality from the TS440 was noted with no undue distortion or excessive 'colouring' being present.

The AM selectivity of the set which varied with set-tings of frequency, RIT, and so on. This probably comes from the display inverter, those with sensitive ears watch out!

**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 tell-tale '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

<table>
<thead>
<tr>
<th>Freq (MHz)</th>
<th>10kHz sep</th>
<th>20kHz sep</th>
<th>100kHz sep</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.9</td>
<td>76</td>
<td>87</td>
<td>107</td>
</tr>
<tr>
<td>3.6</td>
<td>73</td>
<td>84</td>
<td>103</td>
</tr>
<tr>
<td>7.05</td>
<td>82</td>
<td>93</td>
<td>109</td>
</tr>
<tr>
<td>10.1</td>
<td>75</td>
<td>86</td>
<td>105</td>
</tr>
<tr>
<td>14.2</td>
<td>76</td>
<td>87</td>
<td>105</td>
</tr>
<tr>
<td>18.1</td>
<td>75</td>
<td>86</td>
<td>106</td>
</tr>
<tr>
<td>21.2</td>
<td>77</td>
<td>88</td>
<td>108</td>
</tr>
<tr>
<td>24.5</td>
<td>76</td>
<td>88</td>
<td>109</td>
</tr>
<tr>
<td>29.0</td>
<td>76</td>
<td>89</td>
<td>108</td>
</tr>
</tbody>
</table>

S Meter Linearity

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

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

<table>
<thead>
<tr>
<th>Mode</th>
<th>Threshold</th>
<th>Full</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSB/CW/AFSK/AM</td>
<td>0.56</td>
<td>3.29</td>
</tr>
<tr>
<td>FM</td>
<td>0.11</td>
<td>0.28</td>
</tr>
</tbody>
</table>

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

To investigate internally generated spuri, 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 shown 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).
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 from a desk mic — and increasing the mic gain on the set substantially. 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 an aerial tuner. The third harmonic of 10m could cause problems to VHF broadcast reception and an aerial tuner. The third harmonic of 10m could cause problems to VHF broadcast reception and an aerial tuner. The third harmonic of 10m could cause problems to VHF broadcast reception and an aerial tuner.

Transmitter Harmonics

<table>
<thead>
<tr>
<th>Freq (MHz)</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>Higher Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.9</td>
<td>-51</td>
<td>-72</td>
<td>-70</td>
<td>-70</td>
<td>&lt; -70</td>
</tr>
<tr>
<td>3.6</td>
<td>-54</td>
<td>-65</td>
<td>-70</td>
<td>-68</td>
<td>&lt; -70</td>
</tr>
<tr>
<td>7.05</td>
<td>-49</td>
<td>-48</td>
<td>-70</td>
<td>-70</td>
<td>&lt; -70</td>
</tr>
<tr>
<td>10.1</td>
<td>-46</td>
<td>-54</td>
<td>-70</td>
<td>-70</td>
<td>&lt; -70</td>
</tr>
<tr>
<td>14.2</td>
<td>-46</td>
<td>-54</td>
<td>-70</td>
<td>-70</td>
<td>&lt; -70</td>
</tr>
<tr>
<td>18.1</td>
<td>-42</td>
<td>-58</td>
<td>-70</td>
<td>-70</td>
<td>&lt; -70</td>
</tr>
<tr>
<td>21.2</td>
<td>-43</td>
<td>-56</td>
<td>-70</td>
<td>-70</td>
<td>&lt; -70</td>
</tr>
<tr>
<td>24.9</td>
<td>-48</td>
<td>-70</td>
<td>-70</td>
<td>-70</td>
<td>&lt; -70</td>
</tr>
<tr>
<td>29.0</td>
<td>-45</td>
<td>-54</td>
<td>-70</td>
<td>-70</td>
<td>&lt; -70</td>
</tr>
</tbody>
</table>

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

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.

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HAM RADIO TODAY AUGUST 1986
25
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 2 1/2 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 1/2" and 3/8" 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.

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26
Table 1 The driven element lengths may vary slightly. For this reason, all the element lengths are easily adjustable by the user.

<table>
<thead>
<tr>
<th></th>
<th>2 element beam</th>
<th>3 element beam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain</td>
<td>4.5db</td>
<td>7.0db</td>
</tr>
<tr>
<td>E plane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>beamwidth +/-</td>
<td>45 deg</td>
<td>+/- 30 deg</td>
</tr>
<tr>
<td>Front to back</td>
<td>14 db</td>
<td>18 db</td>
</tr>
<tr>
<td>Reflector</td>
<td>10' 1&quot;</td>
<td>10' 0&quot;</td>
</tr>
<tr>
<td>Driven elmt.</td>
<td>9' 4&quot;</td>
<td>9' 4&quot;</td>
</tr>
<tr>
<td>Director</td>
<td></td>
<td>8' 10&quot;</td>
</tr>
<tr>
<td>Element spacing</td>
<td>42&quot;</td>
<td>42&quot;</td>
</tr>
<tr>
<td>Reflector to driven</td>
<td>42&quot;</td>
<td>42&quot;</td>
</tr>
</tbody>
</table>

The 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 ½" 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 ¾" 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).

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 tightly 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. 2. The driven element lengths for both the two and three element aerials are given in Table 1.

Using a 3" x ⅜" 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 ¾" 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
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 \( \frac{3}{16} \)" holes need to be drilled through the boom starting 3" from one end. Now take the three lengths of \( \frac{3}{4} \)" tube (shown in Table 1) and drill a \( \frac{3}{16} \)" hole in the centre of each piece. With just one of these lengths, measure 12" from the centre hole and drill an \( \frac{3}{16} \)" 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 \( \frac{3}{4} \)" elements on the main boom. Take the lengths of \( \frac{3}{8} \)" 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 \( \frac{3}{4} \)" brass or alloy rod. If brass is used, a nut, bolt and
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 $\frac{3}{16}$" of thread turning on and the other about $\frac{1}{4}$". 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" x 1" square boom
- 3 of ½" x 69" seamless alloy tube
- 6 of ¾" x 62" seamless alloy tube
- 3 of element support brackets
- plastic project box (2" x 3" x 5" approx)
- 5 - 45 pF variable capacitor
- 1 of 16" x 1/8" alloy rod
- 4 of 4 BA nuts
- solder tags
- small piece 16swg alloy (2" x 3")
- SO239 socket
- 6 jubilee clips
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 choose 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 29.595MHz (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 28.600 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,
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, 01 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 vertically with the anodes to the PCB and each pin 15, as in Fig. 3. Fit an insulated wire link from 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 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.

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2. Connect a DC voltmeter to TP2, the top bare lead of R126 which is 1cm forward of R124. Adjust L18 until you get a frequency readout of 17.9525MHz (18.1525MHz).

3. Connect the probe again though 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 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.

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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.

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!

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 ellipse 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 ellipse and the vertical one. With no modulation only one or other of the ellipses 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 ellipses, 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 ellipses can be quite broad. Broader ellipses 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.
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 x 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. 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...
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 preferred, 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 x 100 x 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. 9 The component overlay for the display driver PCB.

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

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 and 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

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

Inside the completed unit.

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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.

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<td><strong>POTENTIOMETERS</strong></td>
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<td>RV2,4 470k sub-min hor preset</td>
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<td>C3 100uF 10V radial elect</td>
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<td><strong>SEMICONDUCTORS</strong></td>
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<tr>
<td>IC1,2 LM3914N</td>
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<td>IC3 78L05</td>
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<tr>
<td>Q1 - Q9 BC559 or similar</td>
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<tr>
<td>D1 - D81 5mm red LEDs</td>
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<td>D82,83 1N4002</td>
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<td><strong>MISCELLANEOUS</strong></td>
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<tr>
<td>SW1 rotary mains switch</td>
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<td>SK1 stereo jack</td>
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<tr>
<td>T1 mains primary, 6V - 0V - 6V 100mA secondary</td>
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<td>FS1 20mm 160mA antisurge type</td>
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Instrument case about 150 x 100 x 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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<tr>
<td>Ward Electronics</td>
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<tr>
<td>Reg Ward &amp; Co. Ltd.</td>
<td>25</td>
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<tr>
<td>Ray Withers</td>
<td>IFC/17</td>
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</tbody>
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**HAM RADIO TODAY NEXT MONTH**

**MOBILE MIGHTY MINIS**
We review the Yaesu FT770RH, Trio TM2550 and Icom IC28E mobile VHF/UHF rigs.

**CONVERT PYE A600s TO 6m LINEAR AMPLIFIERS**

**SW BROADCAST RECEIVER FOR BEGINNERS TO BUILD**

**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.

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.

Frequency Independent Interference

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 transmitter, 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 choke 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 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, casse- sette 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 (3amp 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 enamal 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.

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 installaions) 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 foreseeable 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
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 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 28.4MHz which is likely to cause frequency dependent TVI will be the 16th — 29.4 x 16 = 470.4MHz. 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 TV 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 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 into 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.
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.

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

<table>
<thead>
<tr>
<th>1 July</th>
<th>3 July</th>
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<tbody>
<tr>
<td>Bourne ARS: meeting at the Village Hall, Edenham, Bourne, starting at 7.30 pm.</td>
<td>Barry College of FE RS: meets every Thursday at the College Annex, Weycock Cross, Barry.</td>
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<tr>
<td>Chichester DARC: annual summer social at Goodwood.</td>
<td>Bredhurst RTS: construction and natter night.</td>
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<tr>
<td>Warrington ARC: meets every Tuesday at the Grappenhall Community Centre, Bellhouse Lane. Tonight an open forum.</td>
<td>Horsham ARC: HF Aerials and Feed Systems.</td>
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<th>2 July</th>
<th>4 July</th>
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<tr>
<td>Fareham DARC: Weather Satellites by G8VOI.</td>
<td>Preston ARS: preparation for VHF NFD.</td>
</tr>
<tr>
<td>Fishguard DARS: meets every Wednesday at the Club Shack, Further Education Centre, Ropewalk, Fishguard.</td>
<td>Salop ARS: natter night.</td>
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<tr>
<td>SE Kent (YMCA) ARC: natter night.</td>
<td>Worksop ARS: visit to Newark RC.</td>
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<tr>
<td>Borders ARS: meeting.</td>
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</table>
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.
Morescambe 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.

5-7 July
Clifton ARS: meeting.

6 July
Coventry ARS: preparing for VHF NFD at Burton Dassett.

7 July
Loughton DARS: The Story of Laser 558.
N Bristol ARC: natter night.
S Manchester RC: meets every Friday, ring PRO for details.

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 ARC: 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.
Harpenden ARC: DF hunt.
SE Kent (YMCA) ARC: treasure hunt.
Stockport RS: slide show by G4FPW.
Stourbridge DARS: informal.
Stroud ARC: 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 ARC: fox hunt.
Southgate ARC: Homebrewing (Alcohol!) by G3DKZ.
Stirling ARC: meeting at the Argyle Centre, Princes Street, Stirling.

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

12-19 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.

14 July
Coulsdon ATS: Cellular Radio Update by G6UYT.
Felixstowe DARS: social.
Midland ARS: RRD by G4PZA.
Norwich DRS: treasure hunt at 7pm.

15 July
Biggin Hill ARC: computer night.
Bourne ARC: meeting.

16 July
Fareham DARC: junk sale.

17 July
Ayr ARG: summer natter night.
Borders ARC: meeting.
Bury RS: junk sale.

18 July
Ayr ARG: summer natter night.
Borders ARC: meeting.
Bury RS: junk sale.
Clifton ARC: meeting.

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Clifton ARC: meeting.

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

12-13 July
BAC 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, G6OM.

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

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Midland ARS: RRD by G4PZA.
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<tbody>
<tr>
<td>20 July</td>
<td>McMichael Mobile Rally at the Haymill Centre, Burnham, near Slough. Trade stands, flea market, demonstrations and much more besides.</td>
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<tr>
<td>25 July</td>
<td>RSGB 432MHz low power contest.</td>
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<td>26 July</td>
<td>RSGB 144MHz low power contest.</td>
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<tr>
<td>2 Aug</td>
<td>Workspop ARS: barbecue at Clumber Park.</td>
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<tr>
<td>3 Aug</td>
<td>Wolverhampton ARS: DF hunt.</td>
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<tr>
<td>4 Aug</td>
<td>Basingstoke ARC: natter night. Southdown ARS: meeting. Welwyn Hatfield ARC: Model Radio Controlled Aircraft by GOAII.</td>
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<td>Aberdeen ARS operating GB4BGG from Beechgrove Gardens open day.</td>
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<td>16 Aug</td>
<td>Welwyn Hatfield ARC: RTTY station and informal.</td>
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<tr>
<td>21 Aug</td>
<td>N Wakefield RC: The History of Amateur Radio by G3VTD.</td>
</tr>
<tr>
<td>22-26 Aug</td>
<td>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. Hareswood Steam Rally with special event station being operated by N Wakefield RC.</td>
</tr>
</tbody>
</table>
24-25 Aug Bassetlaw Show, Kitten, Workop, with GB2BTF special event station run by Workop 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 ARC: lecture.
Warrington ARC: Melbourne RC video.
Wolverhampton ARC: night on the air.
Workop ARS: DF hunt.
27 Aug Crawley ARC: club 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 DARC: Japanese Morse.
Greater Peterborough ARC: social.
Salop ARC: 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 B40XK.
Sheffield ARC: SSTV demonstration and discussion by 588WV.
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
Abergevenny & NH ARC GB4XQH 0873 4655
Aberport ARC GW/OPDR 0239877 274
Alyn and Isle of Anglesey ARC GW4NIK 0244 666006
Amateur Radio & CC Trevor 04856 81032
Atherstone ARC Roy 0203 393518
Axe Vale ARC Bob 029 74 5282
Ayr ARC GM3THI 01506 432533
Barking RES R. Woodberry 01 594 4009
Barry College RS John 085679 710
Basingstoke ARC Dave 07356 8185
Bath DARC GAUMN Frome 63358
Biggin Hill ARC GOAMP 089 678 5648
Borehamwood Elstree ARC Tony 01 207 3809
Birkenhead ARC G6CJA 0376 262458
Bredhurst RTS Kelvin Medway 376991
Brighton DARS Peter 0276 673773
Bristol ARC G4Y1C 0872 770590
Bristol (Shirehampton) ARC Ron Ford 0272 777095
BT (Reading) ARC G4MUT 0734 639766
Bury RS Allan 0204 706191
Cambridge DARC D. Wilcox 0215 312503
Cheshunt DARC G4VMR/G4VSL 092084 250
Chester DRS Dave 0244 336639
Chichester DARC G4VRY 0243 786667
Clifton ARS RA Hinton 01 301 1864
Conway Valley ARC G4VWV 0492 636376
Cowbridge DARC Ian 0647 433398
Coworth DARC Robin 0203 736201
Cumnor DARC Sec 0236 636368
Darent Valley ARC Dave 0208 266866
Dartford Heath RFC Pete 0322 844467
Dover DARC G3DDY 0464 600298
Devizes ARC G1AUA 0307 522777
Donegall ARC E388B 074 81755
Dorking DRS John 0306 77236
Droitwich ARC G4HLC 0238 332939
Dudley ARC John 0384 278300
Dunstable Downs RC Phillip Morris 0582 607623
East Kent ARC Stuart 0227 68913
East Lancashire ARC Stuart 0254 887285
Edgware DRS John Hatfield 64342
Exeter ARES Roger Tipper 0392 860608
Fareham DARC Alan 0328 286995
Farnborough DRS Mr Taylor 0252 837581
Felixstowe DARC G4QYQ 0473 642589
Fishguard DARS Bernard 0348 872671
Fylde DARC PRO 0253 737680
Galashiels ARC GM3D0AR 0896 560277
G. Peterborough ARC Frank 0733 28148
Halifax DARS D. Moss 0422 202006
Harpenden ARC GB1JBC 0582 72455
Harrow RS Tony 01 861 4019
Hastings ARC Dave Shirley 0424 420608
Haverhill ARC Rob Proctor 0767 281567
Haverigg ARC G0BSI 04024 41532
Horsene ARC Norman 0262 73635
Hordern ARC Pete Head 0403 64580
Inverness ARC Brian 0463 242483
Keighley Arc G1GHC 0274 496222
Kidderminster ARC Tony 0502 716584
Kingston DARSD300H 0308 220000
Ligan Valley ARS Jim 0846 682474
Leeds DARS G1EBS 0274 665535
Leighton Linsdale RC Pete Brazier 052 523 270
Lothians RS Robin 0506 890177
Loughborough ARC Philip 0809 412043
Maidenhed DARC John 0628 28463
Maidstone YMCA//SARS G4AYD 0622 28462
Mattby ARC Ian Abel 0799 814971
Medway ARS Tom 0834 759477
Midland ARC G0BHE 021388 0006
Mid Sussex ARC G1FRF 0791 629273
Mid Ulster ARC Sam 0762 226856
Mid Warwickshire ARS G4TIL Southam 4765
Milton Keynes DARS Dave 0908 501310
Morecambe Bay ARS GM3DAR 0754 265500
N. Cornwall RS G6MLI 0782 332657
N. Staffs ARS Steve 0535 363863
N. Wakefield RC G3VOW 0665 443048
Newbury DARC B4OSW 0968 376029
Oswestry ARC Brian 0691 380102
Plymouth ARC G4CA 0752 337980
Preston ARS Harold 0877 43101
Prestwich DARS Paul 0772 718175
Rhyd DARC GV1AKT Nantglyn 469
Salisbury RES Neil 0980 22908
Salop ARC Simon 0743 677599
Sheffield ARC Sheffield 518766
Sheffield DRS G4PSO Hitchin 579546
S. Bristol ARS Alan 0272 834282
S. Cheshire Chris 07816 73185
S. Lakeland ARC Dave 0229 54982
S. Manchester ARS Dave Holland 01 973 1837
S. Wales ARS G4WKR 0735 289856
S. E. Kent (YMCA) ARC John 0304 216363
Southdown ARS Henry 0732 763123
Southgate ARC G4YLL 0932 300531
Stockton DARS John Walker 0642 52578
Stourbridge DARS G3KGM 0743 827225
Stowmarket DARS M. Goodrum 0449 676288
St Helens DARC A. Riley 051 430 9227
Surrey ARC John 01 657 0484
Swaile ARS B. Hancock 0795 973147
Telford DARS Tom Crosbie 0982 595706
Three Counties ARC Keith, G0BST 0730 66489
Tiverton (SW) ARC Alastair 0392 858509
Towmorden DARS G1G2Z 070 68175722
V White Horse ARS Ian White Abingdon 31559
Verulam ARC Gerry St Albans 25003
WADCAR G3PAU 0759 873147
Wakefield DRS G4VRY 0532 820198
Warrington ARC Paul 0285 814005
Welland Valley ARS J. Day 0888 221095
Welwyn Harford ARC Dave 0703 28138
West Kent ARS B. Guinness 0892 32677
Westmoreland RS G. Chapman 0639 28491
White Rose ARS G4YKD 0423 884481
Willenhall ARS G4LWI 0902 782036
Wimbledon DARS G3DDW 01 540 2180
Winchester ARC Gordon 0703 772719
Wirral DARC Peter 051 677 7376
Wolverhampton ARS Keith 0902 24870
Worcester DARC D. Batchelor 0905 641733
Worlxon ARS G4UN 0745 646000
Dave Davis 01 399 5487

46 please mention HRT when replying to advertisements. 73 G4NXV

HAM RADIO TODAY AUGUST 1986
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 1/2 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...
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 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 G3CVH. 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
The 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 before! So I would have to wait until my 14th birthday and get a licence. I am glad to say my 14th birthday, thanks to yours truly, Geoff.

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 FT29OR 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 last my licence came through! I think that this was a conspiracy.

**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. I 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 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 GUOBGP, 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 GUOBGP = TKS FOR UR CALL = RST 599 599 QTH GUERNSEY GUERNSEY ES NAME GEOFF GEOFF = UA6ATS DE GUOBGP KL**

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 GU4WTP/P and GUOBGP/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 W3DZ 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
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 ICQ 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! I found that I had a lot of letters from people wanting to know about my experiences as a youth operator.

A demonstration at Guernsey Scout HQ, August 1985. A visiting scout from Windsor is listening to GU0BGP operating on 80m.
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 145.560MHz 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 couldn't 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 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!
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 the coils were replaced.

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!

![Fig. 1 The pin out and circuit details of a CM1.](image1)

![Fig. 2 How to revive the diode bridge chip with some 1N4148s.](image2)

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.
Junk Circuits

Transistor Tester

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 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 | 327k |
| 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) |
| 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

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, and over and again. It is quick and easy 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 when 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 from the middle of your message, but it is better that you do it
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.
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 examiners 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 Errors 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 x 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

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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.

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**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 and high 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 the force of her upset became apparent. I then heard the noise of children’s voices and had tired them out now. Anyway it was time to find another resort which had them up very early and had gotten the neighbours to keep an eye on the place — I had

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

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.

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 it’s too damn late!

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

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 ¼th
watt resistor suitable for most small signal applications measures about 0.5 x 2 x 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 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!

HAM Major M588 AM/FM SSB 26.515 to 27.991MHz 1st SWL, £150. Phone 01-892 3114 (Middx). SF7800 2m FM multimode for sale, very good condition, complete with mobile and original packing. £265 ono. 021-449 6274 (after 6 pm).

FOR sale, ZS1TA 2m FT multi-mode base station, as new, 8 months old with original packing, any trial, £600. Pete, G0EDU, (0368) 658929 (evenings), Worsc.

MURILL 1000 2m FM multimode for sale, very good condition, complete with mobile and original packing. £265 ono. 021-449 6274 (after 6 pm).

YAESU FT209R 2m hand set.]{\textit{Very strong mag mount CB scan modes and dual clocks, VHF unit 118-174MHz already fitted, £125 (cost £170). Littlehampton 723164.}}

KENWOOD TS-711E 2 metre multi-mode base station, as new, 8 months old with original packing, any trial, £600. Pete, G0EDU, (0368) 658929 (evenings), Worsc.

DEAL 368284. £4.50. 144-174, 430-512MHz, solid state, new, FT2272D (1012D), vgc, mic, fan, filters, £475. Icom 280E £500, 70cm xtal'd transmitter, not for SWL, £400 ono or consider all band HF transceiver for swap. Also Yaesu FT 709R handheld plus accessories, £180 or consider 70cm mobile in exchange. Phone (0274) 723101 (daytime) or (0532) 501436 (evenings).

RACAL RA17L and manual, £150. Heatkith DX 1000 5 band AM/CW transmitter, not used for some time, £35. Creed 75 teleprinter, Redifon terminal unit, receive only, isolation transformer, £25. M. Levers, Waverley, Independent Hill, Alfreton, Derbyshire, DE5 70G.


YAESU FT209R transceiver, handheld, 10MHz coverage, good condition, boxed, with speaker, mike and charger, £190 ono. Standard C7800 UHF transceiver, good condition, boxed £140. Phone Mike on Waltham Cross (0992) 32114 (after 6 pm), G6EBN, not QTHR.

TRIO TM-211E 2m FM transceiver, 9 months old, still under warranty, instruction manual, boxed, 5W or 25W, including DCS system radio, only used in shack, £250 ono. Phone Cuffley 872772, G1JUB, not QTHR.

GRUNDIG Satellite model 2100 for sale, 10 short wavebands, FM, LW, MW, £150. Phone 01-855 2998.

TRIO R-1000 communications receiver, 200kHz to 30MHz coverage, handbook, £185 ono. East Grinstead (0342) 311049.

YAESU FT-2000 FM transceiver, 9 months old, still under warranty, instruction manual, boxed, 5W or 25W, including DCS system radio, only used in shack, £250 ono. Phone Cuffley 872772, G1JUB, not QTHR.

YAESU FRG-150B general coverage receiver, YAESU FT-7700 antenna tuner, both mint condition, virtually unused, £400 the pair. Phone Tony, 01-995 7225 (daytime) or (0234) 771085 (after 7 pm).


BRAND new radio harness to fit Burndeed's and similar, only £8 including postage. Dragon 32K computer with RTTY and CW cartridge, plus more, £60 plus postage. Wanted, BE600 VHF handheld, Whitehall control head, BE470, no silly prices. (0302) 835280 (S. Yorks).

FTV107R transverter 50, 144 and 430MHz bands, 20 watts DC input, fitted with 2m board, complete, boxed, with manual, £110 ono plus carriage. Also Boots data recorder, £25. 2 x 6146 PA valves, offers? Wanted, CB handheld, must be legal FM. Phone 021-472 3845.

FOR sale, Yaesu FT203R handheld Tx. 2½ watts output, complete with DC car adaptor/trickle charger, mobile hanger bracket, YH2 headset, £195. Phone Eric, G1NYH, QTHR, 01-874 7653.

BELCOM liner 2m SSB, £80. AudioLine 341 legal FM CB, immaculate, £35. Can be seen in north Kent or Birmingham. Phone 021-551 0559.

TOKYO Hy power ATC HV, 200, two months old, mint, 200W PE, 80-10m, £65 + p&p. (0952) 57670.

EDDYSTONE 770R receiver, 19-165MHz, £100, KW Vespa Tx, £40. RTTY CRT tuning indicator, £15. Phone (0608) 811102.

YAESU FT101D receiver, good condition, digital readout, 2m, 6 converters fitted, perfect working order, boxed, new 'S' meter, bulb needed, £175. Sony 1CF7600D, mint, all accessories, boxed, £110. Pidduck, 128 Pound Road, East Peckham, Tonbridge, Kent, TN12 5LH.

COLLECTOR'S item, unmodified R115B communication receiver, £40. Marconi Instruments RF power meter reading 0-100 watts switched, £6. SS8 audio active filter, £10. Amtron frequency counter, 0-600 mgs, as new, £60. Pair ITT Starfones, £12. Pair Pye PFI Pockettsw, T/RX, NiCads, working, £10 each. (0789) 841504.

YAESU FT203R for sale, 2m FM, handheld, NiCads, charger, original packing, £250 ono. Also 2m to 70cm transverter, 1 watt output, no repeater switch, £50 ono, and 2m and 70cm slim Kits, £5 each. Geoff, GB80O QTHR, Letchworth (0462) 676422.

10 METER multi-mode, Ham International series, profes-
vention, 28.010 to 29.700 FM, SSB, CW, AM, RTX, 1.2 kW, suitable for conversion to multi-band and QRP H/F, must be gwo, also QRP H/F, must be gwo. WANTED, 1.8-30MHz, £120. (04246) 49139, G3ZLN.

FOR sale, Yaesu FT-817, £35. Phone 01-656 8310, extension 81285, 4 watts +, with terminal unit, split screen RTTY, c/w software, b/w TV, recorder, cables, switches, ready to go on air, never used, £150. Shure 401 mic and Heathkit VTVM, RF probe, £201 mic. Phone Ipswich 49139, G3LZN.

TETRACON oscilloscope model 2215, 60MHz, dual trace, probes and manual, as new, £150. Phone 01-949 2317.

YAESU FT290R multi-mode listen on input, speaker, mike, NiCads, charger, rubber duck, whip antenna, in original box, will include carrying case, £295 ono, buyer collects. Phone 021-353 6576 (evenings between 7 pm and 9 pm excluding Mondays).

FOR sale, Solartron oscilloscope, type CD513, needs attention, £12. Also power supply unit with cables for WW11 19 set, £15. Buyers collect. Phone Darlington (0325) 464041.

TRIO TR7800 2m FM transceiver, mobile/base, features include hi/low power, auto-scan, multi-function memory, etc, a very sophisticated piece of machinery, hardly used, complete with box, £90 recently spent for various work, £230. Phone Sheffield (0742) 731832.

FOR sale, FT901D memory transmitter, £75, communications receiver, 12-band, Datong. Active antenna, AD270, £25. 2m ground plane antenna, £7. all in mint condition. As one lot, £100. Bookham (Surrey) 56741.

YAESU SP102 extension speaker, £43. Icom SP3 extension speaker, £43. Mutek GDF107UB 10GHz Gunn diode board, £45. Rank Xerox 400 telecopier, £20. Phone Paul (0293) 515201.

AMTOR, terminal unit with PSU CP-1 by AEA, all leads and software included, mint condition, £125. HQ-1 mini quad, £65. 10 new micro switches, £1,50. Bremi linear BRL 200, 2.6 JB6As, 10/11m, sticking relay, hence £35. Phone (0709) 554665.

please mention HRT when replying to advertisements. 73 G4NXV
Free Readers’ ADS!
Buy, sell or exchange your gear through our free service to readers

CONDITIONS

1. These advertisements are offered as a free service to readers who are not engaged in buying or selling the same equipment or services on a commercial basis. Readers who are should contact our advertising department who will be pleased to help.

2. Advertisements will be inserted as and when space becomes available.

3. The insertion of advertisements will be on a first-come, first-served basis, subject to condition (2). As a result, it will not be possible to guarantee the insertion of a particular advertisement into any particular issue of the magazine.

4. Readers should either write out their advertisement in BLOCK CAPITALLS or type it, underlining any words that are to appear in bold.

5. The magazine cannot accept any responsibility for printers’ errors in the advertisements; however, we will do our best to ensure that legibly written advertisements are reproduced correctly. In the event of a gross error, at the Editor’s discretion, a corrected version of the advertisement will be printed (at the advertiser’s request) at the earliest issue in which space is available.

6. The magazine or its publishers will not accept responsibility for the contents of the advertisements, and by acceptance of these conditions, the advertiser undertakes to indemnify the publisher against any legal action arising out of the contents of the advertisement.

7. The magazine reserves the right to refuse to accept or to delete sections of advertisements where this is judged necessary.

8. Advertisements are accepted in good faith; however, the publisher cannot be held responsible for any untruths or misrepresentations in the advertisement, nor for the activities of advertisers or respondents.

9. Advertisers must fill in their names, addresses and (if available) telephone number in the space provided, and sign the form to indicate acceptance of these conditions (forms returned without a signature will not be used).

10. All that is to be reproduced in the advertisement should be entered into the space provided on the form printed in the magazine — note that a photocopy is not acceptable. All advertisements must give either a telephone number and/or address for respondents to contact, and this must be included in the wording of the advertisement.

11. Advertisements must be 40 words or less in length (telephone numbers normally count as two words, exchange or exchange code plus number).

I accept the conditions above.

Name

Address

Signature

Send this form to: Free Readers Ads, Ham Radio Today, I Golden Square, London, W1R 3AB

ENTER YOUR ADVERTISEMENT HERE:
MISCELLANEOUS

HEATHKIT U.K. spares and service centre. CEDAR ELECTRONICS, Unit 12, Station Drive, Bredon, Tewkesbury, Glos. Tel: 0684 73127.

FOR SALE

MICROS

AA/HP7 Rechargeable Cells 4 for £2.30 or for only £3.30 (ex. equip. tested & guaranteed) Universal Micral Charger £8 with battery test facility and LED indicators for any combination PP3 AA. C&D cells. Above prices inclusive of p&p - goods sent with battery test facility and LED indicators for any combination PP3 AA. C&D cells. Only £27.95 Entire Listening Post" Incredible Value & Even VHF TV Sound Business. Surveillance, Utilities & more! provide the for any combination PP3 AA. C&D cells.

FOR DETAILS OF HOW TO ADVERTISE IN THIS SECTION

TERMS

CLASSIFIED ADVERTISING TERMS & CONDITIONS

Our terms for new advertisers (semi-display & lineages) are strictly pro-forma payments until satisfactory reference can be taken up (excluding recognized advertising agencies). Cheques PO's should be crossed and made payable to ARGUS SPECIALIST PUBLICATIONS LTD. and send together with the advertisement to: THE CLASSIFIED DEPT., L.H. NO: 1 GOLDEN SQUARE, LONDON WIR 3AB. There are no reimbursements for cancellations. Advertisements arriving too late for a particular issue will be inserted in the following issue unless accompanied by instructions to the contrary. All advertising sales are subject to Government regulations concerning VAT. Advertisers are responsible for complying with the various legal requirements in force eg. The Trade Description Act, Sex Discrimination Act & The Business Advertisements (Disclosure) Order 1977.

FULL TERMS & CONDITIONS OF ADVERTISING AVAILABLE ON REQUEST

RECEIVERS


MORSE TUTOR

For Spectrum/QL/BBF:- WD Morse Tutor (cassette £4, microk/r £5.25+ disc £6) From absolute beginner to beyond RYA and Amateur Radio scoring. Adjustable Speed to your test level (4-18 wpm). Learn from single characters, via groups with wide spaces to random sentences, decrease spacing to normal. Write down what you hear, then CHECK on Screen or Print (or speak for Spectrum fitted with German Micro-speech). Also own-message, random figures, letters or mixed. Punctuation in own-message or single-characters. Discs may be 40 or 80-track (SPDOs for Spectrum. Price includes postage in Europe. fl extra outside. For Spectrum/OL/BBC:- WD Morse Tutor £30 + £1.50 p&p

COMPONENTS

RF SERVICES AT ROCK BOTTOM PRICES

Duplex, 6000 codes at low strobe. REPLACEMENT RF TRANSISTORS

MRF454 HF/SSB 25W £14.20
MRF450 HF/SSB 50W £11.95
MRF503 HF/SSB 30W £13.80
MRF475 HF/SSB 20W £2.99
MRF1890 HF/SSB 15W £2.50
MRF2304/1375 HF 16W £2.00
MRF1874 VHF 2.5W £7.60
MS2964A VHF 20W £14.30

FOR SALE

REPLACEMENT RF POWER MODULES

M57749/SAU11 934/FM 7W £29.00
M57719 VHF/PMR 15W £45.00
M57714/SAV7 VHF/FM 25W £39.00
M57716/SAU4 UHF/SSB 15W £29.00
MS719 VHF/PMR 15W £29.00
MS727 VHF/SSB 28W £45.00
M7740/SAU11/SPDO TM £29.00
Send £2.00 p&p and S.A.E, for full list.
All prices inc. VAT. Many IC's and other items in stock.
RWC Ltd., 584 Hagley Rd West, Dept HR Quinton, Birmingham B31 6BS 021 421 8201 (24hr Answer phone)

REPLACEMENT RF TRANSISTORS

MRF454 HF/SSB 25W £14.20
MRF450 HF/SSB 50W £11.95
MRF503 HF/SSB 30W £13.80
MRF475 HF/SSB 20W £2.99
MRF1890 HF/SSB 15W £2.50
MRF2304/1375 HF 16W £2.00
MRF1874 VHF 2.5W £7.60
MS2964A VHF 20W £14.30

FOR SALE

PUBLICATIONS

MORSE TUTOR

£30 + £1.50 p&p

Morse Tutor

£30 + £1.50 p&p

M57749/SAU11 934/FM 7W £29.00
M57719 VHF/PMR 15W £45.00
M57714/SAV7 VHF/FM 25W £39.00
M57716/SAU4 UHF/SSB 15W £29.00
MS719 VHF/PMR 15W £29.00
MS727 VHF/SSB 28W £45.00
M7740/SAU11/SPDO TM £29.00
Send £2.00 p&p and S.A.E, for full list.
All prices inc. VAT. Many IC's and other items in stock.
RWC Ltd., 584 Hagley Rd West, Dept HR Quinton, Birmingham B31 6BS 021 421 8201 (24hr Answer phone)

BTM ELECTRONICS

510-512 Alum Rock Road, Alum Rock, Birmingham B8 3HX. Tel: 021-327 1497/6313 YAEU DISTRIBUTORS TO THE UK.

BIRMINGHAM

CENTRE ELECTRONICS

345 Stockfield Road, Yardley, Birmingham B25 8JP Specialist in the sale and service of Ex Government and Vintage Radio and Test Equipment. (Many spares in stock.) Telephone enquiries to 061 32560 Our terms for new advertisers (semi-display & lineages) are strictly pro-forma payments until satisfactory reference can be taken up (excluding recognized advertising agencies). Cheques PO's should be crossed and made payable to ARGUS SPECIALIST PUBLICATIONS LTD. and send together with the advertisement to: THE CLASSIFIED DEPT., L.H. NO: 1 GOLDEN SQUARE, LONDON WIR 3AB. There are no reimbursements for cancellations. Advertisements arriving too late for a particular issue will be inserted in the following issue unless accompanied by instructions to the contrary. All advertising sales are subject to Government regulations concerning VAT. Advertisers are responsible for complying with the various legal requirements in force eg. The Trade Description Act, Sex Discrimination Act & The Business Advertisements (Disclosure) Order 1977.

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EMPIORIUM GUIDE

AVON

6 GOLF CLUB LANE, SALTFORD, BRISTOL Tel: 0221 2402

BIRMINGHAM

R. WITHERS COMMUNICATIONS

584 Hagley Road West Oldbury, Warley B56 9RS
Quintin (98HAM) Tel: 021-421 8201/2/3
*Opening hours 9-5:30pm Late nights Thurs-Fri.
Send just £1.00 (refundable against purchase for latest catalogue + our exclusive products & used list

BIRMINGHAM

HEWARD'S HOME STORES LTD.

(Ed. 1983)
822/4 Kingstanding Rd., Birmingham B4 9RT.
Tel: 021-354 2083
G4RJM with 38 years in The Radio Trade Ham Equipment urgently wanted!
Open: Mon-Sat 9-6

BIRMINGHAM

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345 Stockfield Road, Yardley, Birmingham B25 8JP Specialist in the sale and service of Ex Government and Vintage Radio and Test Equipment. (Many spares in stock.) Telephone enquiries to 061 32560

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DW ELECTRONICS G3XCF

Amateur Radio Supplies

71 Victoria Rd, Widnes
Tel: 01 31 287 8111
Open Mon-Sat 8:30-6 (closed Thurs)
We supply Yaesu, Icom, Tonna, Jaybeam, Microwave Modules, Datalogs, etc.

R. WITHERS COMMUNICATIONS

584 Hagley Road West Oldbury, Warley B56 9RS
Quintin (98HAM) Tel: 021-421 8201/2/3
*Opening hours 9-5:30pm Late nights Thurs-Fri.
Send just £1.00 (refundable against purchase for latest catalogue + our exclusive products & used list

HAM RADIO TODAY AUGUST 1986 65

RING JULIE DYSON ON 01-437 0699

FOR DETAILS OF HOW TO ADVERTISE IN THIS SECTION
EMPIORIUM GUIDE

CAMBRIDGESHIRE

PRE-CHRISTMAS ADVERTISING WHY NOT USE THIS SPACE?

LONDON

DRESSLER UK LTD
191 Francis Rd., Leyton, E10
Open 9-5.30 Monday-Friday 10-5 Saturday
Authorised dealers for:
Dressler, Yaesu, Icom, Standard, Trio/Kenwood,
Datong, SCM, Microwave Modules, Tonna
Tel: 01-558 8554/555-1415 Telex: 8593559

NOTTINGHAMSHIRE

SP ELECTRONICS
48 Limby Road
Hucknall, Nottingham
Tel: (0602) 640377
Open Monday-Saturday 8.30-5.30

DEVON

AGRIMOTORS
Merton CB & Radio Centre
Merton Garage & Post Office, Merton,
Nr. Orpington, EN20 3DZ.
Tel: (08053) 300
Open 6 days 9-6 (Sunday by appointment)
Suppliers in 934MHz

EIRE

RADCOM ELECTRONICS
25 RIVERSFIELD, MIDLETON, CO. CORK
Suppliers of YAESU, ICOM, DATONG,
BNOS, DRESSLER, MU-TEK, S.E.M.
RF CABLES, CONNECTORS, ANTENNAS, ROTATORS, KEYS, METERS & LOTS MORE.
RING (021) 632725

ESSEX

SELECTRONIC
The UK's leading suppliers of 934MHz
personal radio equipment
203 High Street, Canvey Island, Essex
Tel: 0268 691481
(Open Mon-Sat 9-5.30)
Amateur radio equipment also in stock

LANCASHIRE

AMATEUR ELECTRONICS U.K./HOLDINGS
Yaesu, Tel, Jaybeam, Frequency
Counters, Crs, Oszillos, PT871
Exports, Repairs, BJ5CC, 1097YA
6876, RF Clipper, Double Balanced
Mixer, Wac Kit etc. S.A.E. Ltd 15
min. June, 31 MK. Free parking
46 Johnstoun Street
Blackburn 582 18F
CLOSeD THURSDAYS

LEICESTERSHIRE

Elliott ELECTRONICS
26-28 BRAUNSTON GATE,
LEICESTER.
TEL: 553293
Open: Mon-Sat 9.00am to 5.30pm

LONDON

DRESSLER UK LTD
191 Francis Rd., Leyton, E10
Open 9-5.30 Monday-Friday 10-5 Saturday
Authorised dealers for:
Dressler, Yaesu, Icom, Standard, Trio/Kenwood,
Datong, SCM, Microwave Modules, Tonna
Tel: 01-558 8554/555-1415 Telex: 8593559

NOTTINGHAMSHIRE

SP ELECTRONICS
48 Limby Road
Hucknall, Nottingham
Tel: (0602) 640377
Open Monday-Saturday 8.30-5.30

DEVON

AGRIMOTORS
Merton CB & Radio Centre
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Nr. Orpington, EN20 3DZ.
Tel: (08053) 300
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Suppliers in 934MHz

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6876, RF Clipper, Double Balanced
Mixer, Wac Kit etc. S.A.E. Ltd 15
min. June, 31 MK. Free parking
46 Johnstoun Street
Blackburn 582 18F
CLOSeD THURSDAYS

LEICESTERSHIRE

Elliott ELECTRONICS
26-28 BRAUNSTON GATE,
LEICESTER.
TEL: 553293
Open: Mon-Sat 9.00am to 5.30pm

HAM RADIO TODAY AUGUST 1986
At Microwave Modules Ltd, we believe that the new look of our range of linear amplifiers makes them simply the best. The addition of the new brushed aluminium front panel has transformed the appearance of an already superb range of products. Our company's policy is customer satisfaction, not just with service, but also with products that have style.

We're ahead of the times with our range and will be staying that way. Visit one of the many retailers who handle our range, perhaps the Lowe chain of shops, or SMC. Alternatively, our roadshow is visiting many of the mobile rallies this year, so stop and say hello and look at perfection for yourselves.

PRICE LIST FROM 1st APRIL 1986

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<tr>
<th>LINEAR AMPS</th>
<th>TOTAL INC VAT</th>
<th>POST RATE</th>
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<td>MML28/100-S</td>
<td>10m 100W Linear, 10W input</td>
<td>129.95 B</td>
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<td>MML144/30-LS</td>
<td>2m 30W Linear, 1 or 3W input</td>
<td>94.50 C</td>
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<td>MML144/100 LS</td>
<td>2m 100W Linear, 1 or 3W input</td>
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<td>MML432/30</td>
<td>70cm 30W Linear, 1 or 3W input</td>
<td>149.50 C</td>
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<td>MML432/50</td>
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<td>2m High Performance Converter</td>
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<td>MMC1691/137.5</td>
<td>1690MHz WX Satellite Converter</td>
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<td>The Morsetalker</td>
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<td>Advanced Morse Trainer</td>
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<td>MMT144/28-R</td>
<td>2m Linear Transverter, 25W o/p</td>
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<td>23cm Linear Transverter</td>
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<td>128MHz Transmit Up-Converter</td>
<td>258.75 D</td>
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<tr>
<td>MTV455</td>
<td>70cm ATV 2W Transmitter</td>
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<tr>
<td>MX401-KB</td>
<td>RTTY Transceiver with keyboard</td>
<td>299.90 D</td>
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DURING THIS YEAR OUR SALES TEAM WILL BE VISITING MOST OF THE MOBILE RALLIES. TO BE SURE THAT WE DO NOT MISS YOURS PLEASE RING MICK, G4EFO, ON 0403 730 767.

VISA WELCOME

MICROWAVE MODULES Ltd
BROOKFIELD DRIVE, AINTEE, LIVERPOOL L9 7AN, ENGLAND
Telephone: 051-523 4011. Telex. 628608 MICRO G
CALLERS ARE WELCOME, PLEASE TELEPHONE FIRST

HOURS:
MONDAY-FRIDAY
9-12.30, 1-5.00
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WE ARE TRIO AUTHORIZED DEALERS

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Main showrooms and Head Office at Hatfield Peverel near Chelmsford are just off the main A12 which now connects directly to M25 & A45. British Rail Station 3 mins. Free car parking. Open Monday to Saturday 9 - 5pm. Closed Thursday. (ALL MAIL ORDERS)

WE ALSO STOCK THE FOLLOWING: BNOS, WELZ TET ANTENNAS, MUTEK DATONG, KENPRO, TONNA ANTENNAS, MICROWAVE MODULES, DAIWA, SAGANT TONO TERMINALS AND MANY MORE. CALL IN AND BROWSE AROUND.

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