APRIL 1983 90p

Amateur RADIO

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Front cover: The five hand-held transceivers tested in this issue, by Angus McKenzie, G3OSS. They were loaned by South Midlands Communications Ltd. (Yaesu), Thanet Electronics (Icom), and Lowe Electronics (Trio) to whom many thanks must be said. Now turn to pages 18-22.

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ICOM

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IC251 2mtr 10w fmkw/ssb/base	£525.00
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SP230	£41.00
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YAESU

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FT208 2mtr portable	FM	£195.00
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FRV7700A 118-150	£ 60.00
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FRV7700D 70-80/118-150	£ 72.00
FRT7700 Aerial Tuner	£ 37.00
FRA7700 Active Antenna	£ 36.00
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NC11C Charger	£ 8.00
NC8 Base Charger FT208/708	£ 44.00

ALINCO

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DR7600R		£176.00

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W7 RPS SO239	£24.00
W7 RPS N type	£26.00
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CT150 150/400W Dummy Load	£59.00
AC38 3.5 30MMZ A.T.U.	£19.95
CT300	£45.00
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θ 500 CW/RTTY Terminal	£299.00
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144 9 ele port	£18.00	1296 23 ele	£25.00
144 16 ele	£33.00	432 19 ele	£18.00
144 13 ele port	£29.00	432 19 ele X	£30.00
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5XY/2M 5 ele cross	£28.17	Chimney mounting kits, poles, brackets, in stock.	
Q4/2M 4 ele Quad	£29.32		

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Access

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CURRENT·COMMENT

Introducing you to this month's issue

Well, the mighty presses at Bicester have been churning out copies of *Amateur Radio* again and we're now well and truly launched as a monthly – I hope you'll stay with us and enjoy the fun. We've a lot of things in the pipeline and we've also been getting some more information from your questionnaires so we should be in a good position to provide you with all that's best in amateur radio. We had many letters and somewhere between 50 and 100 phone calls concerning the last issue and we hope we're establishing ourselves as a magazine that's useful and informative.

Angry calls

We also seem to have run into our first little controversy. Those of you who study the advertisement pages with eagle eyes will notice that certain of our regular advertisers aren't with us this month. Why can this be? Well, it seems that the article written by Angus McKenzie, G3OSS, in the last issue was more than they could stomach, for reasons which escape us completely. Angus's piece was a good and workmanlike outline of what your relationship with a trader can contain – no more and no less. It wasn't taking side-swipes or pot-shots at anyone and neither was he paid a backhander to praise some companies and omit others, as one person claimed. Angus McKenzie has a reputation as a fair and honest writer who happens to be an authority on all sorts of things; he's written for all kinds of prestigious journals and he's currently active as a consultant to various high-flying companies. He's also a well-known callsign on the amateur bands. Now a man like Angus isn't going to blow the reputation of a lifetime in writing bitchy comments about this or that dealer.

So why we had a couple of angry phone calls and letters (out here in the sticks it's known as "a right lot of verbal") escapes us. Many readers wrote to say thank you for publishing something that set out exactly what you can and can't expect from a dealer in simple terms.

We want, and need, a good relationship with the amateur radio trade. Without them we wouldn't get things for review at short notice, we'd have no advertising and probably we'd then have 12 pages instead of 76 and in general we can't afford to turn them away in droves . . . However, we must reserve the right to publish the occasional piece that's not so much a searing shock-horror revelation as a balanced look at how some things inside the trade work. This means articles like the one in last month's issue, which described your rights as a buyer in simple terms. At some point we're going to have to explore what many people refer to as the "cartel" which is supposed to exist somewhere within the trade; now, regardless of what we find out, that amateur dealers are all as pure as driven snow or that they're all part of a secret network run from the Kremlin or whatever it happens to be, does it mean that if we so much as mention the word, all our advertising will disappear?

Dealer profiles

I would have thought that our main duty was to be as honest and straightforward as possible for our readers, and that means publishing good articles that are true and which help you. We also need a good relationship with the amateur radio trade. From some of the reactions to Angus's article it's beginning to look as though there's going to be an element of conflict in those two from time to time and that's a strange situation. Amateur radio traders we've come across so far have struck us as nice people – no doubt they all, like us, have the usual human failings but we can live with that.

Ah well, I dare say we'll muddle on. We're currently thinking of a series all about dealers – a sort of "dealer profile", if you like, whereby we pay a visit to someone in the trade and tell you all about who they are, how they got started, what their plans are and generally do an in-depth study of the faces behind the well-known names. At least, assuming that any of them are still taking to us! We'd like to give them an outlet to tell you, the amateur, all about themselves and maybe to clear up any misconceptions or funny ideas that one might have. We're also hoping to do a feature on ARRA, the Amateur Radio Retailer's Association, in the not-too-distant future and we'll be seeing what this outfit does.

Dutch station

Did you go to the NEC exhibition? We did and we liked it – there's a report in the May magazine, assuming that the printers managed to get it typeset in time. We're getting a reputation in Bicester for making demands on the typesetters and asking them to do the impossible the day before we're supposed to go to press – oh well, at least it shows we're doing our best to bring you all the hot news! One of these days we'll find our 3-element tribander wrapped round the Editor's neck (stand up the man at the back who shouted hooray!).

I hope you enjoy the magazine, and don't forget – it's yours and we need to hear from you. Tell us what you like and what you hate and we'll do our best to print the first and remove the second! **73 de Chris Drake**

Remember – Amateur Radio is now a monthly magazine. Make sure of your copy by placing a regular order at the newsagent. Or take out a subscription.

For a period of 24 hours, starting at 06.00 UTC, April 30th, Radio Netherlands, the Dutch International Service, is planning to operate a special amateur station from its studio centre in Hilversum, Holland.

This year marks 55 years since regular broadcasts began from the Netherlands to what was then the Dutch East Indies (now Indonesia) and, since amateurs have been involved in the pioneer work of both domestic and international broadcasting, the station feels it rather appropriate to involve them in a project tied in with World Communications Year 1983.

The English language programme on Saturday April 30th will focus on WCY, and licensed radio amateurs will be invited to contact the special station to talk with some members of staff, who are also amateur radio operators. April 30th is also a public holiday in the Netherlands, known as "Queens Day".

A special callsign has been applied for, but this has not been confirmed at the time of writing. Times of transmission for this, and the April 30th broadcast, are listed below. Listeners can also write in direct for details to: English Section Radio Netherlands, P.O. Box 222, 1200 JG Hilversum, the Netherlands. A special QSL card will be issued for listeners managing to hear the special amateur radio station.

Daily schedule of broadcasts in English (for regular Media Network programme on Thursday, and the special April 30th event):

Time UTC (GMT)	Target area	Frequencies (kHz)
07.48	New Zealand and Australasia	9770, 9715
08.48	New Zealand and Australasia	9715
09.48	Europe	15560, 11930, 9895 6045, 5955
13.48	Europe	17605, 11930, 9895, 6020, 5955
14.48	South East Asia	11740, 17605, 21480
18.48	East and Central Africa	6020, 11740
20.48	West and Central Africa (also audible in Europe)	21685, 17695, 15220, 11930, 9715
02.48 (Friday UTC but Thursday in target)	Eastern United States and Canada	9590, 6165
05.48	Western United States and Canada	9715, 6165

L·E·T·T·E·R·S

About the AR88

It is generally assumed, quite wrongly by many magazines, that all readers are interested in transmitting as opposed to receiving or copying. The manufacturing market caters little for these, as few worthwhile receivers are on the market. Not everyone is interested in 2cm reception or transmission.

It was therefore refreshing to see the article by Bob Henly on the AR88D receiver and a very good article it was too. It is too often said that modern receivers are more sensitive than the older types. This is not true, for on one hand you are comparing a receiver just off the track with one that has been around for 30 to 40 years and of course is not reflecting its original merit.

The AR88D in good condition and when properly aligned gives on MW (where most solid states fall down) an overall sensitivity of 1.5uv at 6db. The NRD515 at nearly £1000 gives no more than 6uv at 6db. On the short wave ranges the sensitivity is .98uv overall. You will not notice any level of signal lower than that with respect to noise on any receiver regardless of cost. The selectivity of 400 cycles 1.5kcs and 3kcs with the crystal is ideal as fidelity is worthless under 3kcs. Of course we are talking of a receiver just off the track as new bearing in mind that the manufacturer with his expert alignment engineers and equipment is in a better position to give three-point tracking whereas most receivers end up with two-point tracking. It therefore follows that beginners, other than operators with technical backgrounds, should buy themselves a new solid state receiver so they do not get lost trying to overhaul these older receivers to bring them up to date. Just as car experts strip down vintage cars and present them later as new models, it follows, therefore, that it needs expertise.

Much may be said about alignment, but it is so essential for good overall performance. Naturally visual alignment is better than aural though some (especially the young) have very good hearing. In this case beginners with no equipment may find the following a reasonable method of aligning the crystal and subsequently the IFs. I don't ever remember rea" "his.

Switch the crystal to S3 and tune to a station, say 6035kcs which carries the Australian station in the evenings, and you will find strong modulation splash from powerful transmitters on either side, namely 6030 and 6040kcs. Set the phasing condenser to enhance this, making quite sure that the station on 6035 is correctly tuned in, using the BFO if necessary, or even coming down to S2. Adjust the crystal load L34 to reduce this modulation splash as far as possible, thus bringing the crystal to its maximum rejection.

Now undo the lock nuts on C80 and C81 (if you have the right tools – some sets don't have them, if they are there. They are under the RF cover; remove the four terminals, lift off the case to see if they are in the clip provided) and adjust these also for more rejection of the splash having first checked the frequency of 6035kcs to ensure it has not moved.

Tighten up nuts and adjust the phasing condenser C75 to give a null point. The IFs can now be adjusted, checking with an output meter if you have one in the speaker circuit. This method, as I said, requires good hearing but it can be very successful as you will see by checking the crystal ranges and with SSB. An alternative method is to make a one-valve oscillator using, say, an EF80 or similar and insert the set's crystal 455kcs in the grid of the oscillator and tune the receiver to the first or second harmonic of 910 or 1365kcs, making sure there is no transmission on these frequencies at the time. With heater and HT supply to the osc. from a separate source, inject the output from the osc. *into the aerial* thus adding two extra valves to the osc. before the mixer, the osc. with only one valve being too weak if fed on to the mixer.

Leave the set oscillator in, or there will be no beat and the null point will be missing, the set osc. and the mixer producing this null point. This again requires good ears; tune the crystal load L34 and C80 and C81 to this in conjunction with the IFs to this null point. If you prefer not to use the set's crystal, then a 455kcs crystal should be wired in the oscillator and the same procedure adopted. Remember here, you may be 2% in error, roughly 8kcs plus or minus; in other words no better than a signal generator which is also plus or minus 2% and quite often more than this. The crystal is better.

These, then, are two methods in lieu of a scope and wobbulator, but remember if you have a scope and a wobbulator that the osc. can be used as a marker on the curve. The AR88D is, as Mr Henly says and so rightly, a good receiver, properly aligned and overhauled. It has no spurious responses as many double and triple conversions sets have, being a single conversion job. And if properly aligned there is no second channel up to 30 megacycles.

The above are rough suggestions for crystal and IF alignment for owners with little technical know-how but Mr Henly's article on overall alignment should be closely followed. The AR88D has few weaknesses; one is on SSB where a product detector or even a means of reducing the tuning to an even slower rate for SSB would be an advantage.

Before any of the above remarks are enlarged upon, if the set is not in condition to comply with same, the voltages should be checked in conjunction with a new set of valves – especially the rectifier (which with other spares can be obtained from Messrs Colomar) as well as switch cleaning with carbon tet' and the contacts coated with petroleum jelly.

A set which is not functioning reasonably well should not be bought, unless you have the know-how to completely overhaul it properly. A good AR88D working up to its original performance is worth £150 to £200.

T.W.G. Elsenham, Walthem Cross, Herts.

How to proceed

After 17 years as an airborne operator with the RAF I have only just taken the RAE (May 82), passed my Morse and been given my licence – G4RBP. I have noticed one, seeming glaring omission in the books on amateur operations – PROCEDURES!

There seems to be no standard, basic format for amateur communications; newcomers such as I must have great difficulty in knowing whether their tentative tappings on the key are going to be acceptable to the "old hairies" that have been operating for years. Is there any thought of an article on this subject? I am trying to build an ATU for the HF bands – but no reliable capacitor of the right values can I find! (I'll probably have to buy one!) I do intend to build the QRP rig you featured in issue 3 – time permitting. Here, a quick business trip to Hong Kong and Korea may prove fruitful . . .

R. Broderick Purdy MBIM, G4RBP, 34 Ripon Way, St. Albans, Herts.

Colour blind?

Congratulations on your interesting and lively magazine. But there is an error on page 46 of issue 3 – your formula for capacitive reactance! *(Yes, we know, sorry – Ed).* Your article on colour coding for resistors etc highlights a problem for people like me who are more or less colour blind. This fact, plus the small size of some components makes it quite impossible for me to use this system.

I wonder if anyone else has been able to find a way out of this in view of the large number of people with colour vision deficiencies.

Les Jordan G4KJP, 7 Orchard Lane, Bridgwater, Somerset.

L·E·T·T·E·R·S

Change for the better?

Congratulations on producing a readable amateur radio magazine and though it gives me renewed enthusiasm to join other hams on the HF bands and I have passed the RAE with credits, whilst the present restrictive regulations persist, I find the Morse to be an impossible barrier.

The RSGB, of which I am a receiving member, is the recognised organisation representing radio amateurs in the UK but there would seem to be a feeling amongst the traditionalist members and its officials that any alteration in the regulations to progress with technology and changing conditions, enabling more operators to enjoy the hobby, is undesirable, representing a lowering of standards and a loss of credibility in the eyes of the IARU, the Home Office and the ITU, who are the international body whose recommendations are adopted by most nations.

Statutory Morse tests are an example of this, arousing considerable aggravation amongst those seeking a Class A licence and some sympathy for its abolition among those already holding licences. None of the arguments put forward substantiate any valid reason why the test should be a legal requirement. And despite it being the present policy of the ITU, partly because it allows the use of more primitive equipment within the means of some Third World operators, it does not mean that dropping the test is on a par with an act of blasphemy.

The ITU is controlled by its members, who accept its recommendations at their discretion and should represent the views of the majority of licenced and prospective amateur operators in their own countries. For instance the majority of Japanese operators do not have a Morse qualification.

It is not denied that Morse can add to the enjoyment of the hobby and increase the number and availability of DX contacts but it is not essential. Requests from other users of shared bands, transmitted in Morse, to stop transmission are non-existent, as most official transmissions no longer use that mode.

Despite snide remarks about intelligence there are those people, particularly of mature years, who find it almost impossible to achieve the required standard, in the same way that dyslexics have difficulty with reading. The RSGB should realise that there are those who are mainly interested in communicating verbally with other amateurs around the world, being content to use sophisticated and well designed commercial equipment, accepting the propagational limitations. And there are others for whom the experimental, technical and home brew side is important.

As a first step I am suggesting to the RSGB that all members are circulated with the following questionnaire.

1. If you are a Class A licence holder, do you use Morse telegraphy: a. Frequently, b. Occasionally, c. Rarely.

2. Would Class B licence holders and RS members favour the active endeavour of the RSGB to have the Morse test eliminated from the Class A licence requirement? Yes/no.

3. Would all members favour a two-tier system of Class A licence? a. General licence granted after a minimum period of operation on the VHF bands. Yes/No. b. Advanced licence granted after holding the general licence for one year plus the passing of a more advanced technical examination allowing additional access to a limited range of frequencies throughout the whole spectrum for their exclusive use. Yes/No.

Change will also come about if the RSGB, the Home Office and MPs receive demands for it, so let's get those letters rolling.

W. Meakin, 81 The Avenue, West Ealing, London, W13.

The idea seems a sound one, but what do other readers think?-Ed.

Wanted: an AR88D

I wonder if I could impose upon your good offices (good offices? You should be sitting in my seat!-Ed) to help me acquire a mint condition AR88D.

During this Xmas recess I have been catching up on reading radio mags, including Amateur Radio, now one of my regular good reads. Your excellent article on the AR88 (issue 3) has got me motivated enough to ask your help. You say one may purchase an AR88 in mint condition for around £50. I am prepared to offer £75 for one in first class condition, plus Securicor delivery. My hobby is SWL, and at present I use a Marconi 659, but wish to upgrade my equipment. I would be most grateful for your help.

A.F. Saunders,
137 Sheridan Road, Manadon,
Plymouth, Devon.

Through the ether

As well as being Honourary Secretary of the Swale club, I am Publicity Officer of the World Association of Christian Radio Amateurs and Listeners. We run regular nets on HF bands, and ad-hoc ones on 2m.

In addition, we arrange activity days for contact in the UK and overseas. All members get a membership list and regular quarterly newsletters. We welcome Christians from all denominations. WACRAL currently has nearly 600 members worldwide and is associated with the RAIBC and the G-QRP Club, and is affiliated to the RSGB. Our 1983 Conference is on September 9-11th at London Bible College, and if further information is required, I can be contacted at the address below.

Brian Hancock,
G4NPM.
Leahurst, Augustine Road,
Minster, Sheppey, Kent
ME12 2NB.

Licensed to kill?

If a requirement of this letter being acknowledge is the printing of my name and/or address, please just destroy this letter. Reading your article regards a novice licence, and also reading the replies from the post office, and Home Office etc, it seems quite obvious that it would not matter if you had a completely foolproof idea for this licence. The replies would still be full of excuses.

The main excuse would always be administrative costs against the number of people interested.

I do appreciate that you would have to be sure a person is responsible, inasmuch as going to great lengths to make sure his equipment isn't interfering with other people, and doing something about it when it does. It could well mean an interview with the governing body concerned so that they can assess him/her. Also to gain an interview you could be required to fill in a form and perhaps get two or three responsible people to vouch for you.

The method of going to night school to aid your passing the exam is fine, if (a) you can get in a night school class, and (b) your job doesn't stop you getting there.

I would welcome a novice licence because I don't see how passing a test proves worthiness; just look at death and injury statistics among qualified drivers to prove my point. Also, the laws seem a little crazy when to gain a shotgun licence, as far as I know you need to be vouched for by a JP and GP, a vetting by the police, and bingo – one shotgun licence.

Surely no one in the Home Office or post office would try to convince me that a ham radio is more lethal than a shotgun, or would they?

I hope the contents of this letter have been of some interest, and help sharpen the cutting edge for that red tape that is choking the latest issue in my hands at the moment.

Name and address supplied

Well, what do other readers think?-Ed.

L·E·T·T·E·R·S

The cat's whisker

Without any idea of 'line-shooting' I must say that I belong to the dying breed of 'wireless hobbyists' who constructed their equipment and became amazed if the result functioned at all.

This proved very real when I was 15 years of age in 1925. My first a Xtal set was a 2.5in dia. cardboard tube wound with No.22 enamelled copper wire, tuned by a slider contact mounted above the inductance through a square brass rod, complete with a cup and 'cats-whisker' using generally Hertzite crystal, galena, a piece of coal, lump sugar or the 'eye' of a potato – all these have rectifying properties. Then some experimenting, 2.5 flashlamp bulbs covered with silver foil and a copper wire connected to the foil worked as elementary diodes.

As the years passed I constructed the Baird low-definition "scanner" using a beehive lamp; this was in 1928. I graduated to something very useful in the 1930s, building the "Scott-Taggart 500", then the "Mullard Master Three' for short waves which brought in Schenactady, Pasadena, and Bound Brook, USA. In 1939 I joined PO engineering, then was called up, joined the RAF 1940-1945 as electrician posted to Cape Wrath on a radio site and Occult at the time of the Murmansk convoys. Prior to the Seige of Stalingrad I used the TR9 in conjunction with pilots on the air cover.

In 1945 I was back in civvy street with Telcoms and had many electrical courses and evening classes for C & Gs. I bought two AR88s, then the B40, was Secretary for Southdown Amateur Radio Society, also being co/founder. I am an official monitor for RSA, and have enjoyed many, many years of SWLing with some useful verifications (QSL), with one special, JY1.

I have recently bought the Sony ICF 2001 FM/AM PLL receiver, mains/batt 4.5v, 150kHz to 29+ megs, SSB. I have also CB equipment which works very well but I am rather disgusted with those who use the medium for bad language and filth! I have passed the RAE55 but have not done Morse.

May I suggest lists of SW freqencies to appear monthly? It would save loads of time, especially as we have digital read-out. Wireless or radio history may be of value to readers. Maybe in the next 50 years, thought waves may be transmitted, and who knows, the scent of roses or fried onions!

Leslie E. Tagliaferro
Eastbourne, Sussex.

Foreign stations

I have started taking your magazine, since the first issue, and prefer it to the other new magazine, which has already become far too technical and complaining for me.

I am an SWL, using a three-waveband home made design by R.A. Penfold. I would like to own an FRG7 eventually and would like to see design projects for, say, an ATU and other items connected with short wave listening. With my limited knowledge, however, practical drawings are essential for constructional projects.

I am not very interested in endless lists of prefixes heard, but would welcome articles explaining what time broadcast stations could be heard in English from many foreign stations. I have not heard anything yet from Australia other than amateurs, for instance.

A. Platten,
Prestwich, Manchester.

Missing info

Jolly good article about the AR88 in issue 3. But you forgot to mention the following:

1. Special crane to lift one.

2. Specially strengthened car to transport one.

3. Specially strengthened bench to operate one on.

4. A lift to get it upstairs (having got so far?).

5. An understanding wife and employer – after weeks in the Truss House at Hernia Bay.

6. The RAF ARS might well be a fund of information for real DIY mods including one that simply used two valves like silver balls on an Octal base to zap up the sensitivity quite nicely.

I have an AR8516L which makes for greater weight! And replacement valves and parts problems. We move from here later on this year, and hopefully I can con you into another very efficient article and have them beating the door down with cheque books open and wallets in hands! Amateur Radio is pretty good – but of course, you know that. Cheers.

R.A. Hounslow,
Northampton.

Ex-WD Radio

I have just acquired an ex-WD radio, and was wondering whether you could assist me with some problems. It's an RCA type 19 MKIII. Frequency 1.8mcs to 8.5mcs. With the radio came an aerial variometer. The equipment runs off 12 or 24 volts DC although I am using it presently on 2vdc. I've used the set for receive and have picked up some good stations on or about 3.5mcs.

First, could you tell me what the controls are at the switch at the top of the set? These are AE AVC LT HT1 and HT2 and Driver. What do these mean? And in what position should it be in to receive, and to transmit?

The other switch is marked CW R/T MCW. When I got the set the old microphone came with it. No headphones but there is a separate box at the top for supplying the headset and mike. It has a switch marked A1 IC b A2. What do these mean? And what positions should they be in for T/X and R/X? There are five wires for the earphones and mike. I've discovered the green wire goes to earth. The other colours are red, white, blue, black.

I intend using a long wire aerial. In the loft area, would a length of X1 132ft be OK? Basically, when I get the old type 19 going, would it be of any use? Thanks for a good magazine.

James Donnan,
17 Barnshean Avenue, Patna,
Ayrshire KA6 7PB.

Another plea for help, dear readers. - Ed.

A fast buck

I am taking the liberty of writing direct in praise of your fresh approach to the subject of amateur radio journalism.

I purchased the first issue with some reservations, thinking it was yet another attempt at making a fast "buck" or two, by promising all sorts of "goodies", but turning out to be another advert-filled journal, filled with high technology articles. In fact, your approach is to say the least, very refreshing, simplistic, and humorous (which I particularly like), and yet seemingly dedicated to the ham or SWL who enjoys the hobby in the true sense. In fact, I believe so much in the magazine that I herewith enclose my subscription for one year. (I should add that I am currently a member of RSGB, but in conjunction with many others feel that Radcomm leaves a lot to be desired).

I am sure there are many other readers of your excellent magazine who share similar views to my own, and who look forward to future issues – for their sake and mine, keep up the good work.

Gerry Ward,
G13ZCK, Belfast.

Where's Amrad?

Issue number 2 of Amateur Radio referred to issue number 3 being available on December 9th, but my newsagent tells me it is not available. I've now got one, of course, but why should I be told this by my newsagent?

B. Haywood,
Macclesfield, Cheshire.

December 9th was the day it was due to appear in the newsagents. There could have been local delays, and in any case it's a good idea to place a regular order with your newsagent – that will encourage him to stock the magazine for other (possibly more unlucky) readers. - Ed.

Have readers any ideas for useful circuits or other equipment that would be of interest to others? If so, let us see them and where possible, we will publish your ideas in future issues of Amateur Radio. What's more – we might even pay you some real money for the privilege.–Editor.

S·W·L

Here we are again, and it's been a bit of a quiet month on the short waves - the highlight of the period has to have been the various operations form Heard Island, and several people have written to us about it. Common concensus is that the average standard of operating, not so much from the UK but from Mittel-Europe and the Mediterranean, was nothing short of 'orrible; having spent some time listening toVKOHI on 14MHz, we can't do anything else but agree. Far too many carriers swishing VFOs and generally self–important people telling everybody what was what (which telling everybody else what was what (which was wrong half the time anyway).

Can someone tell us why, if a DX station says quite clearly that he's working split-frequency, half of Northern Italy persist in calling him on his transmit frequency and wrecking the operation for everyone else? Doesn't the Italian equivalent of the RAE contain anything about understanding Q codes, or are all our English prejudices about Latin temperament right after all?

Pretty dreadful

It's an undeniable fact that the standard of operating in Italy in particular seems to be pretty dreadful. Very few Italian stations seem to know how to tune up a linear amplifier, and there seems to be a pronounced tendency for Italian stations to go hysterical as soon as anything remotely interesting shows up on a DX band. I know that in these humanistic days we're not supposed to have any prejudice and that generalisations about other nations and their national characteristics don't go down too well in certain quarters, but my goodness - a bit of sanity wouldn't go amiss.

The Yugoslavs weren't much better; a time or two we heard some Yugo stations sounding as though they were the 14MHz secret police and telling various people things that the amateur bands weren't ever meant to convey. For goodness sake, chaps, your continued existence doesn't depend on whether or not you work the

For the short wave listener

DX and it's only a hobby.....isn't it?

We thought of getting a trained psychologist to analyse the behaviour on some amateur bands but we figured we wouldn't be popular if we did that - so we'll just content ourselves by saying that in our opinion - and in many of our readers, it seems - some of the old-time amateur characteristics like gentlemanly behaviour, sanity and a sense of proportion seem to have gone very QRT, or at least to undergo rapid QSB every time a rare one shows up. One of the staff at the RSGB once told us that he had a notice above his desk that read 'It's not just a matter of life or death, you know, it's my HOBBY' and after listening to the Heard Island operation we can see why.....

Anyhow, after that moan, let's get on to better things. We recently received in the post from Mr E. Vaughan of High Wycombe a nice letter containing a whole lot of interesting little circuits for things, one of which included a natty HF preamp which included a really good direct conversion receiver for the 14 and 21MHz bands and a couple of interesting HF preamp designs. We mentioned an issue or two ago that we'd publish a design for a receiver – well, Mr Vaughan saved the trouble of designing one!

No tendency to hoot

We built one on the proverbial 'birds-nest' basis using a 40673 MOSFET which had been lying in a drawer doing nothing useful for a while, and we tried it out in front of an extremely old and tired AR88D which someone had brought into the office in transit to its new home. So here are a couple of Mr Vaughan's circuits. The first one is a conventional preamp for 28 and 21MHz and it ought to work with a fair variety of FETs - the design specifies a 3N140 or a 40637 but we used a 40673 in ours and one of the other technical fiends around the place built a version on a little PCB using a 3N204 - we told him that this was overkill, since that's usually used in quietish VHF front-ends, but he claimed that someone had given it to him....anyhow, it worked well.

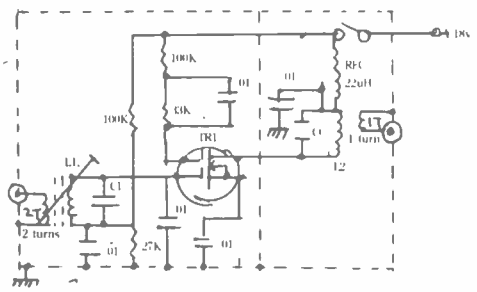
Construction ought not to be critical provided you keep the input and output leads reasonably far away from each other - our birdsnest one worked well and didn't show any tendency to hoot. The PCB was a bit rough and ready, so we didn't think we ought to print it or you might get the wrong idea about the quality of our technical fella - he did it in a lunch hour with a felt-tip and some ferric chloride that was decidedly past its best, so it didn't look quite as good as the Hewlett-Packard stuff he tested it with! Anyway, give it a whirl. Anywhere between 12 and 18 volts ought to work, and the alignment would simply be a matter of tweaking for best signals. We found on ours that L2 needed to be about twenty turns of thin wire on a high-value one watt resistor and that one way to make L1 was to use the same thing as the secondary (ie, the bit between the hot end of the 0.01uF and the gate of the FET) and to wind about three turns of thin wire over the top of the resulting coil to form the primary winding. That worked quite well, although you could have a lot of fun messing about with it with a view to getting the best match into the FET and the best coupling to whatever antenna you wanted to use.

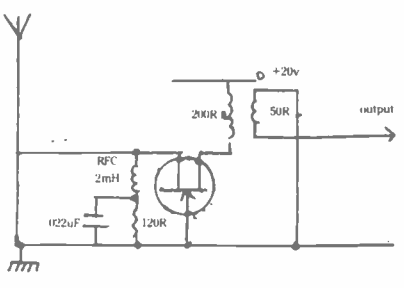
Mr Vaughan's other design is for a broadband pre–amp using a VMOS device. Now we haven't had time to try this so we can't make any recommendations. The only comment that we'd make is that it looks interesting but we'd be a bit careful of what sort of receiver we put it in front of. Mr Vaughan reckons this has a dynamic range of 140dB, which sounds a lot to us and it depends on the device that's used and a couple of important things. We'd suggest trying it out with something like a VK10AF and seeing what happens. In the meantime, thank you Mr. Vaughan, and we'll be pleased to see more of your work.Actually, we thought about having a Circuit Ideas Page in subsequent issues; we'll pay a small sum for every one that we publish, so let's see them!

Not too much else, except to say that conditions have been very up-and-down on the HF bands and apart from the Heard operation we haven't heard a lot. 7MHz has been quite profitable in the wee small hours, with some Caribbean and Central American stations showing at good strength - oh yes, isn't it good that the solar stuff on GB2RS has been cut down a bit? We can understand some of it now.....!

See you next time, and don't forget - this is your column and we need to hear from **you** about what you've heard and what you feel about it all.

Pre-amps *Dual-Gate MOSFET*





28MHz
C1-8pF
C6-10pF
L1, L2-1.6 to 3.1uH
TR1 3N140-40637

21MHz
C1-22pF
C6-22pF
L1-L2 no change

Broadband pre-amp using power FET capable of handling signals to almost 3v p-p, 0.5 to 40MHz with 2.5dB noise figure and 140dB dynamic range. Drain current 40mA. Voltage gain 10dB.

STRAIGHT·AND·LEVEL

News and views from the world of the radio amateur, compiled by the staff of Amateur Radio.

Another month on the Amateur Wireless Waves (or, as the British Broadcasting Company said in 1926, "What are the Wild Waves Saying?" Sounds like a good title for this column, actually . . .) with some good conditions on 144 and 432MHz at the back end of February and, apparently, lots of good DX being worked on some other bands.

The 50MHz people seem to have been having some fun and we've been having a listen to see who's been on and what's been worked. General story so far seems to be that many of the 40 have worked each other but there hasn't been anything worked in the way of esoteric and exciting stations from many miles away – we ourselves have heard nary a DXish thing on the band in the last month or so, despite having gone to some trouble to find and use a good 50MHz converter using a BFT66E front-end and a high-level mixer.

We'll be publishing this design as soon aw we've persuaded ourselves that it's repeatable and that the PCB layout works every time; the trouble is that getting the magazine together doesn't give us nearly enough time for the practical side of things at the moment. It's beginning to look as though we're going to have to expand things here at Bicester, thanks to all you lovely folk out there who buy the mag and keep us in the odd slice of cheese-on-toast-with-tomatoes-on-Thursdays *(oh do shut up, you lot – you only had a rise last year – Managing Editor).*

Illegal rigs?

We had a few letters last month asking rather querulously why we allow illegal CB sets to be advertised in the classified columns. Well, we thought about this a lot when we first got started, and the answer goes something like this. Firstly, we don't condone in any way the use of anything illegal, whether it's multimode CB rigs with weird and wonderful bands, 6MHz transceivers or whatever; we recognise that it's a free country and everyone's able to break the law if they want to but we don't feel like preaching about it except to say that we ourselves don't ever and wouldn't ever. I admit I was a naughty boy on Top Band about twenty years ago, but that doesn't seem quite the same as the trends today. So let's get that straight; nothing in this magazine is in any sense an encouragement to anyone to do anything illegal, and we're proud of the amateur bands, proud of our licence privileges and value them far too highly to jeopardise them in any way whatsoever.

Enormous increase in the number of licencees

So that's our position. However, we recognise that, like my naughty week on Top Band, most people eventually change their ways and realise that there are better ways of living than being illegal just for the hell of it. In amateur radio, the enormous increase in the number of licencees would suggest that a lot of people have become disenchanted with other forms of radio, be they CB or 27MHz AM or whatever; and any club secretary running an RAE course will confirm that many people come to amateur radio from this direction. So let's assume that quite a few people possess, say, a multimode 27MHz rig, see the error of their ways or just decide that amateur radio sounds like a better idea and go for it. And they want to sell the multimode so that they can have the cash to buy something appropriate. That's more like the scenario we suspect, and indeed the scenario that many people phone us about when they want to put an ad in.

RSGB talk

So we ended up thinking that we wouldn't object to advertisements for what is, in fact, illegal gear because many amateurs come into the hobby via that route whether we like it or not. And who dares to say that the bad lad of today might not become the leading amateur of tomorrow? We certainly aren't that arrogant, and after all we don't make money on our classified ads so there's nothing whatever in it for us except a hope that, on balance, we're helping amateur radio in a roundabout sort of way.

But, we're human and we might have overlooked something. Don't forget that if you feel strongly about something, don't sit there and seethe about it, drop us a line and let's have your opinion. If you all feel it's the wrong decision we'll look at it again and maybe change the rules a bit.

We were hoping to have in this issue (but couldn't due to what British Rail calls "operating difficulties") an interview with the General Manager of the RSGB, David Evans, G3OUF. But we'll be running the feature in our next issue. Another ham radio magazine had an editorial last month which slammed the Society for a couple of things that it doesn't, as far as we can see, seem to have done; it'd be interesting to find out why some responsible people have it in for the Potters Bar chaps. Actually, come to think of it, we heard a rumour that that magazine was buying ours; a couple of people we overheard when listening around 144MHz recently were saying as much. and indeed we had a phone call asking us whether it was true. The answer is no. Dammit all, we *like* working on this magazine. There is no truth whatsoever in this rumour – someone got their wires crossed and is confusing us with *Popular Motoring* or whoever it was that was taken over recently. We quite like the other radio mags from the technical viewpoint, although we wish they wouldn't knock the RSGB quite so much. There's nothing wrong with having a go if you get your facts right and there's something that needs sorting out, but just knocking for the hell of it gets boring after a while.

MoD is the primary user

The VHF Phase 5 and UHF Phase 6 repeaters have now been licenced, and several of them were on the air as of the time of writing. Reading between the lines, and thinking about the fact that MoD seem to be getting more active on 432MHz, we're just wondering whether the repeater network will expand much more. This band seems to us to be undergoing something of a change of attitude as far as MoD are concerned, and despite the fact that they're the primary users and the amateurs are secondary and have been so for donkey's years, we're beginning to get the feeling that we're going to have to change our outlook as far as 432MHz in concerned. Or maybe that last sentence should have read "because of" instead of "despite" – it's just that we don't feel that the amateur service has ever been as secure in this bit of the RF spectrum as we have in others. We didn't realise until the other day, when we spoke to the Ministry's very friendly Press Officer, that the MoD is effectively the primary user of ALL amateur bands from 430 to 24GHz and that amateurs are secondary in every single band; now this has always been the case, actually, but it looks to us as though the time isn't far away when that sharing actually gets to mean something instead of being a paper idea in some musty old book of regulations. Watch this space . . .

We'll be going over to a system of two-letter prefixes

Right – they tell us that confession is good for the soul so we'd better get on with it. Last month we said that we were hoping to get a simple propagation forecast for the HF bands going in this issue – well, it was all cut and dried and then, would you credit it, one of the men involved got posted to Hong Kong at three days' notice! So we've got to re-hash the idea, and we're just in the throes of tapping a good friend of ours who ought to be able to do the job for us. So, if you were looking forward to some propagation news, stick with us and we'll definitely (he said, crossing fingers and toes like lightning) have it next month.

Isn't it interesting that there are now more Class B licencees than Class As, or so the Home Office told us the other week? We rang them to ask about the dreaded MOLD system, or actually to ask them whether it was OK to call it that or would the entire staff of Goodhead Publications be whisked off to the Tower of London if we breathed the sacred word? They said no, so we did *(MOLD, in case you'd forgotten, is the MoD system that's now in the 432MHz band – Ed)*. In passing, they mentioned the startling statistic about As and Bs and proffered the information that we'll probably be going over to a system of two-letter prefixes when the existing G4 and G6 callsigns run out. We can't see the G6 calls lasting much beyond the next RAE ourselves, and we asked him for some details; he told us that it hadn't been settled yet but that they were considering a system of two-letter prefixes beginning with G and having things like E for England and S for Scotland. So presumably the prefixes will be GE4 and GS6, for instance, although he said that there wouldn't be a decision on it for "a few months".

An old dodge – cutting glass under water!

Apparently, G7 and G9 callsigns are still very alive and used on all sorts of odd frequencies for testing and development of transmitters and what-have-you. Funnily enough, we heard one a while ago whilst driving from Bicester to Oxford one very wet night and trying to tune in Radio 210 on the car radio – it was near the top of the medium-wave band and sending "G7D" at *enormous* strength about once every five seconds. It wasn't there a few days later, and unless it was something like an aeronautical or maritime MF beacon being tested we haven't a clue as to what it was.

Anyway (where was I?) G7 and G9 can't be used and the Home Office has decided against issuing old callsigns over again, thank the Lord – can you imagine the problems? G1 calls are out and so are G0. So two-letter prefixes it looks like, folks.

Just to finish with, we thought you might like the enclosed "Ten Commandments" which we came across in a club newsletter some time ago. The only snag is that we removed the page from the newsletter to photocopy it and then promptly forgot where we'd put the original, so we can't for the life of us remember where the hell it came from – if any club feels strongly about the infringement of copyright, please let us know and we'll give you some beer or a free subscription or something. If it *was* your club, they're nice aren't they?

Whoever wrote the commandments on this page had a sense of humour – let's hope it wasn't the voice of experience. Safety is important, though, as we keep saying in some of our articles, and it never hurts to remember that your life is a damned sight more important than most other things and certainly more important than amateur radio!

A technical tip of the month which I'll pass on because I'd never have believed it if I hadn't seen in with my own eyes. Technical man was repairing a rather nice old milliammeter which he'd salvaged from somewhere or other and got to work – the only remaining problem was that the glass on the meter front has long since cracked. He'd got a sheet of thin glass from somewhere and marked out the shape of the meter front he wanted on it and I asked him how he was going to cut it out. I thought he'd use some sort of diamond cutter but, oh no, that was far too complicated. Would you believe, he took it over to the sink, with a pair of office-type scissors in the other hand, filled the sink full of cold water, submerged the piece of glass and then calmly cut it to shape with the scissors? I really thought I'd had a few too many that lunchtime . . . but it's an old dodge, apparently. C U next time.

THE TEN COMMANDMENTS

1. *BEWARE OF THE LIGHTNING THAT LURKETH IN AN UNDISCHARGED CAPACITOR, LEST IT CAUSE THEE TO BE BOUNCED UPON THY BUTTOCKS IN AN UNGENTLEMANLY MANNER.*
2. *CAUSE THOU THE SWITCH THAT SUPPLIETH LARGE QUANTITIES OF JUICE TO BE OPENED AND THUSLY TAGGED, SO THAT THY DAYS BE LONG IN THIS EARTHLY VALE OF TEARS.*
3. *PROVE TO THYSELF THAT ALL CIRCUITS THAT RADIATE AND UPON WHICH THOU WORKEST ARE GROUNDED, LEST THEY RAISE THEE UP TO HIGH FREQUENCY POTENTIAL AND CAUSE THEE TO RADIATE ALSO.*
4. *TAKE CARE THAT THOU USETH THE PROPER METHOD WHEN THOU TAKEST THE MEASURE OF HIGH VOLTAGE CIRCUITS SO THOU DOST NOT INCINERATE BOTH THYSELF AND THEY METER. FOR THOU HAST NO SERIAL NUMBER AND CAN BE EASILY REPLACED, BUT THE METER DOTH HAVE ONE AND, AS A CONSEQUENCE, BRINGETH MUCH WOE UNTO THE SUPPLY DEPARTMENT.*
5. *TARRIEST THOU NOT AMONGST THOSE WHO DEAL IN INTENTIONAL SHOCKS, FOR THEY ARE SURELY UNBELIEVERS AND ARE NOT LONG FOR THIS EARTHLY VALE OF TEARS.*
6. *TAKE CARE THAT THOU TAMPEREST NOT AMONG INTERLOCKS AND SAFETY DEVICES, FOR THIS WILL INCUR THE WRATH OF THY SENIORS AND BRING FORTH THE FURY OF THE SAFETY OFFICER TO BE VISITED ON THY HEAD AND SHOULDERS.*
7. *WORKEST THOU NOT UPON ENERGISED EQUIPMENT, FOR IF THOU DOTH, THY GOOD FRIENDS WILL SURELY BE BUYING STRONG LIQUOR FOR THY WIDOW AND CONSOLING HER IN OTHER WAYS NOT GENERALLY ACCEPTABLE TO THEE.*
8. *VERILY I SAY UNTO YOU: NEVER SERVICE HIGH VOLTAGE EQUIPMENT ALONE. FOR ELECTRIC COOKING IS A SLOTHFUL PROCESS AND THOU MIGHTEST SIZZLE IN THINE OWN FAT FOR HOURS ON END BEFORE THY MAKER SEES FIT TO DRAG THEE INTO HIS FOLD.*
9. *TRIFLE THOU NOT WITH RADIOACTIVE TUBES AND SUBSTANCES LEST THOU COMMENCETH TO GLOW IN THE DARK LIKE UNTO A LIGHTNING BUG, AND THY WIFE BE FRUSTRATED NIGHTLY AND HAVE NO FURTHER USE FOR THEE EXCEPT FOR THY WAGE.*
10. *COMMIT THOU TO MEMORY THE WORKS OF THE PROPHETS WHICH ARE WRITTEN IN THE TABLETS OF INSTRUCTION AND GIVEN THE STRAIGHT DOPE WHICH CONSOLETH THEE.*

IF ALL OF THESE PRECEPTS ARE FOLLOWED, YOU WILL SURELY BE OF THOSE ADMITTED TO THE GLORIOUS KINGDOM AT THE DAY OF JUDGEMENT

With apologies . . .

COMPUTERS IN AMATEUR RADIO

Computing is a growing area within the hobby of amateur radio. Here, John Morris, G4ANB, explains what's possible with a computer in your shack. He also gives us an idea of what the future holds...

Computers and amateur radio go together. They are both branches of that massive subject, electronics. Amateur radio is about setting information from one place to another. Computing is about doing things with that information. They are two aspects of the latest fashionable buzz-study, "Information Technology" (Why does that always get capitalised?).

You can look at computers and amateur radio in several ways. If your only interest is amateur radio, then a computer can be a tool. A highly efficient, remarkably versatile tool admittedly, but a tool for all that – just like all the maps, logbooks, countries lists that lie around the typical shack.

If you are really into computers then amateur radio can be the tool, or maybe just an excuse to write programs and build hardware. This attitude is not new; there are plenty of amateurs around who will spend weeks and months building a transceiver, have one or two contacts with it, and then start building something else. To them it is not using the equipment that counts, but the act of creation. Writing computer programs can be the same.

As you have bought this magazine, your first interest is probably amateur radio, rather than computers. So let's start from there, and see what a computer in the shack can do for you.

Programs and data

Amateur radio programs fall into three nebulous groups. according to the sort of data they play with. Data, by the way, in computerese is just another way of saying "information". Computers manipulate information in some coded form. Wandering around the little chips as electrical ons and offs. You don't really need to know anything about the internal workings of the machine, any more than a car driver needs to know anything about the dynamic equations controlling air-fuel mixing in a carburettor. So let's forget all about what goes on inside, and remember that computers manipulate information, or as it is called in the trade "process data".

The way that data is processed is controlled by the "program" in the computer. A computer program is simply a set of instructions, telling the machine what to do. It has to be written in a language the computer can understand, but that's another thing we need not go into details about here. There are plenty of books around, and anyone who can learn to drive a car can to learn to drive a computer competently. Driving it *well* can be a bit more tricky, just as driving a car well takes a bit more than competence. That's why the very best computer drivers - programmers - earn a lot of money. But to use a

computer you don't need to be a red hot programmer, any more than you have to be James Hunt before taking a spin on a Sunday afternoon.

Number crunching

Let's get back to the subject, those three types of amateur radio programs. The first type plays with numbers. The numbers could come from almost anywhere; they don't mean a thing to the computer, only the person who is using it. Because they use numbers, these programs are called "number crunching".

Number crunching programs are those where the computer is given a few numbers, sits and thinks for a while, and then regurgitates some other numbers.

Let's have a few examples. If you are into big antennas and lots of power on VHF or up then you have probably toyed with the idea of moonbounce. Now, a problem with bouncing signals off the moon is that you need to know where the moon is - which can be tricky during the day or on cloudy nights. Even if you can see the moon, there is not much point trying to work someone in the USA if it happens to be below the horizon over there.

In comes the computer; feed it a suitable program, tell it the date, where you are, and where the other station is, and it will tell you where the moon is for both you and the station you want to contact. Add a printer and you can get a personalised moon calendar for a month at a time, giving the bearing and elevation above the horizon of the moon at regular intervals. Make the program really fancy and you can even find out how much Doppler shift to expect. Goodbye Nautical Almanac and hours with paper, pencil and calculator!

Coming a bit closer to home, many amateurs use computers to predict the positions of amateur satellites, and this is going to get much more common - and exciting - with the coming of the Phase 3 orbiter.

For the short wave enthusiast the computer can give some indication of what sort of conditions to expect on the HF bands. Again using a suitable program, tell it the time of year, the sunspot number, and where you want to work, and it will reply with an estimate of the maximum usable frequency. It may not be at all that *good* an estimate - we don't know enough about what goes on in the ionosphere just yet - and it may not be as good as one from the professional propagation predictors, but it is at least a guideline, and it is tailored to your requirements.

Let's look at that last example again. The computer can't give a very precise prediction of MUF because we don't know enough. *We* don't know enough, not the *computer* doesn't know enough. The computer knows nothing. This is important. The computer in the shack can only do things that people tell it how to do. It has no imagination or initiative of its own. So if you, or anyone else who writes the program, don't know how to calculate something, the computer will not be able to find out. A number crunching program cannot do anything that could not be done using a scientific calculator, or even log tables. It just does it much more quickly, makes fewer mistakes, and is much more convenient.

When you get tired of operating and decide to build something, the computer calls in again. Forget all those confusing impedance calculations. Let the computer be a "complex calculator" and do the boring bits for you. That leaves more time to get on with the basic design. For some simple circuits, such a resistive attenuators, it is possible to get the computer to design the whole. Just feed in your requirements and it replies with the best component values. All you have to then is build it. Writing such a program is also an excellent way of making sure you understand the problem yourself.

Character crunching

The second group of programs can be called "character crunching". As the name implies, they deal with characters, such as letters and digits. All radio amateurs have callsigns, and these are made up of characters, so there is plenty of scope for the computer.

A common and very useful program is a "duplicate checker" for use in contests. In most contests it is against the rules to work a given station more than once. Checking through hundreds of contacts by hand for two that are the same is, to say the least, tedious. Typing all the callsigns into a computer is also tedious, but less so. While putting the callsigns in you might as well include the other contact details, and get the computer to print out a neatly formatted, eminently readable log at the end.

Another example. Have you ever had that embarrassing experience of making a contact with someone who you have worked before, and knows all about you, but whose name you just cannot remember? A few years ago it would have been a good bet that you had come across someone with a well kept index-card system. These days it is just as likely that the information is being read off a computer screen.

There are two great problems with many of these "character crunching" programs. They tend to need a lot of storage, and they usually involve a lot of typing. An index system sounds fine in theory, but in practice it means having floppy discs to store the massive amounts of information that will be accumulated. And that starts to cost money.

The typing can also be painful. While the Home Office insists that we have to keep a log book (not loose-leaf) in which all contacts must be recorded in indelible ink, computer storage documents looks a bit sick. Who wants to have to write all the legally required information into the book, and then type it in again to the computer?

There are programs that combine number crunching and character crunching. Converting QTH locator references to distances and bearings is a popular example. Type in your own locator, and that of the station you have worked, and back comes the distance between you. For VHF/UHF contests you can also get the number of points scored in the RSGB "radial ring system".

The first stage of this is to analyse the locator typed in, break it down into little bits, and from these find the corresponding latitude. That is the character crunching part. When both locators have been sorted out the two latitude and longitude pairs are used to calculate the distance. That is the number crunching part.

Bit crunching

There are infinitely many possible different numbers. A computer can deal, at least approximately, with just about all of those likely to be encountered in amateur radio. The number of different characters likely to be used is rather smaller, maybe fifty or sixty. Continuing this process we reach the third group of programs, the "bit crunching" ones.

A "bit" is the simplest possible item of information. It can be either "true" or "false", or in electrical terms, "on" or "off". There are no other possibilities for a single bit. It is like a switch.

A bit crunching program deals with just a few bits at a time; maybe only one. Take Morse code. The key is either up or down, there are no other possibilities. A computer can be used at either end of a CW contact; either sending it or receiving it. Sending Morse by computer is actually quite simple, and programs to do this are available for many machines.

Receiving CW is a bit more tricky. It is not too hard to write a program that can copy well sent Morse under good conditions, but producing one that can drag those dots and dashes out of the noise and turn them into words is a bit more challenging. It's the same old problem; nobody really knows how human-type people manage to hear weak signals buried in the noise, broken up by QRN, so nobody has written

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a program that can do it so well.

Is this a disadvantage of computers? I don't think so. There is a whole field here ripe for amateur exploration. Amateurs led the world in developing use of first the short waves, then VHF and UHF, and then microwaves. The professionals, with professional resources, have caught up and overtaken us now in most fields, but here is an application where there are still new things to be done. Computers can not only be useful, but also open new challenges.

Once you have a CW sending program it is very easy to adapt it for Morse practice. It cannot replace personal tuition, but it can help relieve the tutor of some of his tedious slow pounding.

Instead of using a computer to send and receive CW, which was after all designed for human use, one can instead use it to send and receive codes designed for machines. On the amateur bands this mostly means radio teletype, or RTTY. Again this is communication using just a single bit; one of two tones is transmitted at any time. Until computer arrived, RTTY enthusiasts had large, often noisy teletypes sitting in the shack scaring visitors. A computer sitting quietly with characters appearing on a TV screen may not have the glorious mechanical delight of a teletype, bit it does take up less room, and keeps the neighbours happier. Listening on the air there is no difference.

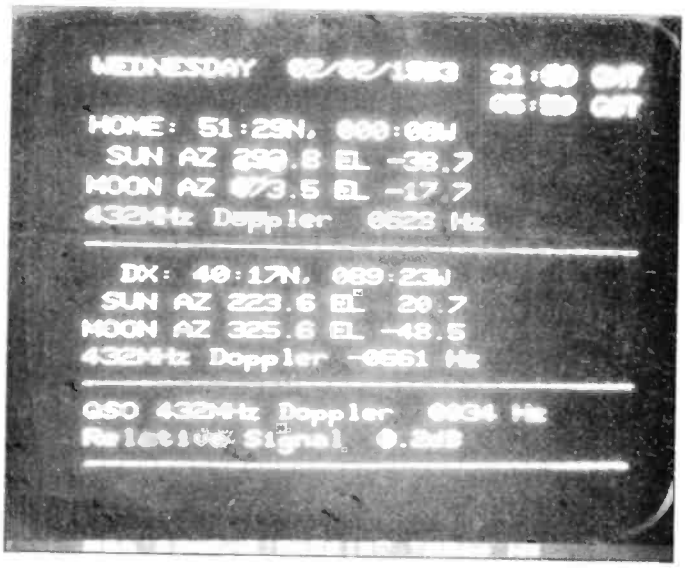
Beyond RTTY many amateurs have been experimenting with communication using "ASCII" codes. This is very similar to RTTY, except that the codes sent are those used by the computer itself, rather than copies of those produced by teletypes.

Equipment control

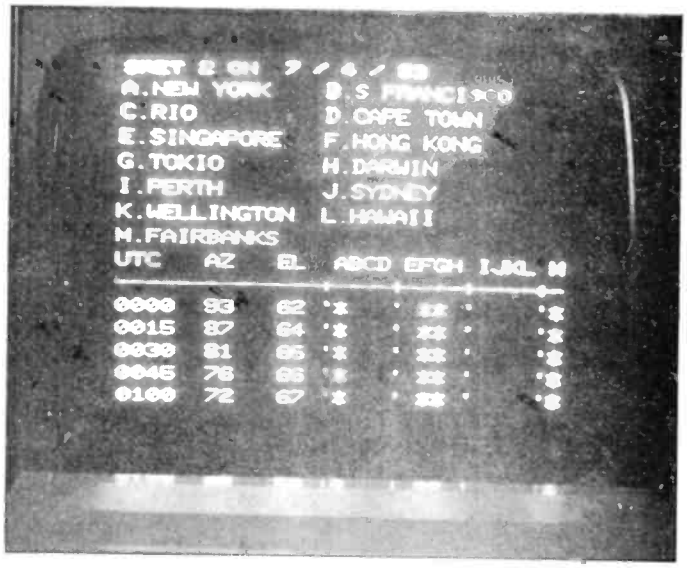
This rapidly leads on to the idea of computer communicating over the air, exchanging data and even programs. There is plenty of scope for exploration here, but it is more along the lines of using amateur radio as a computing tool, rather than vice-versa.

An interesting "bit crunching" use of computers is "Amtor", developed by G3PLX. In this system, microprocessors are used to send information repeatedly until an acknowledgment is received for the other end. The result can be reliable communication over paths that would normally be considered "unworkable". I suspect that amateurs have hardly scratched the surface of this subject.

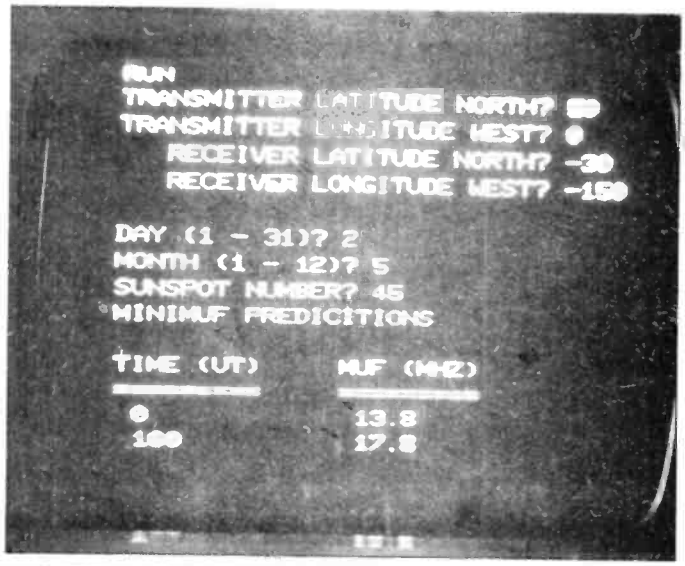
A real-time sun and moon position display. The azimuth (bearing) and elevation (degrees above the horizon) for the sun and moon are given for the "home" station and for a dx station, along with the time and date. For moonbounce contacts the expected Doppler shift and signal strength are also shown. The display is kept continuously up to date using a clock in the computer.

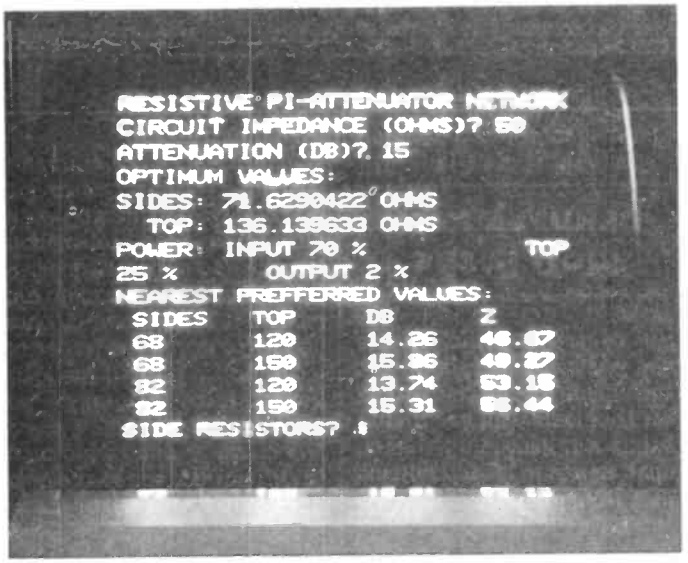


A satellite tracking program. This display is for SRET 2, which is not an amateur satellite, but is in orbit similar to that predicted for Phase 3. At 15min intervals the satellite position is given, and the line of asterisks shows which places could be worked at that time. Based on a program by GM4IHJ.

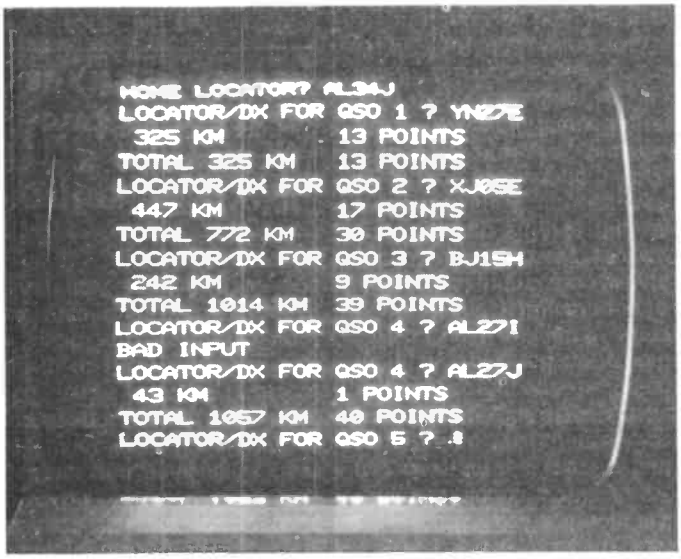


Given the day, date, position of two stations, and the sunspot number, the computer gives an estimate of the maximum usable frequency at regular intervals through the day.

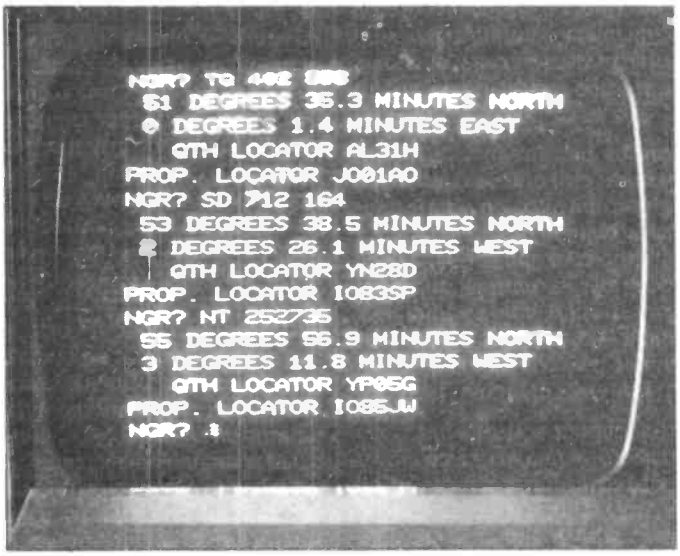




This display is produced by an attenuator design program. The required impedance and attenuation are fed in, and the program gives the best resistor values and the power that would be dissipated in each one. Then it gives the nearest preferred values, with the actual attenuation and impedance that each combination would produce.



A VHF contest scoring program. QTH locators are typed in, and for each one the distance and RSGB "radial ring" score are given, along with running totals.



Why spend hours with pencil and paper working out your QTH locator when the computer can do it for you? This display shows how the computer can be given a National Grid reference and calculate the corresponding latitude and longitude, as well as the locator reference, in any system you want.

Besides sending and receiving, computers can be used to control equipment. Many new rigs use microprocessors (which are just small computers) inside them simply because they are cheaper than conventional circuitry. On some transceivers, lines are brought out to a socket so that a home computer can be used to control the rig.

Continuing this theme we soon start encroaching on professional territory. Spread spectrum techniques;secure communication by "trap–door" encryption; speech encoding and decoding for bandwidth reduction; all of these techniques are impossible or at best more difficult without computers. Whether they can, or even should, be used on the amateur bands is problematical. Present licence conditions restrict experimentation that can be done, so there is little experience.

Interference

You may have noticed that the three groups of programs are divided not only by what sort of data they process, but also in the way they tend to be used. Number crunching programs are used by themselves, away from the rig. Character crunching programs are used while on the air, the operator alternately twiddling knobs on the rig and typing on the keyboard. Bit crunching programs involve a physical connection between the rig and the computer, usually via some interface circuits - home construction buffs please note!

As soon as you connect a computer to a rig, or even switch them both on in the same room, then one problem will become immediately obvious - interference. Most home computers are very, very noisy electrically, putting out harmonics well into the UHF bands. The normal methods of suppression should be used; screen all leads and fit filters wherever they leave a box, keep the physical separation as great as possible, and make sure all cases are well earthed. In extreme cases putting the whole computer inside a metal biscuit tin has been known to work!

The future

So far we have have been looking at what is being done by amateurs now. Let's speculate about the future a little. One may expect that computers will become more and more integrated with the rest of the gear in the shack. Each piece of equipment is likely to have its own, small microcomputer controlling it and reporting on what it is doing. All of the gear will then be slaved to a central "master" computer, controlled by the operator. Instead of having expensive digital displays on each and every piece of equipment, all the information required could also be showing

The biggest problem with computers and amateur radio is getting all the boxes onto one bench! Here though, is a typical amateur radio/computing set up. On the right is the rig with the usual SWR bridge, power supplies, converters and so on. On the left is the computer (with another on the shelf behind!) and a television for display. On top of the TV is a tape recorder for program and data storage.

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the time, and how many stations you have worked so far in a contest, and whatever else you fancy.

For a different sort of operating just change the program. Instead of a high pressure contest, where every bit of information you need is presented clearly on the screen, you are into "chatter" mode. Type in the callsign of someone you hear, and up pops a list of when you last worked, where he is and any other notes you made.

If you want to turn your beam to the north, then just tell the computer. We will probably have voice input by then! Get it to scan the VHF bands occasionally, and give you a shout if it finds evidence of Sporadic-E propagation. Be chatting away to a local and have it remind you five minutes in advance that you have a DX sked coming up. Why not? Computers can do these things. All we have to do is learn how to fit them into the shack so as to make amateur radio even more fun.

There is an ever present nagging worry that perhaps amateur radio is getting too clever; computers are doing too much; there will soon be no room left for the amateur who just likes to use simple equipment and enjoy operating.

This is a valid worry. It is a dispiriting thought that it could soon be possible to switch on a computer at the start of a CW contest, come back twenty four hours later, and have presented to you a potentially winning entry, ready to be posted off. But we need not, and should not, go down that road. To give an analogy, look at transport. There are *more* horses in Britain today, used for racing, recreational riding, pulling drays and underneath policeman and soldiers, than there were before the motor car was invented. The car has diminished the role of the horse as a means of transport, but made it possible for many more people to enjoy riding as a recreation.

Computers *should*, and if we are careful *will*, do same thing for amateur radio. Computers must not take over amateur radio, but be used to enhance it. There must always be room for non-computer users to operate in their favourite way, just as now the band plans all leave space for CW operation. So long as it is possible to build a simple transceiver, fasten it to a long bit of wire and pound the brass up and down to somebody at the other end of the world, without being laughed off the band as some sort of throwback, the spirit of amateur radio will still be alive.

Coming back to the present, now is the ideal time to start exploring the use of computers in amateur radio.

But did you pick up one vital point? All of these diverse activities are done by the *same machine*. A computer in the shack is not just one piece of equipment; it is many. It is whatever you can program it to be. For less than half the price of a good HF rig you can get - now - a machine that can do as many different jobs as you like. The only limit is your own imagination.


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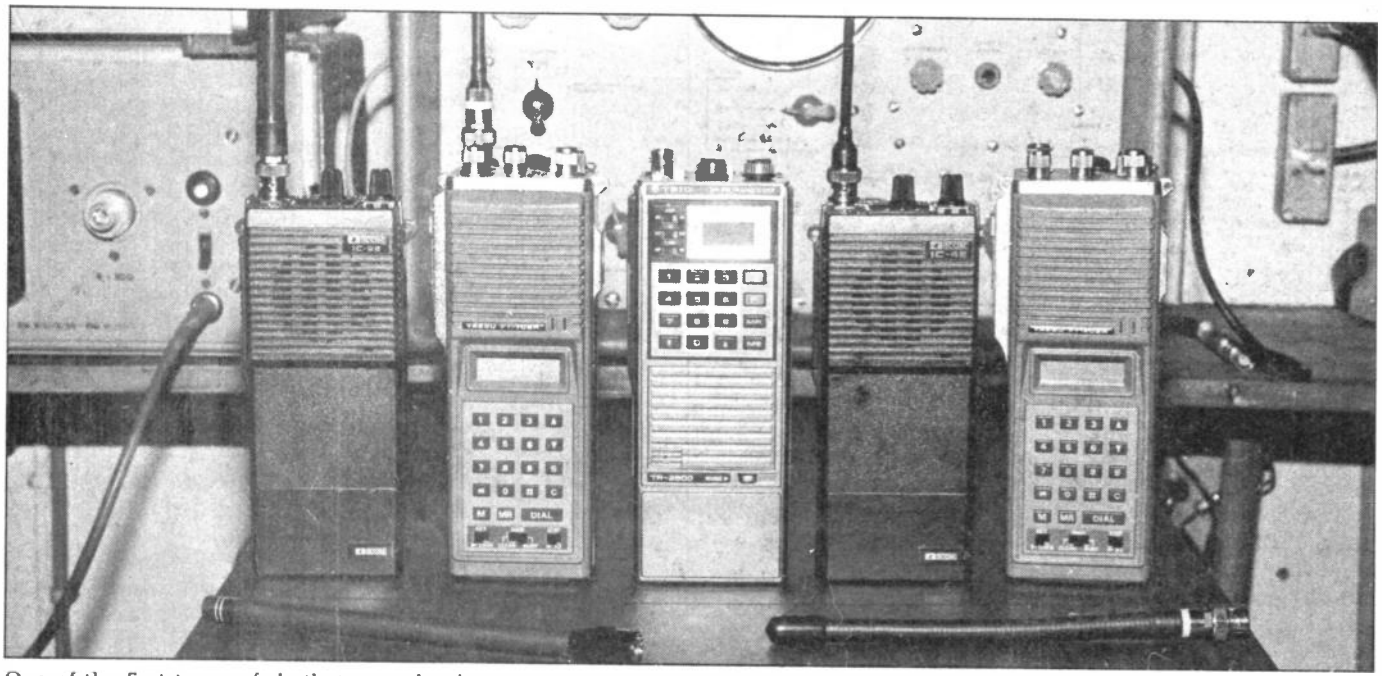
TOP HAND-HELDS TESTED

Continuing his series of important test reports, Angus McKenzie MBE, C.Eng., FIERE, G3OSS, puts five of the most popular hand-held rigs through their paces.

THE RIGS COMPARED

ICOM IC-2E	*£159.00*
ICOM IC-4E	*£199.00*
TRIO TR-2500	*£207.00*
YAESU FT-708R	*£205.00*
YAESU FT-208R	*£195.00*



One of the first types of rig that a newly licenced amateur is likely to purchase is a 2m, or perhaps 70cm hand portable transceiver, usually with an FM facility only.

The three most widely available makes are Icom, Yaesu and Trio, so we have chosen 2m rigs by each of these companies, and 70cm ones by Icom and Yaesu. The Trio 70cm equivalent arrived too late for testing, so has been held over for a future issue.

In order to give the reader an outline of such rigs it might be useful to comment briefly on some older ones that may well be available secondhand, or perhaps still in stock at your local friendly retailer at a reduced cost. It would only be fair for me to comment on models that I have myself owned or tried fairly comprehensively.

The AR240 was introduced into the UK in late 1978, and it is very similar (but less comprehensive) to the IC2E. RF sensitivity was fair; RFIM was diabolically bad on my sample, and selectivity much too wide. I found it awkward to use, although it was quite a lightweight. Unless it can be bought very cheaply, I do not recommend it. The earlier Yaesu FT207 was quite a nice rig, but had a nasty habit in which its synthesiser completely locked up, requiring the rig to be switched off, and then on again after several seconds. This of course made it useless for blind operators, and annoying for everybody. Several samples showed the same problem.

One of the earliest portables (rather than walkie talkies) was the notorious Trio 2200G which had relatively few crystal-controlled frequencies, was deaf as a door post, and rather heavy, although very reliable. The later Trio 2200GX had around 11 frequencies and was more sensitive, but still a little deaf by today's standards. Crystals used to cost several pounds per channel, so that an investment of £60 or so in crystals alone seems crazy today, now that we have modern synthesised rigs. The Trio 2300 was indeed synthesised and although rather heavy (being more a portable than a walkie talkie), was superb ergonomically, and reliable. It had 25kHz channelling, selectable by rotating a large knob round many click steps, and was

switchable between the bottom and top halves of the band, a repeater position giving down shift for TX. The 2300 could also be fitted with auto tone burst, and friends find them rather better than many modern rigs, which they consider too complex.

The rigs in this review have all been measured in the same way, and I have used them to work various locals, most of whom use such rigs frequently in Raynet exercises.

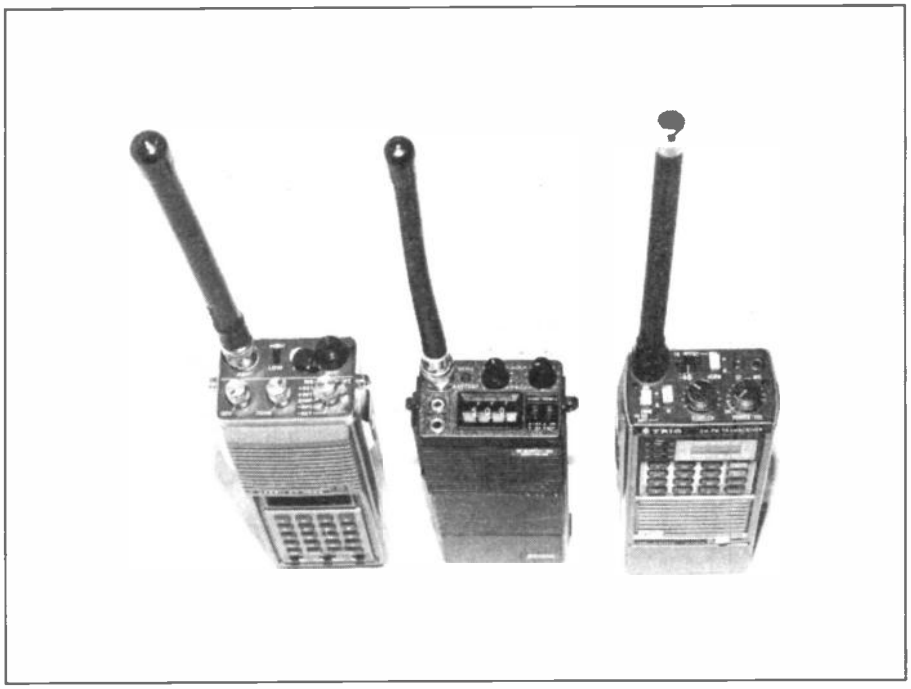
Ergonomics

In discussing the ergonomics of the rigs one must consider the ease of portability, the weight, and of course the retail cost. Some users want a rig which for 95% of the time might be used on one frequency only, whilst others hop around like Jiminy Cricket. I like to be able to have a quick listen on repeater inputs, but many don't bother. Battery size and current drain may be important for those who leave a rig on squelch all day long. Some prefer auto toneburst on 2m whereas others prefer to press the tone on within the PTT switch. Current drain on low power is important, and sometimes the low power position is nowhere near low enough, for many like short-range rigs for use in emergencies. Whilst all rigs reviewed accommodate 25kHz channelling, only the Yaesu 208 can manage 12½kHz spacing, and tuning ergonomics is in my opinion extremely important and may well rule out a set which otherwise is most recommendable.

Frequently, useres have been disappointed when they have tried to use walkie talkies and portables in a car. The audio power output is usually insufficient to compete with car noise, and often I have screwed up my face in agony when listening to the distorted noise emanating from a portable rig blaring forth on RX on the floor!

It is a pity that manufacturers have not designed these rigs to work properly on a basic 12v supply so that they could more easily be used mobile without the additional cost of a voltage attenuation/charger lead. There is the advantage, though, that nominal 8.4v units can actually be recharged from a cigar lighter socket (which may be useful in an emergency) so this is one point that outweighs the lack of direct 12v operation. It is all very nice to have complicated pads and pushbuttons for scanning, memory control, direct frequency access and almost everything bar pouring out a drink, but do we really need all this complication?

For many weeks, I have been asking amateurs what their basic requirements are, and whilst some like keypads it seems the majority feel that a walkie talkie should be as simple as possible, with perhaps either a 40-position rotary with a MHz switch and a 12.5kHz offset switch with the usual repeater functions, or an extremely simple key pad with 12.5/25kHz channellisation and up and down pushbuttons. Very few people had a good word to say about 10kHz channelling, and indeed quite a few went as far as to say that the use of channels offset by 10kHz from 25kHz ones was selfish, as it could cause much more interference to users of old equipment, than could the use of 12.5kHz offset frequencies. Having had a look at some of the criteria, by which you may care to make your judgement, let's see how each rig worked with its good and bad points.



Far left: From left to right, Icom IC-2E, Yaesu FT-708R, Trio TR-2500, Icom IC-4E, and Yaesu FT-208R. Above: Showing the controls on the (l to r) FT-208R, IC-2E, and TR-2500.

Icom IC-2E

Frequency changing is achieved by rotating three edgewise thumb wheels, each having ten steps for MHz, 100s and 10s of kHz. A 5kHz switch up-shifts to obtain 5kHz spacings. As supplied, the rig only covers the UK 2MHz band width, but is modifiable internally for the US market, requiring 4MHz. The aerial is a rubber duck plugging into a standard BNC socket and by its side are miniature sockets for external mike and ear piece/spkr. On the main operating panel are simple squelch and gain controls with a separate miniature on/off switch. I would have preferred this to have been built into the volume control and I found it was awkward to use, frequently leaving it on by mistake! Switches on the back control high/low power, simplex/duplex operation, and TX plus or minus shift.

A large and strong belt clip is on the back, but caused slight top-heaviness unless the belt worn is a thick one. Whilst it did clip on to the top of my trousers, I felt it to be rather clumsy, but my colleague had no problems with his large belt! The PTT switch on the side was easy to use, but tone burst required the volume control to be depressed, it neither being automatic nor built into the PTT, although putting carrier on when pushed as well as tone. Its light weight made it very attractive for Raynet use, but I disliked the channelling system intensely.

Transmitted speech quality was generally regarded as thin but acceptable, with RX also reasonable, although of limited volume.

Technical comments: RF sensitivity was excellent, RFIM poor; selectivity was poor for rejecting 12.5kHz offsets but good for 25kHz rejection. Audio output power was limited, and distortion high at at average levels. Current consumption with RX squelched was low, which is a great benefit. The receive frequency was only marginally mis-set at the factory, sensitivity measuring slightly better, with the RF frequency being offset by only one kHz.

The transmitter gave a useful ratio between high and low power, and was reasonably economical on current drain on low power, but efficient at high power which is most commendable, although our review sample seemed more efficient by far than the manufacturer's specification claimed. Transmitted frequencies averaged around 310Hz high, which is adequate, repeater shift being nearly 500Hz out, which is getting a little near the edge, if you are weak into a repeater. Absolute maximum deviation was slightly on the high side, whilst normal speech deviation was surprisingly no lower. A small tweak of the deviation pre-set would bring the deviation down to a recommended 4kHz. The tone burst frequency was extremely accurate, and deviation about right. RF harmonic distortion was reasonable for a VHF rig, although the second harmonic of the other two 2m rigs was better.

Summary. The main good points about this rig are its light weight, sensitivity and acceptable selectivity for normal use, but its bad points are the awkward tuning and the lack of facilities. Battery economy is a strong point in favour, but it is awkward if you want to listen on repeater input. Perhaps this rig is a little over-priced. It is well established now, and everyone tells me that it is extremely reliable. Strongly recommended for Raynet use, and probably the rig for you if you do not want to change frequency too often.

top panel is a BNC socket for the antenna, a rubber duck being provided. A small high/low power switch is alongside this socket. External earpiece and microphone sockets have useful waterproof tags over them.

A mode switch by the side of the volume and squelch controls selects simplex, normal duplex, TX+ shift at 600kHz, + and – programmable equal repeater shifts (ideal when transverting to 70cms repeaters), and a final position which splits between memory for receive and dialled frequency for transmit. A heavy duty belt dip on the back was liked and the rig did not seem as top heavy as the IC2E. Most listeners found the transmit audio quality very slightly woolly, but I found the receive quality excellent for communication purposes; the built-in speaker was more efficient than average, capable of giving a louder sound although reproduction was slightly coloured, and never completely clean. Only marginal synthesiser whine was audible on the transmission by a local amateur, but no whine was noticeable on RX. The rig was a delight to use, sensitive and versatile. I felt though, that it was too heavy for a walkie talkie, but reasonable for a portable rig.

Technical comments: RF sensitivity was excellent, but RFIM poor. Selectivity was amazingly good at 12.5kHz, in fact just as good as the IC2E was at 25kHz, and so there will be virtually no break-through from adjacent channels, other than that due to RFIM; the 25kHz selectivity was even better. More audio power was available on the FT208, but received distortion was not noticeably clearer at lower levels than the IC2E. The DC current drawn by the receiver when squelched was again low, and should not cause a problem. The FT208R receiver gave optimum performance precisely on frequency, which is creditable. On transmit, the rig gave a surprisingly high output power, which reduced usefully in the low position, but whilst the current drawn on high power was reasonable, on low power it was double that of the IC2E, which is fascinating, showing the Yaesu should perhaps examine current drain economy systems.

Transmitted frequency accuracy was good, withim 30Hz. Repeater shift accuracy was precise, which is commendable. The frequency deviation was as usual set slightly on the high side, particularly bearing in mind that the rig is basically set up for optimum performance at 12½kHz spacing, and the deviation setting needs to be taken down by around 4dB or so, although the tone burst deviation was correct. Tone burst frequency was extremely accurate. Second and third harmonic transmitted outputs were at low levels, and should not cause any problem.

Summary. I must admit to enjoying using this rig, and only two points were disappointing; the weight was rather high, and the RFIM performance average. This is a good multi-purpose rig, good as a portable, perfectly reasonable as a home station rig, and provided you do not have too many strong locals, also good for use for driving a 2m to 70cm transverter. The price seems about right, and this may be discounted more readily than Icom anyway, which is all to the good. It should be reasonable in your car as it seemed to be appreciably louder than the IC2E, although not loud enough for very regular use. Recommended as a good all-purpose rig, within its limitations; can be internally modified for 10kHz spacing for overseas use.

Trio TR-2500

Frequency selection can be made either from the numerical key pad (as with the FT208), from scanning (scanning steps can be programmed in addition to start and stop frequency including all normal scanning facilities), from memory recall (ten stores), or from up/down buttons which can step 5kHz at a time. The last point is a bad snag.

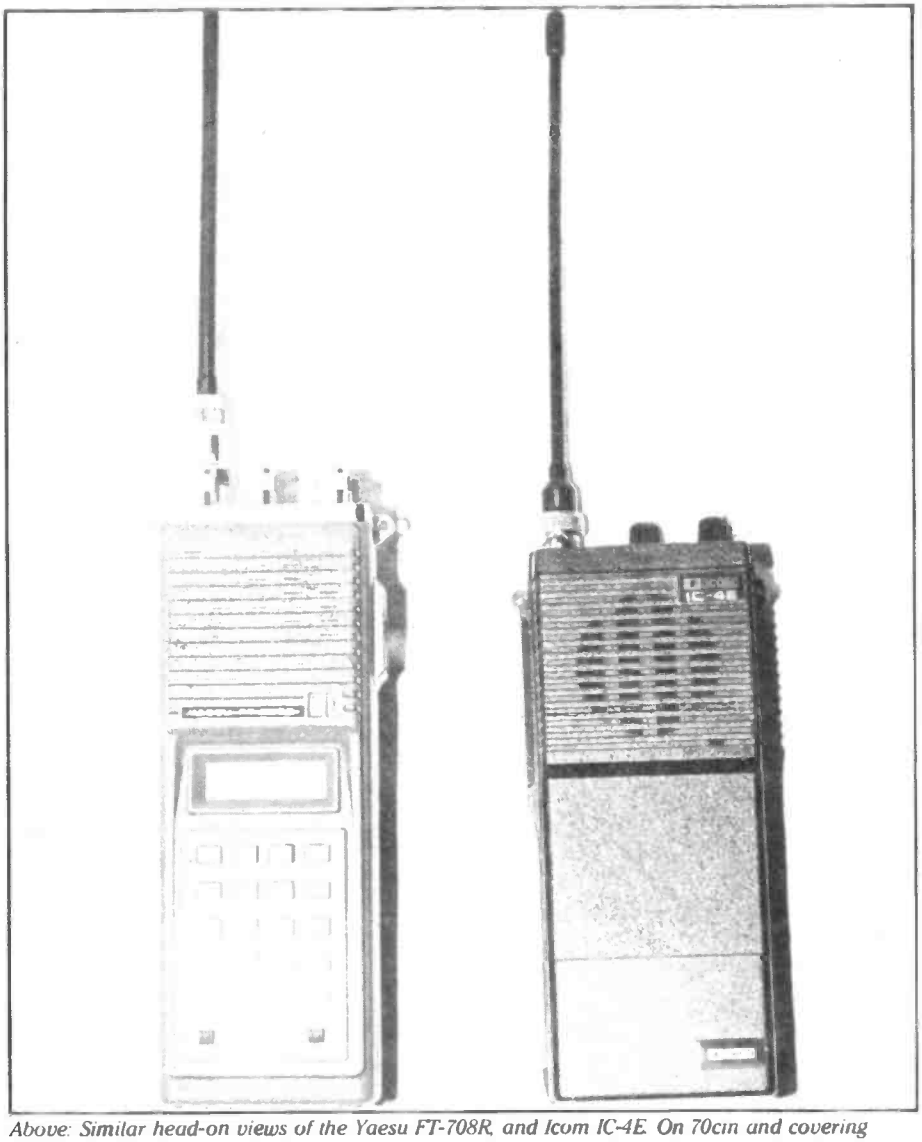
As with the FT 208, the TR2500 has a lithium battery which should last five years as a back up for memory, and allows the rig to come on on the same frequency as had last been used before switch off. On the top of the rig is a BNC socket for the aerial (rubber duck supplied) in front of which are two buttons operating auto tone burst, on/off and high or low TX power. A three-position switch (slightly awkwardly situated) selects simplex, normal repeater or split operation with memory TX and dial RX.

A useful pushbutton is provided for listening on repeater input, which I feel is a valuable asset; two miniature sockets are provided for external speaker and microphone connections. The PTT on the left was easy to operate, and the rig did not feel much heavier than the IC2E, and was well balanced. Transmit quality, although liked, slightly lacks HF. Receive quality was good but limited in volume from the internal speaker, although distortion was low with the volume kept down, audio seeming clean on a good transmission. The audio receive quality was thought better than that of the other two rigs, and this was judged before lab measurements were taken.

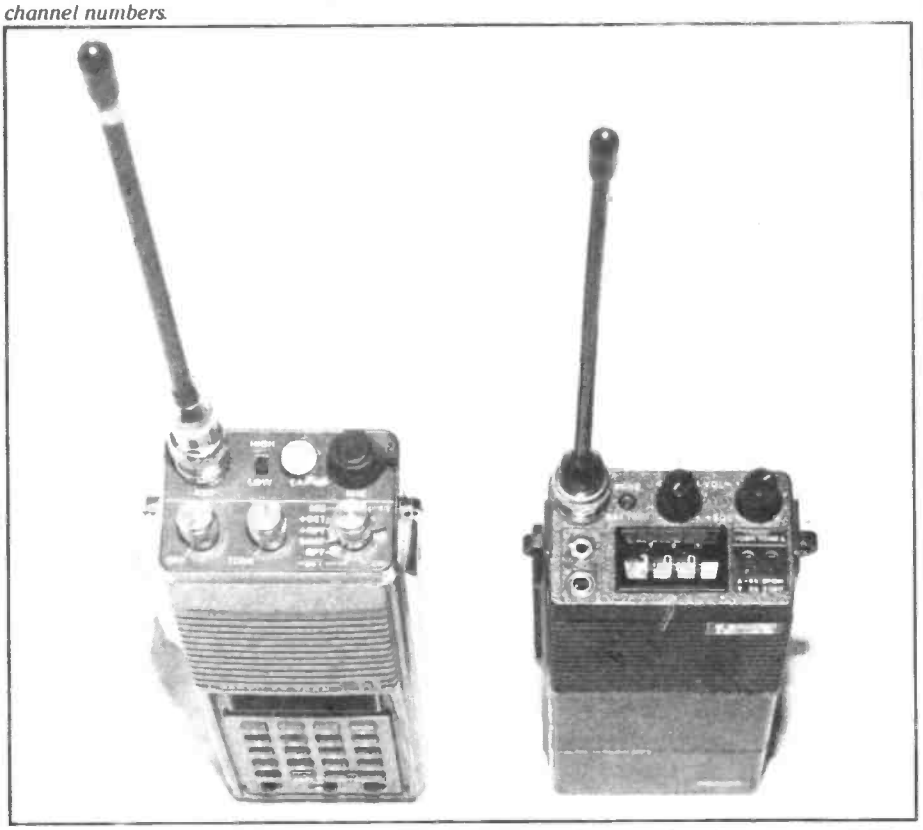
Technical comments: Although the RF sensitivity was the worst measurement of the three 2m rigs, it was only 1dB inferior to the best, which would hardly be noticeable, and the sensitivity is far better than portables of a few years ago. RFIM was some 10dB better than that of the other two rigs and was thought good, allowing for better results under fixed station operation as well as mobile. Selectivity was better than the IC2E at 12.5kHz spacing, but was not as good as either the latter or the FT208 at 24kHz and we feel that Trio should consider a better filter in future. Audio power output into eight Ohms fell between that of the other two rigs, but the internal speaker was not very efficient, and so the apparent volume was limited, although audio distortion at normal settings was much lower on the Trio than on the other rigs. RX with squelch on current drain was significantly higher on this rig than on the other two. Bearing in mind that the Trio and Icom batteries have about the same capacity (but the Yaesu battery is a larger one), Trio should try to reduce consumption. The RF frequency on receive was only marginally off, a 500Hz shift in the generator improving the sinad ratio by 1dB, this being equivalent to around 0.5dB RF improvement.

On transmit, the ratio between low and high power was well controlled, but the high current drain on high power seems strange, whilst the drop to low power seemed quite considerable, although the current was much higher than on the IC2E again. It seemed that the PA transistor of

All three hand-helds look neat in their non-reflective cases, and short but businesslike antennae. From left to right are the Yaesu FT-208R, Icom IC-2E, and Trio TR-2500. Trio and Icom batteries have roughly the same capacity, while the Yaesu's battery is slightly larger. Current drain on the Trio was relatively high, with squelch on.



Above: Similar head-on views of the Yaesu FT-708R, and Icom IC-4E. On 70cm and covering 10MHz, the IC-4E is virtually the same in style and operation as the IC-2E, except that the repeater switch allows reception of repeater input frequency, among other things. Below: Top views of the FT-708R and IC-4E (right). Note the different ways the manufacturers indicate channel numbers.



the review sample was perhaps less efficient than it should have been, and other samples would be better. Maximum deviation was rather high, and even average speech close to the mike was too high; the deviation preset should be taken down quite a lot, although tone burst deviation seemed satisfactory (auto, too short to measure easily). Tone burst frequency was marginally low, but well within reasonable tolerances. The 2nd and 3rd harmonic was exceptionally good, and this is commendable. Simplex frequency accuracy was very good, and repeater shift accurate.

Summary: I like using the little Trio a lot, but its main snags are the 5kHz steps which were annoying, the limited audio output and the highish battery consumption. Outweighing this was a good audio quality, excellent main facilities, its light weight and the RFIM performance, although selectivity was a little disappointing. If weight is an important consideration and you want memory/scanning facilities, then this is certainly a recommendable rig, the reverse repeater button being thought a particularly strong point. Auto tone burst reduces aggro on 2m, and can, of course, be switched off for 70cm repeater operation once a repeater has been accessed, when the rig is used with a transverter, itself having repeater shift. The price is slightly high, especially since Trio equipment is not normally readily discounted, but there is most certainly room for this model.

Icom IC-4E

This model working on 70cms and covering 10MHz is virtually identical in styling and operation to the IC2E except that the repeater switch – in addition to normal repeater operation – allows reception of repeater input frequency. Unfortunately, when switched to this latter position, the rig still transmits on repeater input which is a pity. The supplied aerial is a quarter-wave flexiwhip. The transmitted audio quality seems rather spitchy at HF when the user is too close to the microphone, and received audio quality was not liked as much as that from the 708. The IC2E seemed to have better TX audio than the IC4E. Once again, the 5/10kHz steps design was found annoying, and this is felt to be quite a snag, although the likelihood of continuous channel changing is probably appreciably less on 70cms than on 2m. Maximum volume on RX was adequate for a walkie talkie but not enough under mobile conditions. Repeater tone burst again is achieved by pressing down the volume control.

Technical comments: RF sensitivity was thought to be adequate but not good (same as FT708 though). Compared with early rigs such as the Trio 3200 which was extremely deaf, the sensitivity is probably adequate for normal use. RFIM measured poorly, but this would not be a problem as there are fewer strong local stations on this band. 25kHz channel selectivity was fair, but did not improve enough at 50kHz which is a little disappointing, although in practice it will not be a problem for most users.

Power output was limited (as usual with the small units) but distortion measured quite well at normal levels. Receive squelched current drain was low, which means they can be left on squelch for a long time. The receive section gave maximum performance exactly on channel, which is good. Transmitted high power was a little lower than on the 2m rig, but power did not reduce enough for low power, current drain on high being reasonable, but the drain on low power was a little high (though acceptable) since 70cms takes more current on average than 2m. Deviation was a little high even for 25kHz spacing, but not impossibly so, although the tone burst level was correct, its frequency being very precisely set. Curiously, transmit frequency accuracy was much better on the 4E than on the 2E, and beyond criticism. Repeater shift was also reasonably accurate. Harmonic suppression measured well and should not create any grumbles from the Home Office.

Summary: I have the same reservations about the IC4E as I did for the 2E, although the reverse repeater listen facility is a good point. For me the main snag again is the dreaded tuning wheels and 10kHz steps, but the light weight does again allow the rig to be strongly recommended for use when frequency changing would be a rare occurrence. I must again criticise the cost, which seems too high to me for this rig's very basic facilities.

Yaesu FT-708R

This rig is virtually identical to the FT208 except that the built-in basic repeater shift is actually set at 7.6MHz for some other countries, and 1.6MHz shifts have been programmed by the importers into the + and – set positions of the mode switch, thus providing normal repeater operation. Audio quality on receive was very good, it being virtually impossible to overload the inbuilt speaker even with audio volume at maximum; the maximum sound level was surprisingly high because of good speaker efficiency. On transmit however, the otherwise good audio quality was marred by an annoying fairly high pitched synthesiser whine which was obvious to all. This was a sample fault though for I have heard one on the air which was not whining. The step up/down buttons allow 25 or 50kHz steps to be switched which again is useful. It is possible by invading the internal diode matrix to alter the steps for special purposes for use overseas; this is, however, quite difficult to accomplish. The rig is on the heavy side, but again had a useful belt clip.

Technical comments: RF input sensitivity was the same as the IC4E, but RFIM measured far better and would hardly be likely to create a problem anywhere. Selectivity was also much better, and audio power output normal for a walkie talkie, but with good speaker efficiency. Audio distortion at lower levels was acceptable, most certainly in the context of communication. Receive/squelched current drain was low, and as the batteries had a larger capacity than the IC4E versions, the rig could be left on squelch for hours and hours. The sensitivity sinad ration improved by 1dB when the input RF frequency was decreased by 500Hz, but this would only be equivalent to a 0.5dB improvement in RF sensitivity. The transmit power was marginally below that of the IC4E, but the current drain a little higher. Low power was nowhere near low enough as a ratio, and current consumption was thus too high here.

Transmitted frequency accuracy was remarkably good for a UHF rig; the repeater shift was extremely accurate. Peak deviation was slightly better controlled and average speech peaks were only just over the top and acceptable for 25kHz channelling. Tone burst deviation was marginally high although most, if not all, repeaters should handle it, frequency being extremely accurate. Harmonic radiation was reasonable for 2nd harmonic, and 3rd harmonic was a little on the high side, which could cause an annoyance to 23cm addicts trying to receive moonbounce signals!

Summary: Your friends might get a little tired of hearing the constant whine behind your transmission from this rig, but in other respects I like it very much, finding it excellent ergonomically, although on the heavy side. It worked well as a simple home station, and even under mobile conditions it was useful, although the volume limitation should be borne in mind.

Accessories available with each hand-held rig

Several accessories were submitted for the various rigs reviewed. Although Icom did not send any, various alternative battery packs with different capacities can be supplied which are compatible for the IC2E and 4E. A speaker microphone type HM9 can be useful if you want to leave the rig on your belt or in a large pocket, whilst using it intermittently. For this type of application the larger battery pack could be helpful. A base charger is optional, which both charges and can drive the rig (type BC30). A neat little mobile booster (the ICML1) gives 10w output, a mobile charging lead type CP1 being available for interconnection with a cigar lighter socket. A 12v adaptor pack can be provided to drive the Icom rigs directly off a 12v car system.

SMC supplied a useful mains charger/PSU unit type NC8 into which either the FT208 or 708 can be mounted to allow operation off mains, or charging under trickle, normal, or faster charge rates. A crude mobile hanging mount type MMB10 allows the Yaesu rig to be slung from anywhere on which the mount can be hung. In my opinion a piece of bent aluminium might well work out more convenient and a lot less expensive. A mobile charging/PSU unit (type PA3) allows either of the Yaesu rigs to be worked directly off a cigar lighter socket. A speaker microphone accessory is available, type YM24A.

Trio (Lowe Electronics) supplied us with many accessories, which was most helpful. An external speaker microphone was liked and had a useful spring-loaded clip on its rear allowing it to be clipped onto one's breast pocket (SMC25) giving plenty of audio output. A home station mains charger/PSU charges in only one hour, which is commendable provided this doesn't affect the nicads, the rig sitting neatly within the stand allowing ease of operation (ST2). A natty little mobile mount can be screwed somewhere convenient and somewhat surprisingly has built in a mobile 12v supply converter charger in addition to a light to illuminate the keypad, as well as on/off switches (MS1); the unit is fed with an appropriate lead from a cigar lighter socket. A 62cm telescopic whip (type RA3) is said to give a slightly better gain than the rubber duck, but we found that the difference was marginal. A dry battery holder (for a 6 AA cells) can be supplied to take the place of the nicad pack, and this is useful as a backup (type BT1). A neat mobile (PA type VB530) is fitted with a BNC socket for interconnection with the Trio rig and an SO239 socket for the antenna and this provides 30w (25w claimed for 5a current) output, this of course, can be used with any of the 2m rigs reviewed.

Conclusions

It is impossible to come out with a clear best buy, since every rig reviewed above has its merits. Icom rigs had the benefit of being lightweight and easy to use, provided you didn't want to change channel much, whereas the Yaesu rigs were easily the most flexible, although heavy.

Trio have put a lot of thought into their 2500 design, but just slightly spoilt matters with their 5kHz up/down buttons. This was perhaps outweighed by the reverse repeater facility auto tone burst, and superb range of accessories. If you want a simple 70cm portable, for very local operation, you might be better off with a much cheaper crystal controlled rig. Of the older 2m rigs mentioned in the introduction, my favourite would be the Trio 2300 and possibly the earlier 2200GX. Considering 12.5kHz channelling, the Yaesu FT 208 is the only one that can cope, its selectivity being excellent, and by points just becoming my own favourite. The Trio comes a very close second but only because it lacked the narrower spacing. Both the Yaesu rigs can have their channelling changed for use in the US etc, but this may be best done by the retailer, unless you are a dab hand with miniature soldering irons. I must admit to being quite surprised at how good all the rigs were in most parameters as compared with those of a few years ago, and I do not rule any of them out as not recommendable.

FM HAND HELD TRANSCEIVER MEASUREMENTS

	General frequency 145.000 MHz, deviation 3kHz, batteries fully charged.			General frequency 433.000MHz, deviation 4kHz, batteries charged.	
Receiver measurements	YAESU FT208R	ICOM IC2E	TRIO TR2500	YAESU FT708R	ICOM IC4E
Sensitivity: RF level for 12dB sinad (uV pd)	0.14	0.13	0.15	0.19	0.19
Generator shift for best sinad (dB/kHz)	12/0	12.5/1	13/-0.5	13/-0.5	12/0
Selectivity high/low alternative channel spacing ratio off channel to on channel (dB)	75/75	65/65	50/50	71/71	63/63
Selectivity high/low adjacent channel spacing ratio off channel to on channel (dB)	64/66	37/37	42/42	63/58	54/54
RFIM: level at 25 and 50kHz offset for 12dB sinad product (mV pd)	0.14	0.13	0.45	0.80	0.11
Audio output power for 10% THD (W) (into 8 Ohms)	0.6 (3.2%) max THD	0.5	0.6	0.5 at 3.7% THD	0.5
THD for 125mW audio output into 8 Ohms (%)	3.2	3.4	0.7	1.8	1.2
DC current drawn when squelched (mA) (rated battery voltage)	21	19	25	19	18
Transmitter measurements					
Power output: high/low: (W) batteries fully charged	3.5/0.42	2.7/0.24	3.3/0.21	1.8/0.44	2.3/0.32
DC current drawn high/low: external DC at nominal (W) battery voltage	600/330	390/160	700/220	500/330	470/240
Deviation from dialled frequency (Hz)	+30	+310	-120	-50	-140
Deviation of repeater shift from 600kHz	0	+170	0	0 (from 1.6MHz)	-230 (from 1.6MHz)
Toneburst accuracy/ duration (Hz/secs)	0/manual	0/manual	-2/0.7	0/manual	0/manual
Harmonics high power 2nd/3rd (dBc)	-67/<-70	-61/<-70	-70/<-70	-65/-54	-67/<-70
Peak deviation absolute/close speech (kHz)	7.2/7.0	6.5/6.5	7.3/7.0	7.0/6.3	7.4/7.0
Toneburst deviation (kHz)	3.4	3.4	0	3.9	3.6
Weight (inc) Nicad batteries	720g	470g	540g	720g	470g
Recommended retail price	£207.05	£169.00	£220.80	£237.05	£199.00

Note: Channel spacing - 70cm 25kHz, 2m 12.5kHz.

SHOPTALK

Equipment available today. From hand-held radios to full blown bench equipment, there is enough to suit all tastes and requirements. Here is a selection of things available in the shops currently.

Rumour has it that there's a 3-band Yaesu multimode VHF and/or UHF rig on the way, known as the FT726R. We weren't able to get hold of a pic of the beast, but apparently it's got all the usual gubbins you find on an HF receiver, such as IF shift and variable bandwidth, plus full duplex facilites. We gather that the main frame accepts three modules, with 144MHz being standard and an optional 430-440MHz and an unspecified amount of 50MHz being available as options. It's got SSB, CW and FM, 2 VFO's, 10 memory channels and 20Hz steps in the synthesiser, and the basic unit costs in the region of $650. The full duplex unit costs an extra $80-odd, whilst the 70 centimetre module will set you back $208 and the 50MHz module a further hundred-and-fifty-something. It ought to be pretty good for that sort of money, but as we said we haven't seen any pix or spex yet. Sounds like a candidate for early review, but if it grabs you in the meantime no doubt SMC or whoever deals in Yaesu gear could tell you all. SMC are in Southampton, as you no doubt well know, and you could always give them a call on Southampton 867333 and ask them to reveal all.

FT101 kit

Next off the pile came a nice letter from H. Leeming, G3LLL, of Holdings Photo Audio Centre in Blackburn. He's the man who pointed out last time that we'd boobed when we discussed electric fire elements and things a while back (Technical Man still blushes about that and gets ever so narked when we kid him about it, ho ho ho) and he's had a lot of experience with Yaesu equipment of one sort or another. G3LLL has now produced a simple modification kit to put the three new post-WARC amateur bands of 10, 18 and 2MHz for the old series FT10's - if we remember rightly, that's from the FT101 Mk 1 up to the FT101E. Apparently it uses the CB and WWV positions on the switch, together with a relay in the 15 metre postion on the bandswitch (or so it says here - we're not too clear about quite what that means but no doubt a phone call will bring Instant Enlightenment).

The kit is said to be simple to fit and it will allow full power output; however, the note goes on to say that "....to avoid any problems it is suggested that the power is kept to 50 watts or less". Well, that's fine in the UK at least. The kit costs £15.75 inc. the dreaded VAT and postpaid, and you can get one from Holdings Photo Audio Centre, Mincing Lane, Darwen Street, Blackburn BB2 2AF. Their telephone number is 59595 (that's a nice number for an amateur radio shop!) and it says on their notepaper that they're seven miles from the M6 and closed on Thursdays. Certainly from what we've heard over the years Harry Leeming knows a lot about the FT101 and its popular brethren, so although we haven't seen a kit we'd bet it's well worth a look if you're interested in adding more bands to your wireless.

FT290R Pre-amp

Just before goung to press, we received a well-written information sheet on Mutek's new SLNA 145sb transceiver optimised pre-amp for the Yaesu FT290R. We think we could do worse then re-print it here:

There are usually two reasons for the less-than-adequate sensitivity of current 144MHz transceivers. Firstly, the receiver designer's brief includes a dynamic range specification which leads him to balance large signal handling with sensitivity. with devices currently available at prices the transceiver manufacturer is prepared to pay, the balance comes out to around 4dB noise figure and 70dB intermodulation-free dynamic range in SSB bandwidths.

The second point is that, also to save money, designers shy away from the use of electromechanical relays for antenna change-over switching and tend to use various forms of diode switch. These inevitably introduce greater insertion losses than suitable relays, approaching 4dB in some circumstances. Thus it's not unusual for the overall noise figure of a transceiver to reach 8dB!

At 144MHz, sky noise limits the maximum usable sensitivity of a receiver used for terrestrial communications to about 2dB noise-figure - this about the same as 0.05uV for 10dB s+n/n in SSB bandwidths. Lower noise figures are easily obtainable with modern devices, but they won't let you hear any more! However there is a distinct advantage in using a very low-noise preamp to improve the sensitivity of a transceiver – if it has been designed properly.

Overall (or system) noise-figure depends not only upon the noise figure of the preamplifier, but also on its gain and the noise figure of the subsequent stage, the transceiver in this case. By adjusting the gain of the preamplifier it is possible to set the system noise-figure to any wanted value greater than that of the intrinsic noise figure of the preamplifier.

Why bother to adjust the gain? Any preamplifier will degrade the strong-signal performance of the receiving system. The name of the game is to use as little gain as possible ahead of the receiver; just enough low-noise gain to set the overall sensitivity to a level where external noise is the limiting factor is all that is required, Use any more and the dynamic performance of the receiver will suffer unduly. A very low noise preamplifier will minimise the gain needed ahead of the transceiver and hence the degradation of the dynamics.

The new SLNA 145sb is a preamplifier which has been designed using the principles summarised above, specifically for incorporation in the FT290. It will also complement other 144MHz transceivers for which no complete front-end modification is available. A low-loss nitrogen-filled relay provides a sane alternative to diode switching. This is followed by a BF981 in an input noise-matched, output conjugately matched configuration for a very low noise-figure and optimum dynamic performance.

Following the output matching a variable attenuator provides gain control without compromising the dynamic performance, which would be the case if the normal amateur practice of providing gain control by varying the bias on G_2 of the BF981 was followed. After the attenuator, a properly designed Butterworth bandpass filter provides substantial rejection of out-of-band signals.

The preamplifier is constructed and tested to very high standards. A plated-through-hole epoxy fibre glass pcb is employed and bushed mountings are provided for mounting in the FT290R. A cable kit utilising high quality ptfe dielectric cables is also provided. You can get the SLNA 145sb transceiver optimised preamplifier for the FT290R from Mutek Limited,

PASS THE R.A.E.

What you're letting yourself in for

The test explained, where to take it, and when, and how to set about studying for it.

This month we begin an important new series which is designed to take the beginner from his first steps in radio and electronics right the way up to the capacity to pass the Radio Amateur's Examination. We'll be looking in depth at everything that's needed so that, come the great day, you'll be able to walk into the examination room confident that you'll be able to pass the thing and get the coveted pass slip.

On the way we'll look at a few other issues such as operating on the amateur bands and how to go about passing the Morse test; they'll come much later on, though, and we don't need to worry about those at this stage!

We'll be assuming that your knowledge of radio and electronics is pretty close to nil, zilch or zero at this stage, and we'll start from there. So for this first instalment we'll take a look at just what is required to pass the exam, what's contained in the syllabus and how you can go about it.

Closer work

So where do we start? Basically, before you can operate an amateur radio station it's necessary to have a licence for same and you don't get one by breezing into the local Post Office and asking for one! There are two categories of amateur licence, the Class A and the Class B and the requirements go something like this; you need to be over 14 years old and provide some sort of evidence of being British, such as a passport or a birth certificate.

At the time of writing we understand that the Home Office is considering abolishing that bit of it and we'll bring you up to date as we carry on in the series. Also you need to have passed the Radio Amateur's Examination, which is what we'll be dealing with in this series. This is Subject No. 765 of the City and Guilds of London Institutue, and we'll consider them in a bit more detail

Part I

shortly. You also need to have passed the Post Office Morse Test at 12 words per minute if it's a Class A licence you're after (in other words, one which authorises you to use frequency bands below 144MHz, or, to put that another way, if it's VHF and UHF you're interested in and you're not that bothered about using Morse on them, you don't have to pass the Morse test). All you need to do then is to fork out the cash, which is £8 these days and renewable each year.

Since our series is mostly concerned with how to pass the RAE, with a sidelong look at the Morse test somewhere along the way, let's take a closer look at what the examination is all about. The aforementioned City and Guilds is charged by the Home Office with administering the exam on its behalf, and at the present time they do this three times a year in March, May and December. As we said earlier, it's Subject No. 765 and if you want a copy of the official syllabus and all the rules and regulations it's a good idea to write to C & G at the following address: **City & Guilds of London Institute, Electrical and Telecommunications Branch, 76 Portland Place, London W1N 4AA.** They'll supply with all sorts of paperwork for about £1.50 and they'll also answer any miscellaneous questions you might have.

So let's now take a closer look at the examination itself. It lasts three hours in all and consists of what amounts to two separate exams: Paper 1, which deals with the conditions of the amateur licence itself and also interference and breakthrough from radio transmitters, (takes one hour) and consists of 35 multiple-choice questions; and Paper 2, (which takes 1 hour 45 minutes) on various topics which we'll get to in a minute. You're allowed a 15-minute break in between to unwind, etc. You must take both papers, or at least you must if it's your first time round – you're allowed to take only one of them if (heaven forbid) you goofed in one last time and you're resitting that particular one. Not that you *will*, of course, especially after you've read our series . . . !

Paper 2, the 1 hour 45 minutes epic, is what we'll be devoting a lot of our attention to in this series because it's mostly technical stuff. There are actually 60 multiple-choice questions and they divide up as follows: Five on "operating practices and procedures", 11 on "electrical theory", nine on semiconductors, nine on radio receivers, nine on transmitters, 10 on propagation and antennas and seven on measurements. If we can believe our calculator, that makes 60.

Exam centres

Having read that lot, especially if you're new to the hobby, you might feel like closing the books, quietly forgetting the whole idea and taking up something nice and simple like brain surgery. Well, please don't because the whole thing is a lot less formidable than it sounds. We'll take a look at the whole syllabus in a bit, and here again we'd ask you to hang in there and not panic just because it's full of nasty-looking long words. All will become clear and it really isn't anything like as bad as you might think.

Before we do that, though, having established that there is an examination it'd be a good idea to say a bit about where you can take it and where you can study for it if you're so minded. Basically, various colleges and institutions such as your local tech or poly or whatever offer courses which lead into one of the three examinations; they're of variable length and also cost varying amounts according to where you go. Unfortunately, there isn't any kind of central directory of who's

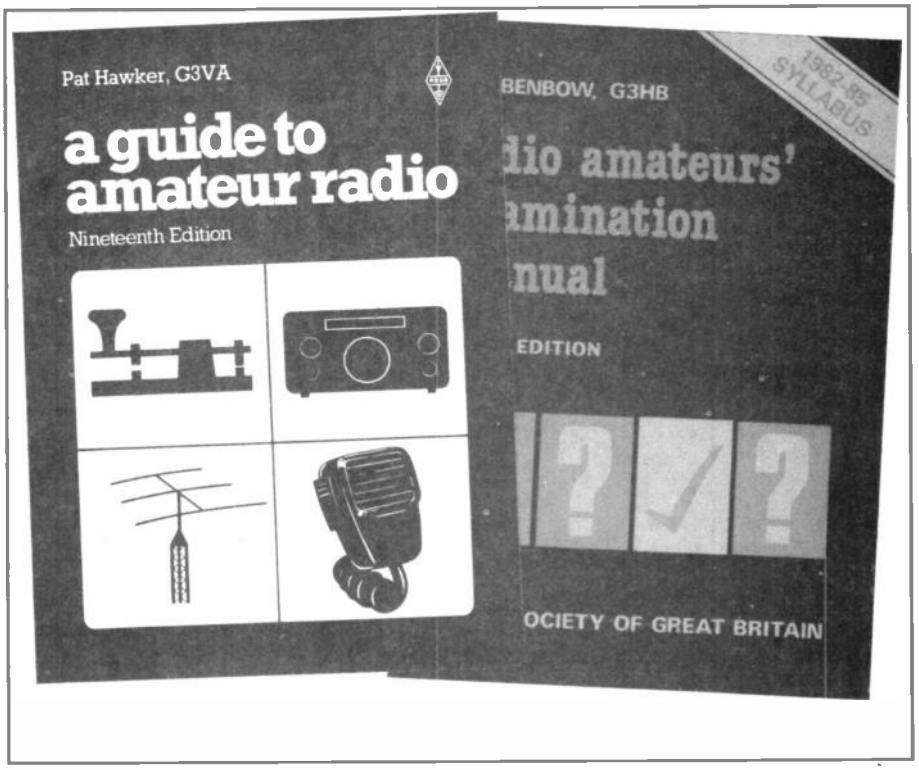
offering such a course and you're down to either ringing the RSGB, who may know of somewhere in your area, or trying your local friendly tech and seeing if they'll do a course. The RSGB do try and keep what info they can get but it'd be impossible, or so they tell us, to keep tabs on every institution in the Kingdom so it's pot luck as to whether or not they know anything about your area.

Local radio clubs

However, another line of attack is your local radio club. Some run very good RAE classes, although not all of them by any means, and it's well worth keeping an eye out for any club local to you which is doing something. The club news section in this magazine sometimes says that such-and-such a club is doing classes and they're usually happy to take on all comers for a small fee. So do try that route, and it's worth looking in other amateur magazines such as *Short Wave Magazine* just in case your club has sent them details and not ourselves! See how honest we are? Smile, smile. Anyway, there are other good reasons for joining a club if you're new to the hobby, so we'd certainly suggest visiting them even if you know they don't do an RAE course – after all, they might well know somewhere that does and you'll cut down your phone bill.

As for taking the exam, there's a bit more scope here because it's sometimes possible to get your local tech or whoever to provide facilities for actually taking the exam even if they don't do a course leading to it. So that's a good place to start, and you may well find that even if they can't do it they can tell you who will. Also, the RSGB themselves run two examination centres, one in London and one in Derby, so if either of those two are handy for you it's well worth ringing Potters Bar 59015 and asking for the RAE department; actually, according to last month's *RadCom* it's the Membership Services Department now. The only snag is that sometimes there's a bit of a scramble for places, or at least there has been in the last couple of years, so it'd be as well to start your post-exam research as early as possible, get yourself fixed up with an examination centre and get cracking.

Before we dig in any further, it's worth thinking about how you're going to tackle the exam. We'll have a lot more to say about this later on, but for now are you determined to take a course or do you feel you can do it yourself from books, chatting to people at the club and splendid series like this one? To some extent that's a matter for you and how you learn best, and it also depends whether you already know something about electronics and things or whether you don't know a thing and you're starting from scratch. We'll be dealing in this series in everything from



square one, but you might well feel that you work better in a class where you've got a real live instructor to talk to and ask to explain something you didn't understand all over again – in that case we'd suggest using both, ie books and magazines and your course if you can get one.

Black art?

Okay – what are we going to have to know in order to pass the exam? You can see the syllabus which we've reproduced here courtesy of City & Guilds and you're quite likely to have had an acute attack of terror if you've skipped over and read it cold! Well, as we said earlier don't panic and let it get to your because syllabi for an exam always look absolutely fearful – my son's just started A-level chemistry and just looking at the syllabus frightens me to death even though I know a fair bit about it! Let's take it in easy stages. **"Operating practice and procedures"** is more or less to do with what you'd think it is; it's things like what various Q-codes mean and what signals you'd send at the end of an over in Morse and it's all stuff which you can learn easily enough and hear on the amateur bands every day.

"Electrical theory" is pretty basic, and even if you can just about change your house fuses you can cope with RAE-type stuff if you've enough brains to add up and shift decimal points about. "Semiconductors" is all about transistors, diodes and whatnot and the basic physics of how they work. For many people, this is the trickiest because it's easy to get over-complex and go into it too much – all you'll need are some insights and a modicum of stick-at-it-ness. **"Radio receivers"**, again, is about what you'd think it is and you shouldn't find that too difficult to handle, as indeed is also the case with transmitters.

"Propagation and antennae" can be heavy going because some of the concepts are a little difficult to grasp and we must admit that we here in the office tend to think that the clever scientists are bluffing half the time when they talk about things like the impedance of free space; in other words, propagation and antenna theory sometimes seems to us suspiciously like a black art instead of the pure science some of the books would have you believe. However, let's stick to the RAE for now and you can quote us when you write your thesis demolishing all antenna theory in twenty years from now.

"Measurements", the last item on the agenda, is more or less what you'd guess it is, particularly with regard to things like the output power and efficiency of a transmitter; nothing too nasty there.

So, that's a quick look at the syllabus of Paper 2. Paper 1, which is to do with regulations and whatnot, is much more a matter of straight learning with a few technicalities thrown in – there's nothing in the technical part of Paper 1 which isn't adequately covered by the syllabus for Paper 2 so we won't consider it in isolation just for now.

We're getting short of space so we'll leave it there for now. Next time we'll set about Paper 1 and start seeing how to get a grip on it. In the meantime, if you're seriously thinking about the RAE we'd strongly suggest you buy the RSGB's *Radio Amateurs Examination Manual* because it's the single biggest favour you can do yourself, apart from reading our series, of course! See you next time.

1982-85 Radio Amateurs' Examination syllabus and objectives

As the title suggests, this is the current RAE syllabus and its objectives. Study it carefully, noting every word - look them up if you don't understand them! This syllabus comes from the RSGB's A Guide to Amateur Radio, and this book along with the Society's Radio Amateurs' Examination Manual, should definitely find a place in your shack. We are grateful to the RSGB and City and Guilds of London Institute for allowing us to reproduce this information.

The examination objectives describe in general terms the nature of the examination questions, while the syllabus states the subject matter to which they relate.

PAPER 1: LICENSING CONDITIONS AND TRANSMITTER INTERFERENCE

1. Licensing conditions

Examination objectives

(a) Name the types and state the purposes of Amateur Licences available.
(b) State the qualifications required of their holders.
(c) State accurately the conditions of the Amateur Licence A, and the notes appended to it, with regard to
  (i) period of validity, renewal, revocation, variation and return
  (ii) places in which the station may be established and used
  (iii) purposes for which the station may be used and persons who may use it
  (iv) frequency bands, powers and classes of emission which may be used
  (v) requirements relating to avoidance of interference, restriction of bandwidth, limitation of harmonic and spurious emissions and checking transmitter performance
  (vi) requirements for logkeeping, use of callsigns and recorded messages, inspection and closing down of the station
  (vii) limitations and prohibitions in connection with the use of the station.

Syllabus

1. Types of licence available and the qualifications necessary.
2. Conditions (terms, provisions and limitations) laid down by the Home Office in the Amateur Licence A, including the notes appended and the schedules of classes of emission and frequency bands.

2. Transmitter interference

Examination objectives

(a) Describe the consequences of poor frequency stability.
(b) For spurious emissions
  (i) describe in non-mathematical terms their causes
  (ii) describe methods, appropriate to the Amateur Service, of detecting and recognizing their presence
  (iii) describe in practical terms the measures which should be taken in both the design and construction of transmitters and the use of filters to minimize them.
(c) Describe the simple means of limiting the audio bandwidth of emissions and explain why this is necessary.
(d) State the causes of mains-borne interference and describe methods of suppression.
(e) Demonstrate knowledge of the Home Office guidelines relating to frequency checking equipment.

Syllabus

1. Frequency stability; consequences of poor frequency stability: risks of interference, out-of-band radiation.
2. Spurious emissions, causes and methods of prevention; harmonics of the radiated frequency, direct radiation from frequency-determining and frequency-changing stages of a transmitter, parasitic oscillations, key clicks, excessive sidebands due to overmodulation. Excessive deviation of fm transmitters.
3. Restriction of audio bandwidth, typical methods used and their limitations.
4. Mains-borne interference, causes and methods of suppression.
5. Home Office requirements for frequency checking equipment: Appendix F to *How to Become a Radio Amateur*.

PAPER 2: OPERATING PRACTICES, PROCEDURES AND THEORY

1. Operating practices and procedures

Examination objectives

(a) Describe calling procedures in telegraphy and telephony.
(b) Demonstrate knowledge of maintaining a log.
(c) For satellites and repeaters
  (i) explain why they are used in the Amateur Service
  (ii) describe the method of accessing a repeater.
(d) Explain the reasons for using Q-codes and other abbreviations.
(e) Demonstrate knowledge of the phonetic alphabet and explain why it is used.
(f) For safety in operating
  (i) state the precautions recommended
  (ii) explain why capacitors should be discharged
  (iii) explain why equipment to be repaired should be disconnected from the mains supply.

Syllabus

1. Calling procedures in telegraphy and telephony: general calls to all stations and calls to specific stations.
2. Logkeeping: Clause 6 of the Amateur Licence A.
3. Use of satellites and repeaters: accessing a repeater.
4. Use of Q-codes and other abbreviations appropriate to the Amateur Service.
5. The phonetic alphabet: reasons for its use; recommendations in *How to Become a Radio Amateur*.
6. Safety in the amateur station: recommendations of the Radio Society of Great Britain.

2. Electrical theory

Examination objectives

(a) For basic terms and units
  (i) define the terms
  (ii) state the SI units for given measurements and define their relationship to each other.

(b) For current, power and resistance
  (i) state Ohm's Law and use it to solve simple problems.
  (ii) calculate total current in series and parallel circuits
  (iii) calculate power in a dc circuit
  (iv) calculate the effective resistance of resistors in series and parallel circuits
  (v) describe the function of resistors in electronic circuits: name types for given applications; give practical values
  (vi) state the magnetic and heating effects of currents and their applications.

(c) For inductance and capacitance
  (i) define the units
  (ii) state the factors which affect the value of the capacitance of a capacitor
  (iii) state the factors which affect the value of the inductance of an inductor
  (iv) explain what is meant by the time constant of circuits containing resistance and capacitance, and resistance and inductance
  (v) calculate total capacitance in series and parallel circuits
  (vi) calculate total inductance in series circuits
  (vii) explain what is meant by inductive and capacitive reactance
  (viii) explain their effects in ac circuits
  (ix) solve simple problems on given ac series circuits.

(d) Define the terms describing the sine wave.

(e) Explain simply the terms relating to power, reactance, impedance and resonance.

(f) For transformers and tuned circuits
  (i) explain the function and describe the operation of a transformer
  (ii) identify series and parallel ac circuits and calculate resonant frequency from given data
  (iii) explain voltage amplification and current amplification effects
  (iv) state the conditions under which oscillations may be maintained.

(g) For radio and electrical components give typical tolerances and limits on the nominal values.

Syllabus

1. (a) Basic electrical terms, their meaning and use: emf, current, conductor, resistance, insulator, power, series circuit, parallel circuit.
(b) SI units, their use and relationship to each other: volt, coulomb, ampere, ohm, watt, hertz.
2. Current, power and resistance: Ohm's Law. Total current and effective resistance in series and parallel circuits. Power in a dc circuit. Magnetic and heating effects of currents: applications.
3. Inductance and capacitance: appropriate units; effects in ac circuits. Effective inductance and capacitance in circuits. Meaning of inductive and capacitive reactance. Factors affecting capacitance and inductance value. Time constant.
4. Sine wave. Definition of terms: amplitude, period and frequency; instantaneous, peak, peak-to-peak, rms values.
5. Power, reactance, impedance and resonance in ac circuits; simple explanation of terms: phase angle, phase difference, phase lead and lag, reactance, impedance, series resonance, parallel resonance, resonant frequency and Q (magnification) factor.
6. (a) Transformers: function and operation.
(b) Tuned circuits: series and parallel ac circuits, resonant frequency data and calculations; voltage amplification and current amplification effects. Maintenance of oscillations in tuned circuits. Dynamic impedance.
7. Types of components used and their applications in electronic equipment; tolerances and preferred values.

3. Solid state devices

Examination objectives

(a) Explain in simple terms the principles of
  (i) operation of npn and pnp transistors
  (ii) diode rectification
  (iii) biasing and protection of transistors in amplifier circuits
  (iv) operation of simple integrated circuits.

(b) Describe the operation of given devices in radio equipment.

(c) Describe and explain the principles of operation of typical power supply circuits with smoothing and voltage stabilization systems.

Syllabus

1. Characteristics and principles of operation of npn and pnp transistors; principles of diode rectification; control of output current and voltage when transistors are used as audio-frequency and radio-frequency amplifiers. Simple integrated circuits.
2. Use of solid state devices in radio equipment as
  (a) oscillators (crystal and variable frequency types)
  (b) amplifiers (audio-frequency and radio-frequency types)
  (c) frequency changers
  (d) frequency multipliers
  (e) demodulators
3. Typical power-supply circuits: power rectification; smoothing and voltage stabilization systems.

4. Radio receivers

Examination objectives

(a) Explain the principles of reception of given signals.

(b) Describe the operation of simple receiver circuits.

(c) State the advantages and disadvantages of high and low intermediate frequencies.

(d) Explain adjacent channel and image frequency interference and the methods of minimizing them.

(e) Explain the general principles of the demodulation of frequency-modulated signals.

(f) Describe the use of a beat-frequency oscillator for the reception of type A1 signals.

(g) Explain the principles of reception of single-sideband signals.

(h) Describe the purpose of a carrier insertion oscillator.

Syllabus

1. Principles of reception of continuous wave, double-sideband, single-sideband and frequency-modulated signals in terms of radio-frequency amplification, frequency changing (where appropriate), demodulation or detection and automatic gain control, audio amplification. The superheterodyne principle of reception.
2. Advantages and disadvantages of high and low intermediate frequencies; adjacent channel and image frequency interference and its control.
3. Typical receivers; use of a beat-frequency oscillator. Characteristics of a single-sideband signal and the purpose of a carrier insertion oscillator.

5. Transmitters

Examination objectives

(a) For oscillators
  (i) describe their construction
  (ii) state the factors affecting their stability.
(b) Describe the operation of given stages in transmitters. Explain the procedure for the adjustment and tuning of transmitters.
(c) For methods of keying
  (i) describe and explain the methods
  (ii) state the advantages and disadvantages of each
(d) For modulation and types of emission
  (i) describe and explain the principles of modulation of radio-frequency emissions in given modes
  (ii) state the relative advantages of given modes
  (iii) describe the procedure for adjusting the level of modulation.

Syllabus

1. Oscillators used in transmitters: stable variable frequency and crystal controlled oscillators; their construction and factors affecting stability
2. Transmitter stages: operation of frequency changers, frequency multipliers, high and low power amplifiers (including linear types). Procedure for transmitter adjustment.
3. Methods of keying transmitters for telegraphy; advantages and disadvantages.
4. Methods of modulation and types of emission in current use including single-sideband and frequency modulation; emissions in the A2, A3 (A3E), A3J (J3E), F2 and F3 modes; relative advantages. Adjustment of level of modulation.

6. Propagation and aerials

Examination objectives

(a) Explain given basic terms.
(b) For electromagnetic waves
  (i) explain their production
  (ii) state the relationship between electric and magnetic components.
(c) For the ionosphere, troposphere and upper atmosphere
  (i) describe in simple terms the structure of the ionosphere
  (ii) explain in simple non-mathematical terms the refracting and reflecting properties of the ionosphere and the troposphere
  (iii) explain how given factors affect the ionization of the upper atmosphere
  (iv) state the effect of varying degrees of ionization of the upper atmosphere on the propagation of electromagnetic waves.
(d) Describe in simple terms given forms of propagation.
(e) Explain fade outs and given forms of fading.
(f) For radio waves
  (i) state their velocity in free space
  (ii) state the relationship between velocity, frequency and wavelength
  (iii) calculate frequency and wavelength from given data.
(g) For aerials and transmission lines
  (i) describe and explain their operation and construction
  (ii) describe balanced and unbalanced feeders and explain the principles of propagation of radio waves along transmission lines; describe the effects of standing waves
  (iii) explain the principles of coupling and matching aerials to transmitters and receivers
  (iv) identify from diagrams typical coupling and matching arrangements.

Syllabus

1. Explanation of basic terms: ionosphere, troposphere, atmosphere, field strength, polarization, maximum usable frequency, critical frequency, skip distance.
2. Generation of electromagnetic waves; relationship between electric and magnetic components.
3. Structure of the ionosphere. Refracting and reflecting properties of the ionosphere and troposphere. Effect of sunspot cycle, winter and summer seasons and day and night on the ionization of upper atmosphere; effect of varying degrees of ionization on the propagation of electromagnetic waves.
4. Ground wave, ionospheric and tropospheric propagation.
5. Fade-out and types of fading: selective, interference, polarization, absorption and skip.
6. Velocity of radio waves in free space; relationship between velocity of propagation, frequency and wavelength; calculation of frequency and wavelength.
7. Receiving and transmitting aerials; operation and construction of typical aerials including multiband and directional types; their directional properties. Coupling and matching.
8. Transmission lines, balanced and unbalanced feeders; elementary principles of propagation of radio waves along transmission lines; velocity ratio, standing waves.

7. Measurement

Examination objectives

(a) For the measurement of ac, dc and radio-frequency voltages and currents
  (i) state the types of instruments in common use
  (ii) explain how errors can be caused by the effect of the instrument on the circuit.
(b) For power input and output measurement
  (i) explain in detail how dc power input on the final amplifier of a transmitter is measured
  (ii) describe the incorporation of metering arrangements in an amateur transmitter
  (iii) explain the method of measurement of radio-frequency power output of power amplifiers (including linear types).
(c) For given frequency measuring instruments
  (i) state the purpose for which they are used
  (ii) state the relative accuracy
  (iii) describe in detail their use at an amateur transmitting station.
(d) Describe the construction of dummy loads and explain their use.
(e) Explain the purpose and method of using a standing-wave ratio meter.
(f) Describe in detail the method of setting up an oscilloscope.

Syllabus

1. Types of instruments used in radio work for the measurement of ac, dc and radio-frequency voltages and currents: errors in measurement.
2. Measurement of
(a) dc power input to the final amplifier of a transmitter
(b) radio-frequency power output of power amplifiers (including linear types)
(c) current at radio frequencies.
(Reference to *How to Become a Radio Amateur*.)
3. Purposes, operation and use of absorption wavemeters, heterodyne wavemeters and frequency counters; relative accuracies.
4. Dummy loads; their construction and use in tuning transmitters.
5. Use of standing-wave ratio meters.
6. Setting up and use of a cathode-ray oscilloscope to examine and measure waveform and monitor the depth of modulation.

GOING MOBILE ON VHF

Angus McKenzie MBE, C.Eng.,FIERE, G3OSS, explains the whys and wherefores of mobile operation on VHF, and guides us through the questions of DX working, whether to go FM, or SSB on 2m, linears, antennas, and equally important, whether to buy new or secondhand equipment!

Many radio amateurs find that mobile operation is the most attractive part of this remarkable hobby, and as there are so many different aspects in working mobile, I feel justified in devoting an entire article to the subject.

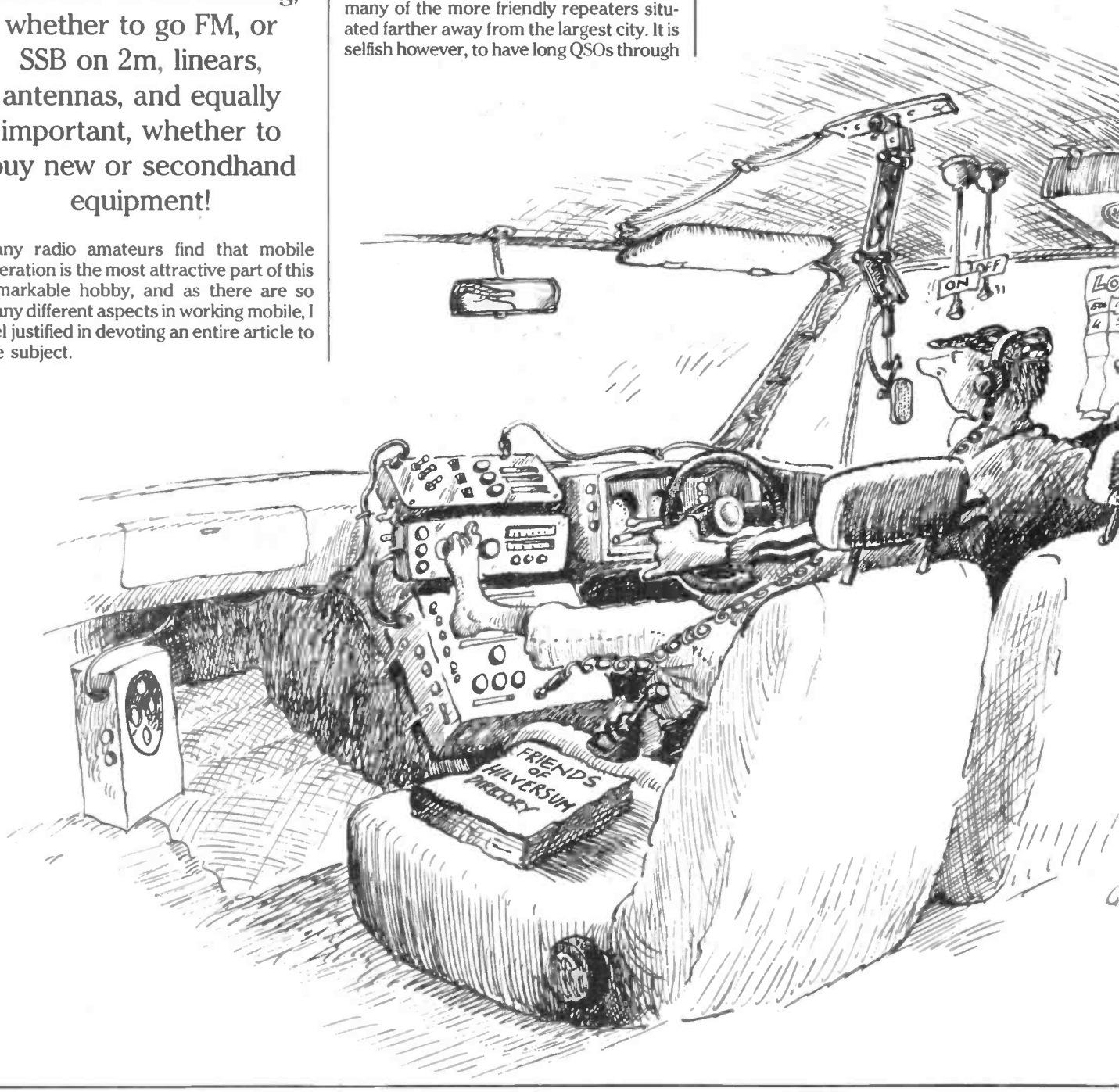
If you want to go mobile you will have to make many decisions, some of them in the light of your own experiences, whilst others may be the result of advice from people who have been working mobile for many years.

The first decision you will have to make is whether you want to concentrate primarily on FM or SSB on 2M, for the decision is nowhere near so obvious as many seem to imagine. There are dozens more on FM than on SSB in any particular locality, but SSB is far better for DX working, which may be important to you if you make long journeys and want to keep in contact with a friend over a long distance.

The problems in the use of FM repeaters are of course well known, and it is unfortunate that (particularly in the South East) many repeaters are jammed for hours on end. It is to be hoped that special clauses in the new British Telecommunications Act may result in less jamming.

You can easily work DX on FM through many of the more friendly repeaters situated farther away from the largest city. It is selfish however, to have long QSOs through repeaters, since others may want to use them at the same time, but may not want to interrupt; returning to the FM versus SSB comparison in the light of all this, is highly relevant. Many mobilers have tried SSB and abandoned it within a week, finding it extremely difficult to get QSOs, and seemingly disproving the SSB enthusiasts' claim to better DX. In virtually every case that I have checked back on, in which an amateur has thrown out SSB mobile, he has not given it a fair trial. Almost invariably he will have tried SSB using vertical polarisation obtained from a vertical whip, which may work well for FM, but it is frankly almost useless for working SSB.

It is convention that SSB contacts are made with horizontal polarisation whilst most FM is vertical and one might say "never the twain shall meet". FM was not always vertical though, for not only have we the recently organised "horizontal FM group", but in fact horizontal FM began in

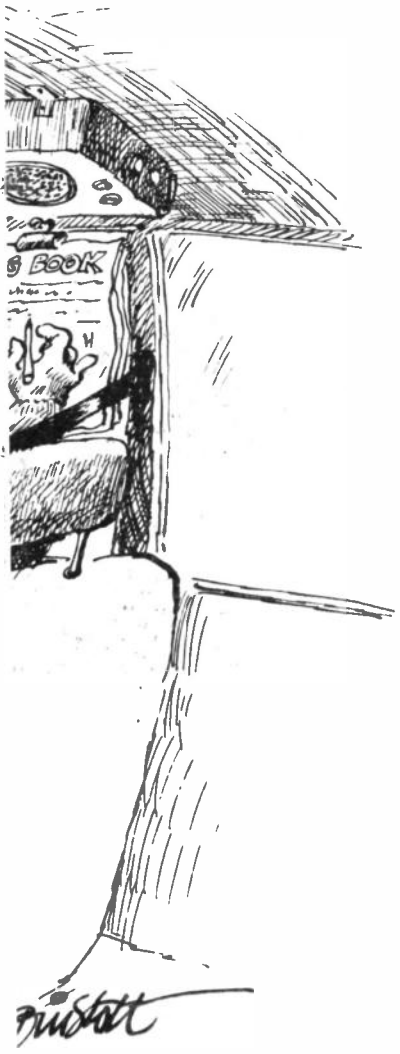


earnest around 20 years ago in an attempt by several VHF enthusiasts to reduce TVI problems when using high power. One of the most well-known original proponents was G6AG.

If you are going to try SSB mobile on 2m, then at least be fair to it by trying a horizontally polarised antenna such as a square halo made by Jaybeam.

I have used one of these antennas for SSB at the top end of a fairly thin 1m long vertical bar with its bottom end locked to a ski rack on my Volvo estate car. It has been fascinating to compare reports using this halo as opposed to an Antenna Specialist's ⅝-wave in urban and rural areas; each time I have made the comparison in various parts of the UK, with various fixed stations, over all manner of distances and terrain, I have given, and have received, reports strongly in favour of the halo to the tune of between 2 and 4 S points, ie between eight and 20dB or so.

Typical contacts with SSB mobile have been over distances of 30 to 200 miles, the longer distances being more frequent when I have been using high transmitted power. If we contrast this to FM, with mobile fixed station ranges, from perhaps ten miles to 40 miles, it can be seen that SSB wins hands down for DX, but it must be said that FM wins on quite a few criteria, including quality of received audio, operating fatigue and ergonomics, repeater usage, background noise using squelch and intelligibility. FM is also less prone to interference although I must admit that a good noise blanker on a 2m SSB rig can be very effective at removing ignition interference.



Another extremely important consideration is the amount of power taken by the two modes when you are using a linear. With SSB, even when you are running 100w or more output (PEP), you should only be taking a few amps on average out of your battery on transmit because of the SSB duty cycle being so favourable. On FM though, full carrier is being transmitted all the time, and the average linear and rig combination which gives 100w FM output, will take perhaps a continuous 20 amps from the battery. If you stop at the top of a hill, and turn off your engine but forget to turn off your linear, don't blame me if you can't start your engine again after nattering for an hour and a half or so! The only consolation that you will have is that you will at least be at the top of the hill rather than at the bottom.

Points to remember if you are buying a mobile rig

Consider the following points very carefully before purchasing a mobile rig:

1. FM or SSB-only or multimode?
2. Dedicated 13v DC mobile rig, or battery operable portable one as against a rig with built-in mains supply as well as 13v DC?
3. New or secondhand? See my article, March '83 issue, on purchasing secondhand equipment.
4. What do others think of the rig that you intend to buy? If FM, has the rig 12.5/25kHz channelling and reverse repeater function which is quick and easy to use?
5. Is the rig easy to operate under mobile conditions?
6. Is the frequency display visible at a glance?
7. Is a mounting frame available which can allow the rig to be slung below the dashboard?
8. What accessories are provided and is the microphone fitted with frequency up/down control?
9. Does the rig have auto repeater tone burst or is this manual (the latter would be an extreme nuisance if you regularly use repeaters)?
10. Does the rig have a priority channel auto monitoring circuit, and are the memory functions effective and easy to operate?
11. Does the rig give good isolation on both receive and transmit against ignition noise and dynamo/alternator whine etc?

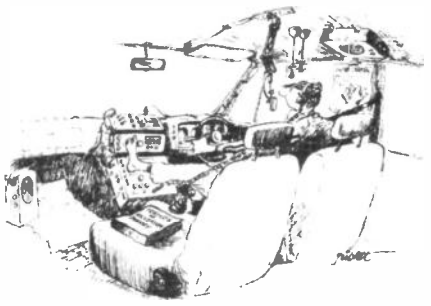
The above points cover quite a lot of ground and are all important in choosing a rig. Quite obviously some rigs will be more sensitive than others, and the technical performance may well sway you from one rig to another in your final choice. In assessing the receive sections for mobile operation, I rate selectivity and front end inter modulation performance as both at least as important as input sensitivity. Audio quality is very important indeed, and too many rigs distort very badly if you turn them up to hear somebody if you are driving through heavy traffic, (the rig should give 2w audio output into eight ohms, but many give less). You may find that you would get much better sound quality if you use a separate loudspeaker which you can place optimally. I feel it is most important for frequency changing to be very simple, so that when you are driving a car you won't be distracted too much when going up say, three 25kHz channels, ie 75kHz. A rig which only has 10kHz main steps and a 5kHz offset switch can be a disaster area for a mobile, as you will have to think and concentrate in order to QSY!

Car boom mikes

It is true that the large majority of mobile will use the microphone supplied with its inevitable PTT lever and "coily coily cord". This can be very dangerous though, for when you are transmitting you will only have one hand free for gear-changing and the steering wheel. This means that you are forever picking up the mike and putting it down, and thus straining the cable and connectors. Many microphone cables have a habit of going open circuit just where the live audio or relay wire goes into the plug. Many mobile enthusiasts therefore have fitted various types of boom mikes which hang down from the car roof in front of them, or alternatively hook a mike with a fixed RX/TX switch on it onto the front of their jersey or jacket. Although the use of such mikes is much safer, the transmitted audio quality will usually be worse particularly if the car is in heavy traffic as car noise will be louder compared to the speech level.

Some have found microphones such the Daiwa RM-940 infra-red mic available from Lowe Electronics extremely useful, since the microphone itself can be hooked around the driver's neck and be completely separate from the infra-red sensor which is plugged into the rig. The mic can be plugged into the sensor for recharging its battery when not in use. I found the quality of this microphone amazingly good, and the range quite adequate provided there was line of sight in the car between the mic and sensor.

Unfortunately, microphones supplied with rigs are often rather nasty in sound quality but it is the other station who is inconvenienced, and not you. A good mobile mike may well get you more contacts, for it may give better intelligibility and be more pleasing to listen to. It is worth noting that there are many compatibility problems between mikes and rigs, and whilst a medium impedance mike may work with



most rigs, a high impedance one is totally unsuitable for 600ohm inputs. Some Icom microphones have built-in amplifiers specifically for use with Icom rigs which make them unsuitable for other equipment. Many microphones will not work satisfactorily into Icom rigs because they have insufficient output level. Although Yaesu, Trio, Icom and Drake have all used the ubiquitous 4-pin mike plug on many models it is incredibly annoying that the pin connections used by each manufacturer are frequently incompatible. This is extremely tiresome but may be the reason why a microphone might not work with a particular rig.

Setting up the antenna

I have tried many different positions for vertical whips, and undoubtedly the best position from a radio frequency point of view is in the centre of the car roof, although this may well be the most unsightly. Wing or boot mounting can give reasonably good results, but window mounting with a clip is usually rather poor as there is much less of an earth plane in the antenna's immediate vicinity. Antenna positioning is extremely important and can make many dBs difference to both your transmitted signal strengths and your receive capability. You will have to bear in mind the susceptibility of the entire installation to ignition pickup.

I have known instances where the quality of the screened cable used to interconnect the rig with the antenna can make up to 10dB difference in ignition breakthrough. Some antennas require the braid to be earthed to car chassis at the antenna end, or may achieve this within the antenna transformer, whilst others are completely isolated from the chassis other than via the rig and cable screen. Dependent upon the car itself, ignition breakthrough can vary between unearthed and earthed antennas. It is very important to resonate the aerial carefully, for the centre of the required frequency range (and this is best done approximately first) by altering the length fractionally for the best received signal strength on a stable signal which is vertically polarised and fairly local.

You can adjust the length more accurately by using an SWR meter, but this may have to be quite a good one if it is not to give you misleading results. Unfortunately, the antenna will not necessarily give minimum SWR reading when it is on resonance, although on VHF bands minimum SWR is a fairly reliable indication of optimum aerial tuning. It is worth pointing out here that the converse is usually true for the LF bands, for very rarely is an antenna resonant in a mobile installation at its minimum SWR point on say the 3.7MHz band.

A VHF whip or halo tends to pick up less ignition when properly resonated, and particularly when there is a good SWR in the cable. Part of the reason for this is that a properly matched 50 ohm cable/antenna combination giving a good SWR radiates and picks up less from the coax cable screen, and thus picks up less direct ignition radiation at other than the antenna itself. An antenna in the centre of the roof or towards the back of the car should not pick up so much ignition from your own car, but will of course attract everything from other vehicles etc.

Before selecting what may appear to you to be the highest gain whip, think about some of the following snags. Higher gain antennas are of course longer, and apart from the fact that you don't want to biff the underneath of bridges or telegraph wires, a longer antenna bends back much more than a shorter one when you are going at speed. It is more important to have a small safety spring at the bottom of a 5/8 or 7/8 whip than a quarter-wave, but a 7/8 whip that is bending right back will lose much of its effective vertical gain, whereas a quarter-wave whip will be more stable. The longer whips will thus cause more flutter, and VSWR will of course vary considerably as it waves around. On the other hand, when you are driving more slowly, or you are at the top of a hill, a high gain vertical may get you a lot farther, but don't forget it will be more obtrusive.

"One linear I owned had a delay of two seconds which was annoying . . ."

Mag mounts, if they are good ones, are not likely to fall off unless you put a ridiculously heavy aerial on them. They should grip the centre of a car roof well, and their use prevents the requirements of cutting holes in the car! Mounting a halo is much more difficult, and the most practical way is to install a single element of a ski rack frame across the back end of the car, and mount a 1m vertical rod to the centre of the ski rack, and a square halo at the top end of the rod. I have found that if the halo is less than ½wave above the car roof, the effective gain starts deteriorating rapidly and the antenna becomes more difficult to match. At this point it may be worthwhile to mention my own personal tale of woe concerning halos.

When I first went mobile on 2m, in 1961, I had a Withers TW2 AM transmitter which was crystal-controlled, and a valve crystal-controlled converter with a command receiver with crude VFO and noise limiter for receiving. The antenna was a Withers halo on the top of a long rod which my wife used to jam down into the hinges of the back doors of the estate car. Although my wife never told me at the time, she regularly used to prang the halo when she forgot to take it off before garaging the car. After some years, she admitted with some amusement that she got thought about one every month! I must admit that I always used to wonder how it was that my old 2m halo was always in such immaculate condition! I wonder how many other amateurs get their wives to pay for replacement aerials out of the housekeeping! This little story shows the importance of providing a quick release facility for your mobile antennas.

Security

It is unfortunate that in our society today, there are rather too many thieves and destructive individuals who vandalise mobile installations. For this reason you should think about having a quick-release frame for your rig thus allowing you to take it out quickly if you are going to leave the car for any length of time. Always take off your mobile antenna and pop it inside the vehicle when not in use. Even burglar-alarmed cars have had rigs stolen from them. Incidentally, always make a note of serial numbers and any peculiarities of your rigs so that if they are stolen they will be more identifiable.

Installation and suppression

The optimum way in which rigs should be interconnected, with the 13v DC car battery, can vary from car to car. It is sometimes better to take the wiring straight to the battery, but it might be more convenient to connect to the cigar lighter socket, as an example. Ignition interference both on RX and TX can come down the 13v leads and so you may need an ignition suppression filter on these leads, and these are readily available. You will need to suppress alternator/dynamo, spark plugs, distributor, and the induction coil assembly. Bad sources of interference include windscreen wipers, car heater motors and even the car clock. In warm weather, you can get car tyre static but some of the more awkward and indeterminate interferences are often only bad at LF.

Many mobile enthusiasts are quite happy to use just two or three watts and work only their local repeater and amateurs in the immediate vicinity, but most of us like to spread our wings a bit so whilst 10w RF is an average power for a mobile, many rigs have 25w output available. If you want more power you will have to install an external amplifier. If you are using only FM then one capable of giving 40 or 100w output from three or 10w input will be perfectly sufficient. You will not have to worry about the amplifier being linear, but you should be careful to allow plenty of air to pass around it at its chosen location in the car. Most amplifiers are RF sensed,

which means that the amplifier comes on when a sensing circuit detects the presence of RF at the input. Some amplifiers incorporate switchable RX preamps and these can greatly improve sensitivity, although RF intermodulation products will be far worse and cause trouble in urban areas. For this reason, I cannot recommend the use of amplifiers in which the receive pre-amp can not be switched out of circuit or by-passed.

If you are an SSB enthusiast, then your choice of linear amplifier will be far more limited. All too many amplifiers advertised for mobile use are unfortunately, anything but linear, or at best are sensitive to being over-driven. Many rigs give more output than the specification claims, eg the average Trio TS700 series gives around 15w, despite a 10w spec. It will be seen that putting 15w into a linear requiring only 10w drive for 100w output will cause bad spreading on SSB, with the attendant howls of disapproval from various SSB enthusiasts. Most rigs have a preset control inside with which you can set the maximum PEP output, and so back this down to reduce the drive to the linear, until you get clean reports.

Some so-called linears cause severe spreading, even if they are under-driven, and unfortunately good linears cost a lot more money than nasty ones which cause offence to others when you use them! Sometimes you will want to use a linear for both FM and SSB. RF sensing circuits for SSB operation usually have a hold off time of one second or so, so that the linear remains on TX in between words in a sentence, but returns to RX when you stop speaking for a moment. I find RF sensing for SSB rather annoying, and I prefer a direct relay change-over operated by the main rig, and most better quality linears allow for this choice. Some also have an FM/SSB switch which may alter the biasing on the PA transistors in addition to allowing the RF sensed change-overs to be almost instantaneous for FM, whilst hanging on TX for SSB. One linear I owned had a delay of two seconds which was very annoying when I was on FM for I could not hear the other station for two seconds after I had ceased transmitting, so often missed a quick break in comment.

When you install the 13v leads for the linear you must bear in mind that there may be a marked voltage drop on the leads between the battery volts and the voltage appearing inside the linear, so use the thickest cables that you can for this interconnection. Bad voltage drops here will just restrict power on FM but cause non-linearity on SSB as well. If you are installing (for example) the new Microwave Modules Jumbo linear for 2m which will give 200w output, then only 0.05Ohms resistance in the DC wiring can give you perhaps 1.5v drop and thus substantially reduce the output power. You'll also find youself sending Morse code with your headlights in the middle of the night when you are using the linear on SSB, as the peak current demand pulls down the battery volts in the car system on speech peaks!

One or two words of warning might not be out of place here; if you are running high power mobile, then beware of transmitting close to petrol stations, or in areas where blasting is taking place. There really is a chance that you could ignite a fuse which could set off an awfully big bang when you start transmitting! It was suspected that this precise problem was behind a petrol station's blowing up in Saltsburg, Austria in 1965. Avoid using very high power near airports and docks or estuaries. 200w of SSB at VHF from a mobile can also cause havoc near electronic laboratories or research establishments. So do be responsible if you want to run high power. Switch off the linear if you see another mobile on the same band close by, otherwise you could blow up his receiver's front end. Don't transmit high power if you see anyone within a wavelength or two of your antenna. You might be endangering someone's sight if you transmit whilst he is leaning on the car, perhaps talking to a passenger.

Operation

When you have taken all your decisions, and have installed your gear and removed the bugs, you will be able to get down to some enjoyable mobile operating. A few do's and don'ts might be useful, for some of them are the sort of things that even your best friend won't tell you! When you are identifing yourself, give your call sign reasonably slowly and speak clearly. So often I have heard the word "jait" followed by a complete meaningless mumble, with loud car noises, rather than a clear "G8 . . . mobile". There are occasions when you might be sorry that some amazing DX station has missed your call sign, and the QSL card to confirm that mobile QSO with somebody in Norway or Switzerland has gone to the wrong station.

It is only necessary to give your call sign in accordance with licence regulations, and if overs are short, it is not necessary to give two lots of call signs, all with phonetics, at the beginning and end of each over. If copy is 5/9 in both directions, then it should not be necessary to spell your name, QTH etc phonetically. You would hardly do this in the pub, so why do it on the air, unless it is necessary? Quite frequently, new mobile operators tend to have overs that are too long, and find that they have completely lost the station that they are talking to. You will soon get used to the effects of local terrain and tall buildings.

Contrary to some current practice, repeaters have always been installed with the idea of mobile operators having first priority. In many parts of the country a mobile only has to give his call sign in between the end of someone's over and the "K" in order to be invited immediately to use the repeater. Fortunately, many repeaters and the locals who use them are friendly. It is a good idea if you are working a fixed station to listen on the repeater input frequency to find out if you can hear him direct, in which case suggest a simplex channel, which then allows someone else to use the repeater. There are many complaints from people who say there is not enough room; we all have to live together on 2m, and everyone has an equal right to the band. If you have 12½kHz spacing steps on your rig, and you know the other station has the same, then why not move to one of the 12½kHz channels, sometimes referred to as the S½ tones, eg S18½ or S21½? If everyone used these additional channels where necessary and possible, there would be much less congestion. Please avoid certain spot frequencies which are informally reserved for certain activities, such as 144.6, and 145.3MHz for RTTY etc. Also avoid 144.9 to 144.9875 as these are in the beacon band, and are continually monitored by many stations who do not have FM, and who therefore will not be able to politely request you to QSY. Politeness is vital here and I have found that it usually works in both directions. Frequencies above 145.800 are reserved for satellite communications, so please avoid these frequencies. SSB operators do not normally pop up between 145.0 and 145.8MHz, so it is best not to put out mobile FM below 144.5MHz.

Returning to the matter of courtesy, I am sure we have all at times, let off steam a bit, because of unintentional or possibly intentional interference. I will never forget an experience heard whilst on Raynet listening watch. A particular frequency was being temporarily used by Raynet, and a young mobile operator landed on the frequency and first asked if it was being used. A very rude Raynet controller immediately replied, "Get off, this is a Raynet frequency being used for an exercise". As a Raynet member, I was so ashamed that I immediately called in, despite the exercise and invoked the controller's wrath by apologising to the young mobile operator. Impoliteness is not normal with Raynet, for they of course want to encourage, rather than discourage amateurs to joining the ranks.

Remember that on FM you will hear the strongest stations with very little interference from weaker ones on the same channel. This "Capture effect" means that many QSOs can continue on the same channel without directly interfering with anothers, unless one station uses an unreasonably high power level.

Finally, avoid using S21 on a Sunday morning, as it is used for the GB2RS news reading, and don't have long QSOs on 144.3 and 145.5, the calling frequencies for SSB and FM respectively. You may not hear anybody else on them, but quite possibly someone else may be listening for a weak DX station which you could unwittingly be clobbering. May I wish all those who are going mobile a lot of fun. I have most certainly had tremendous enjoyment from this aspect of the hobby over the last 22 years, seeing the change from a single mobile heard (in the London area) during an evening, to the chaos of the present day!

Q·&·A

Q "Can you explain what a gasfet is? I've seen a lot about them in advertisements which extol their virtues, but is it just another sort of field-effect device or is it better than the usual things like mosfets and what-have-you? Thanks for a great magazine." **E.L. Crowther, Lincoln.**

A *Well, yes and no. Although it's usually written gasfet, it really ought to be GaAsFET because the thing is made of gallium and arsenic, or rather the compound of them called gallium arsenide, and the chemical symbols for these two elements are Ga and As. The mosfet, by contrast, uses silicon as its basis (pity we don't call them SiFET's, isn't it?)*

The point about the gasfet is that it was originally intended as a very low-noise amplifier for microwave frequencies. Amateurs then discovered that its low-noise properties were useful on relatively low frequencies such as 432 and 1296MHz (low in comparison with microwaves, that is). They are *quieter than ordinary field-effect devices, but it very much depends on the individual device and who manufactured it – good ones tend to cost a fortune. So, yes it is a field-effect device but no, it is quieter than the usual mosfet. We hope to publish some designs for good masthead preamps using them in a future issue.*

Q "I have an amplifier using a 4CX250B with 2kV on the anode. Recently I happened to be using it in a dark room and I noticed that when I switched to transmit, there was a pale blue glow aroundd the anode connection which disappeared on receive. It varied in intensity as I spoke, using SSB. Can you tell me what cuases this?"
S. Spooner, Romford.

A *Well, Mr Spooner, the short answer is that we dont' really know. We looked at our own '250B amplifier and it didn't show anything like this, and we asked a couple of friends of ours whether theirs did and they said not. Our technical man thought it might be either an odd corona effect or something to do with ionisation of the air, but he wasn't convinced and didn't understand why it only apparently happened when the valve was conducting.*

We also asked John Nelson, G4FRX, who's well up on the 4CX250 family, and he wasn't very sure either. He's never seen the effect with Eimac valves, although he did hear of it some years ago with some unbranded types and thought that it might be something odd like Cerenkov radiation. He didn't sound very convinced, however, and has asked EMI-Varian if they have any ideas. We'll let you know if anything comes back. Anyone out there got any other wizard ideas as to why Mr Spooner's bottle lights up like this? We've seen valves light up blue inside, and also noticed that it varies with the anode current in things like the EL34 and some specimens of the 807, but that's in a vacuum – we've thought that would be some ionisation of residual gas inside the valve. Quite how you'd get that effect with an external-anode device like a 4CX250B baffles us.

Q "I'm a newcomer to the hobby, and this might seem to be a silly question but why is it said that Morse will get through when everything else fails? Surely it's just sounds, like the voice you hear from an SSB signal. Also, maybe you could tell me why radios crackle during a thunderstorm? Is it the thunder? I think your magazine is very good and I hope you'll put in some of the things that people wrote about in last month's letters."
F. Thorley, Rotherham.

A *We certainly will, Mr Thorley. Everything that people suggest goes on a card index file in the Editor's office and we keep a close watch on the suggestions so that we can incorporate several of them into one article. Now that we're going monthly, we'll be doing this a lot.*

Now, as for Morse, it's tricky to explain in a few words(we had an article about it in our first issue) but basically there's only one radio frequency involved, which is the carrier from the transmitter, and this means that it's possible to use a much narrower bandwidth at the receiving end. This means that the ratio of signal to unwanted noise is much better than with voice transmissions. Also, a skilled operator can detect Morse when there's only about as much of it as there is noise, which is completely impossible with any form of voice transmission – some complex factors of how the brain works are involved here, but it's a fact that Morse knocks practically everything else into a cocked hat when it comes to weak signals.

Lightning (not thunder) causes the crackles in your radio during a thunderstorm. This is because a lightning flash generates radio-frequency energy over a very broad spectrum, and your radio interprets it as sound of some sort. Thunder is the shock wave associated with the very rapid expansion of the air caused by the heating effect of the lightning and doesn't cause any radio effects.

Q. "I've been hearing a couple of 4N7 stations on 7MHz recently - are they legal? Also can you explain what a "Wadley loop" is? I 'gather it's a way of making a VFO drift-proof." **M.R. Jessop, Plymouth**
A. *4N7 is a prefix for Yugoslavia, according to the Prefix List, and they're some sort of special-event station as far as we know. In any event, they're quite legit. As regards the Wadley loop, if you have a look at our article on the Racal RA17 receiver last month you'll find that our eminent phase-locked crystal-controlled low-noise Peter Dodson has explained it all in words of one syllable - we guess you didn't see last month's mag! We'll send you a photocopy for a nominal fee if you didn't.*

Q. "The amateur licence these days uses a unit known as the dBW for power measurement; lpm a SWL who's hoping for a G4 and I don't understand it - can your technical chap enlighten me?" **R.Griffiths, Newport,Salop.**

A. *Certainly. It all started last year when the Home Office decided to start using this unit instead of the good old watt, for reasons best known to themselves. What it means is a figure in decibels related to a unit of one watt, so that a power level of 0dBW would be the same as one watt. If we take the power limit of 20dBW which is specified on the 432MHz band as an example, this implies a level 20dB higher than one watt. And you'll remember from our article on feeders a few issues ago that if you increase a given power level by 10dB you increase it ten times, or if you increase the same power by 3dB you double it. So 10dB on top of one watt, or 10dBW, would be 10 watts and increasing that ten times implies 100 watts which, under the new regime we'd call 20dBW. If you double that power of 100 watts you get 200 watts and, remembering that we've doubled the power, you can say that you've increased it by 3dB so that 200 watts is the same as 23dBW.*

Doubling that again, out of interest, gives 26dBW or 400 watts, which is the power limit on many amateur bands. Quite why the Home Office decided on this unit defeats us - no other radio user apart from the amateur service specifies power levels in this unit. The dBM is quite common, meaning dB related to power level of one milliwatt, but dBW strikes us as decidedly unnecessary.

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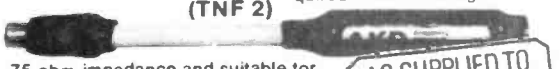

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INDEX TO FORMULAE

First off, an apology from the We Goofed Department - it concerns last month's article about resonance and things, and we made a very silly hash of something about which we certainly shouldn't. We discussed the resonant frequency of a parallel-tuned circuit consisting of a 1nF capacitor and a 1mH inductor and proceeded to say that it was 15.9kHz; we then showed that the reactance of the capacitor was equal to that of the inductor at that frequency.

Well, we don't know whether it was a gremlin in the calculator, a case of low batteries or a simple case of complete and utter brain sprain but although the theory was fine, the maths were anything but!

The resonant frequency of 1nF in parallel with 1mH would be 159kHz, not 15.9kHz or, to put it another way, the value of the capacitor to resonate with a 1mH inductor at 15.9kHz would be 0.1uF, not 1nf. The reason for this particular silly was that we were working out the formula literally, as it stood, and it's a fact that decimal places are all too easy to get screwed up doing it that way - we didn't want to go into indices at that stage, which are a much better way of attacking AC circuit formulae, and we fell into the classic trap that's monumentally easy to fall into. It's tricky to solve formulae in that way because it's fatally easy to get your decimal points messed up. This little nasty has caught out more eminent engineers before now than we've had hot dinners, so before we carry on where we left off last time let's take a look at a better way of sorting formulae like:

$$\frac{1}{2\pi\sqrt{LC}}$$

It's all to do with something called the "power" of a number, and something you may have learned at school is that a number is said to be raised to a power when it's multiplied by itself a given number of times. Let's take a basic example. 2 times 2 is 4 (yes, well done chaps, you got that one right) and you can say that 2 raised to the power of 2 equals 4. Now 2 raised to the power of 2 is usually known as 2 squared and you'll see it written as 2^2, or 2 squared, or $2^2 = 4$. Equally, 2 times 2 times 2 is 8; now here we've multiplied 2 by itself 3 times, so you can say that that's 2 to the power 3 or 2^3, or if you want to you can call it 2 cubed. Mind you, cubed and squared are only usable for the powers of 3 and 2 because there aren't any ways of saying 2^4 or 2^{15} except "2 to the power 4 or 2 to the power 15" unless you count "2 to the 4th or 15th" so we'll promptly forget squared and cubed from here on in.

Last issue, we showed you how to work out some common formulae. In this issue, we take a look at a rather better way of doing the same thing – using indices Chris Drake explains.

So, just for a little test, what would 2 to the power 7 be? We'll, it means multiplying 2 by itself 7 times, so that's 2x2x2x2x2x2x2 assuming that our maths has recovered from last month's fiasco, that's 128. In other words, or other figures, $2^7 = 128$.

Now you might be beginning to wonder what the blazes all this has to do with microfarads and resonance and things. Basically, the trouble with radio is that some of its units aren't what you might call convenient – as we said last time, it isn't much fun to have to deal with something whose value is written as 0.000000001 of a farad! The farad is the standard unit of capacitance, you see, and the formulae for resonance and reactance is written in terms of farads - however, 99 per cent of the capacitors that you'd be interested in from the point of view of radio and wondering what their reactance is would have values consisting of a decimal point followed by a lot of noughts and a couple of other figures right at the end. Take the case of the 1nF we discussed last time - 1nF, or nanofarad, is a thousandth of millionth of a farad, if you please, and even if you consider a large smoothing capacitor for a low voltage power supply - with a value of 1000uF - that's still only a thousand-millionths of a farad.

Frequencies in Hertz

Equally when it comes to inductors you'll usually be working with values which are a fraction of the standard unit which goes in the formulae we've seen so far and which is the Henry. A 1 Henry inductor is a moderately large chunk of iron and it certainly isn't the sort of inductor you'd be interested in putting in a formula and seeing what its resonant frequency in combination with a certain capacitor was every day of the week. You're much more likely to use something like a thousandth of a Henry, or even less than that, so here again it's a case of lots of noughts and tricky decimal points if you don't watch it.

And while we're on this tack, it's worth mentioning that in all of these formulae you need to express frequencies in Hertz. This is just about bearable if you're into audio-frequency components, but if it's VHF and UHF you're after, the numbers start to grow like nobody's business. Don't forget that 144MHz actually means a frequency of 144 million times a second, or 144,000,000Hz.

The point of all this is simply that the numbers you find in this area are apt to get rather large and cumbersome at the drop of a hat and it's no fun shuffling them around in a formula.

Now, we were looking a few moments ago at ways of expressing numbers by raising them to powers, and it so happens that if you take our example of 2^7, which is equal to 128, the little figure 7 to the right and above the 2 is called an **index** - in fact, this whole system of expressing numbers is called **index notation** and it's a very handy way indeed of expressing large numbers because if you take, say, 2^{15} which was our other example, that turns out to be 32,768. If you took, say, 10^{15}, that turns out to be 10 with an awful lot of noughts on the end - viz 10 times itself 15 times - and it's obvious that it's a lot easier to write 10^{15} than 1000000000000000. It also is quite permissible to use index notation for numbers less than one, simply by putting a negative sign in front of the index, so if we take our dreaded 1nF capacitor which we wrote down as 0.000000001 of a farad, we can replace that quite simply by calling it 10 to the power minus 9 or 10^{-9}. In other words, we've shifted the decimal point 9 places to the left and called it the power, which amounts to the same thing, and it's certainly a damn sight easier to write it that way.

It's just the same with our frequency of 144MHz. As we saw, that's a large number if it's expressed in Hertz, which is what the formula requires us to do, whereas a nice quick way of dealing with it is to convert it to a power. We have to watch ourselves a bit here because 144 first needs to be converted to something with a "base" that we can compare with our last examples and the easy way to do that is to say that it's something like 144 times one million, or in other words 144MHz equals 144 times 10^6 (because it's 144MHz, or 144 million Hz, and one million is the same as 10 to the power 6, which is 10^6). All good stuff - if you preferred, you could call it 14.4

STARTING FROM SCRATCH

times 10^7, or 1.44 times 10^8 - they all imply the same thing, which is 144 million or 144,000,000. It's much easier to say 1.44 x 10^8 than to have all those noughts cluttering up the place and, as we'll see in a bit, it makes some formulae a lot more manageable.

This bit about bases is very handy because it applies for all sort of things. If we think about an inductor with a value of 6 micro-henries, or 6uH, you can call that 6 x 10^{-6} henries, for example, or a capacitor with a value of 82 pF becomes 82 x 10^{-12} farads. Which is a sight easier than writing all those noughts and losing sight of the decimal place.

"Fine" I hear you say. "Now what about all those formulae? You haven't shown us how to do those yet!" Well, folks, let's have a look at what you can do with all these indices. You multiply simply by adding them; for instance, 10^4 and 10^{10}, if you want to multiply them together, simply become 10^{14} because you just add 4 and 10 and even the Bicester Simpletons can just about cope with that. Or, to take another one, 10^{-2} multiplied by 10^5 is just -2 plus 5 which is 3, so it's 10^3 which is 1000. Division is likewise dead easy with index notation - you just subtract them. So 10^4 divided by 10^2 is the same as 10^{4-2} which is 10^2.

Now this is jolly potent stuff because if you bring each nasty figure into a formulae down to the same base and get it into this notation, it becomes a doddle to get the answer out in a jiffy. Let's invent a really nasty-looking sum which is the result of some weird and wonderful formula from an erudite textbook; let's say we need to work out the following: $B = 6000/2\pi RCF$, with R in ohms and C in farads and F in Hz.

$$B = \frac{6000}{2\pi \times 10K \times 100uF \times 100kHz}$$

Now this formula doesn't really exist, but it puts together some thoroughly nasty units which have great scope for getting us in a right mess if we do it with noughts and decimal points and whatnot. Let's put it in index notation. 6000 is 6 x 10^3, since 10^3 is 1000 (10 x 10 x 10 - yes?), so that deals with that. 10K is 10,000, so that's going to be 10^4 and 100uF is going to come down to 10^{-4} farads. F is going to be 10^5 Hertz.

So when we've done this, the formula we're left with is:

$$\frac{6 \times 10^3}{2\pi \times 10^4 \times 10^{-4} \times 10^5}$$

So, what now? Well, for a start the 10^4 and 10^{-4} in the bottom line cancel each other out quite nicely, so they both disappear. If we're feeling somewhat bolshie and we're not after absolute accuracy, we can claim that 2π isn't a million miles away from 6 – so the 2π and the 6 cancel each other out as well. Where does that leave us? Hmmm - it looks better than the first one we did:

$$\frac{10^3}{10^5}$$

If you like, we can chicken out at that and say it's 1000 divided by 100000, which if you do the cancelling bit comes out to 0.01. However, it's just as easy to transfer the 10^5 to the top of the fraction and change its sign to 10^{-5}: if you do that, it just becomes 10^3 plus 10^{-5} which comes out to 10^{-2} which is 0.01. Isn't maths wonderful? B, therefore, equals 0.01 and we've got to it a lot faster than if we had to fiddle about with millions of noughts and decimal points sprinkled about as though they were flakes of snow!

Okay, armed with that, let's see what we *should* have done last month. Our 1nF capacitor can be called a 1 x 10^{-9} farad ditto and we can put that in the formula.

$$X_c = \frac{1}{2\pi fC}$$

This pans out to

$$X_c = \frac{1}{2\pi \times 1.59 \times 10^4 \times 10^{-9}} \text{ ohms}$$

Now this little beast will reduce to:

$$X_c = \frac{1}{2\pi \times 1.59 \times 10^{-5}} \text{ ohms}$$

It's a handy dodge to remember that you can take the value of the $1/2\pi$ bit as about 0.16 unless you're after fanatical accuracy, and so we get left with one less thing to worry about.

$$X_c = 0.16 \times \frac{1}{1.59 \times 10^{-5}} \text{ ohms}$$

Nearly there; let's now get the index to the top of the fraction and make it a nice easy sum:

$$X_c = \frac{0.16 \times 10^5}{1.59} \text{ ohms}$$

which pans out more or less to:

$$X_c = \frac{16 \times 10^3}{1.59} \text{ ohms}$$

which is of course:

$$X_c = \frac{16000}{1.59} \text{ ohms}$$

And even my antique calculator can see that that's a whiff over 10K. Or thereabouts, anyway - if you're feeling pernickety you wouldn't take 2π as 0.16 but this is certainly good for reactance and resonance calculations in the real world.

Since we're feeling daring, let's see what the resonant frequency of 1nF in parallel with 1mH is under this super new regime. The formula is our old mate:

$$F_{res} = \frac{1}{2\pi\sqrt{LC}} \text{ Hz}$$

and we can kick off by bashing 1nF and 1mH into 10^{-3} Henries and 10^{-9} farads. This makes the formula now look like this:

$$F_{res} = \frac{1}{2\pi\sqrt{10^{-3} \times 10^{-9}}} \text{ Hz}$$

Ah, but here's a thing! What the devil do we do with square roots under index notation? No sweat, mate, just divide an index by 2 and you'll have it. So our 10^{-3} x 10^{-9} come out at 10^{-12} as per usual, and the square root of that little lot is just 10^{-6}. So - what do we have now? Simple - it's just:

$$F_{res} = \frac{1}{2\pi \times 10^{-6}} \text{ Hz}$$

As we've seen before, we can get shot of the minus index by booting it up to the top of the fraction and changing its sign, thus:

$$F_{res} = \frac{1}{2\pi} \times 10^6 \text{ Hz}$$

which, as we've seen, falls out nicely at the other end as 0.16 times 10^6. Making this a bit easier in the usual way, it becomes 16 times 10^4, or 160 times 10^3, or 1600 times 10^2, or 16,000 times 10 or whatever you'd prefer - either way it's 160,000. In case you'd forgotten, that's in Hz, so we can say that it's 160kHz - as before, we're slightly out since 0.16 isn't quite the right value for $1/2\pi$ but it'll do us.

Well, we never did get round to Q and L/C ratio and all that, did we? Still, it was an interesting diversion and maybe we ought to have gone into indices right at the start and saved ourselves a month's embarrassment - you live and learn, though, don't you? If we find that there's a boo-boo in this one, on the day it hits the bookstalls, we'll - well, I don't know what we'll do but it'll probably involve at least 10^5 volts travelling through someone's head . . .!

The new weapon in the war on

CRIME!

Police turn to **RADIO TELEPHONE** for help

Getaways are harder to make—and *fewer too*—in cities where the police use Western Electric radio telephone equipment. ¶ The desk sergeant gets an alarm, and without moving from his chair issues instructions which are instantly picked up by patrolmen in cruising squad cars and motorcycles. Result: Seconds instead of minutes to pick up the trail. ¶ Over Western Electric radio telephone apparatus, voices are transmitted clearly. The skill and progressive viewpoint of Bell Telephone manufacturers make available this new and timely police weapon.

Western Electric

LEADERS IN SOUND TRANSMISSION APPARATUS

FOR·WHOM THE·BELL·RINGS

The early days of short wave were nothing less than exciting. Especially in the United States, where it was quickly recognised as one of the best ways of catching criminals. Early Chicago gangsters had much to fear from this new form of crime detection. Report by David Lazell

Just over fifty years ago, in the spring of 1932, the arrival of shortwave at Police Headquarters was officially announced in the pages of a handsome American publication:

"The new weapon in the war on crime! Police turn to the radio telephone for help!!"

All very dramatic, and no doubt designed to stimulate other police authorities to sound investment. The advertisement came from the Western Electric Company, well known in Britain for its sound recording system for movies, but equally well known in the USA for its telecommunication and satellite activities. During 1982, the Bell Telephone Company celebrated its centenary, this coinciding with considerable telephonic excitement on the British scene. The liberalisation of telecommunications (it is said) could even out-do the Yanks in the wonders of shortwave radio just ahead.

That apart, it is hard to imagine Dixon of Dock Green, or even the more flamboyant cops of 'Z Cars' getting so enthusiastic about radio. In any case, whilst the police in the 1930s were certainly developing shortwave communication, the great, tough cops and robbers movies more often had the megaphone, or other public address system, used by the Police Commissioner (Pat O'Brien *et al*) to persuade the wayward crooks to come out 'with their hands up' (and not holding any kind of mike at that).

The true life of police radio, in the 1930s, was nicely captured by Rosita Forbes in *The Wireless Constructor,* a monthly which championed shortwave in those halcyon days. Rosita Forbes wrote of many places afar, but her observation of police radio in Chicago must have been unforgettable.

"In Chicago *(she wrote)* there is a large room at the top of Police Headquarters, in Lower State Street, with a table down the middle, at which sit seventeen or eighteen men in their shirt sleeves with cigars in their mouths, green celluloid shades over their eyes, and telephone receivers clamped over their heads. At the end of the table, there is a cabin for the Wireless Operator, and the two men nearest to him are Emergency Officers, dealing only with serious crimes. Along the walls of the room are the telephone girls who receive the SOS calls. Most of them have acquired the sort of nerves which permit them to reduce the most incoherent cry for help, to a common denominator of address, cause and effect, before passing it to a detective at the middle table.

"Thus, 'He's murdering my husband! Crash! Help! Help!' has become 'Armed man attacking householder, third floor back, such and such a block of flats', by the time that the Emergency Officer (who deals with murders and hold-ups) has scribbled the message on a sheet torn from the block in front of him, and passed it through an opening in the wall of the wireless cabin. Inside this – at the Operator's elbow – there is a map of Chicago, divided into numbered squares. In front of him, is an instrument which looks rather like a telephone switchboard. It is also divided into squares, numbered to correspond with those on the map; and each containing rows of electric light bulbs the size of shillings (ie 5p pieces) representing the police cars patrolling that particular area. When an SOS comes in, the Wireless Operator looks at the map to see which district is concerned. He then presses a button on the corresponding portion of the switchboard, and by the number of bulbs that flash into light, he knows which cars are still at his disposal."

The Chicago Police Department had to cover an urban area of around four hundred square miles. Indeed, it is to the city's credit that it was one of the first cities in the USA to use shortwave radio on so imaginative a scale. It is true that one or two Canadian cities, the other side of the Great Lakes, claim to have been first, but Chicago took the new medium seriously. Perhaps it was appropriate that in the early days of CB mobile radio – when it was still an untried medium – the state of Michigan initiated some of the first experiments in mobile radio use by ordinary citizens, ie for traffic condition reports.

Mobile radio in the 30s

The approach, back in the 1930s, was that of flexibility. At least eighty police cars used radio on night patrols, but the number could be increased rapidly to twice that number. Contemporary descriptions of the quipment suggest that it took up a lot of space. For example, sometimes loudspeakers were mounted in the roof of the police car, apparently above the driver's head. That may serve to explain the necessity of safety belts and crash helmets, since any sudden leap by the vehicle could have given a severe case of hi-fi on the cranium.

Proving that history usually repeats itself, *The Wireless Constructor* article included reference to civic unrest. A Communist riot affecting the whole of Chicago's South Side was counteracted by the quick use of police radio. About fifty police cars were brought in quickly, this possible through radio contact – indeed Rosita Forbes estimated that no more than five minutes had elapsed between report of the riot and the moving in of the fifty radio-armed vehicles. One wonders if we would be as quick today. Within fifteen minutes, five hundred policemen were mobilised, and the riot brought under control.

The Chicago Police Department claimed that usually an SOS call was answered within thirty seconds minimum, to two minutes maximum. And being inclined to public relations (local citizens were invited to watch the police radio headquarters in action) the Police Department liked to show its skill in moving fast.

Far left: Western Electric were quick to advertise the new radio telephone system. Below: Radio became extremely useful for ship-to-shore and and fire fighting use, as written about in the US magazine Western Electric News.

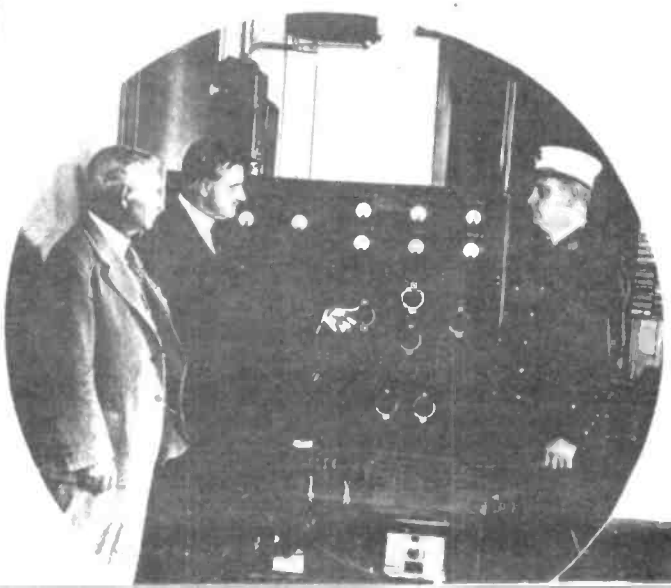
A Call for Water on the Waterfront

New York's Fire-Fighting Flagship Gets First Application of Western Electric Radio-Telephone to Harbor Craft

DOWN New York harbor sailed the *John Purroy Mitchell*. That boat can suck up the water she's sailing on and spout like ten thousand whales. With all her nozzles phizzing, she wears nearly a dozen white plumes, some stuck just the time that a million-dollar blaze cut loose on a palatial liner, she would know it as soon as would the nearest fire engine on land; she would shoot one last Niagara into the barge and then go plowing back up to the river a few miles to save the palace. Which really takes quite an intelligence.

Looked at as a matter of dials, condensers and inductances, the intelligence was a Western Electric 8-A radio transmitter, together with a short-wave 9-B radio receiver. These have recently come into use for harbor craft and were virtually making their debut on the flag ship of New York's fire-fighting fleet that day.

Fire Commissioner John J. Dorman, the same who nightly advises New York's thousands of theater-goers to "walk, not run to your nearest exit," was in the pilot house addressing his remarks to what looked like a desk stand without any receiver. Those remarks were being clearly heard by Deputy Chief McElligott located at Marine Fire Headquarters on lower Manhattan some two miles away. The Commissioner and his deputy



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FOR·WHOM THE·BELL·RINGS

'Fast' may not be the right word.

"Each car carries a radio on the dashboard." reported Rosita Forbes. "Its four or five occupants are armed with heavy revolvers as well as sawn-off shotguns, with repeating magazines which fire a 'big duck shot'. If they are going to storm a position in which gangsters have entrenched themselves, they carry tear gas bombs as well – and bulletproof shields some four feet high. A list of stolen cars, as many as fifty representing the day's harvest, hangs on the windscreen. The man beside the driver is supposed to keep his eyes peeled for 'hot shots', suspicious cars. Each car picks up every message transmitted from headquarters. As soon as a police car picks up a call to its own number, it goes like a bat out of hell. Red traffic lights mean nothing at all . . . Skidding over greasy or sandy streets, cornering like maniacs, they go all out through alleys, cluttered and ill-lit, along tram lines and wharves thick with lorries.

"As soon as a police car picks up a call . . . it goes like a bat out of hell"

"As soon as he is within range of the suspect car, the detective on the front seat starts firing. Behind him, at each window, is the barrel of a shotgun. With a final screech of metal, glass and gears, the police car hurls itself across its quarry, and at the expense of its mudguards and bonnet, rams it straight across the pavement into the nearest wall. Then it is only a matter of time, as to which party can shoot quickest, straightest and longest. But in the last resort, the driver – remaining at the wheel – may cover, not a retreat, but a final offensive when only one detective is left on his feet."

As usual, art followed life. Cartoon strips in the comic sections of the Sundays, movie serials and feature films all caught the police radio bug. Some of this material is gaining a new 1980s audience, and the Dick Tracy feature films of the 1940s have just been released on video, by Video Yesteryear of the USA. Dick Tracy excelled the Chicago police in his use of a wrist watch radio, just becoming a practical proposition in these 1980s From the 1930s, great and rather barmy film serials incorporating radio in the cause of virtue have also been released recently, by Video Yesteryear. Perhaps the oddest of all these video features is the 1935 *Murder By Television*, with Bela Lugosi – in which a famous radio and television genius is murdered during a practical television demonstration. Well, you can get details from Video Sales Ltd, PO Box 107, Kidlington, Oxford, or direct from Reel Images (Video Yesteryear) Box 137-M, Monroe, Connecticut 06488. USA.

The real work in developing shortwave radio in the USA was pursued by Western Electric and perhaps one or two other organisations. In 1930 for example, the Bell Laboratories arm of Western Electric provided two radio-equipped aircraft for a demonstration of airborne police radio. Using a Ford TriMotor and a Fairchild aircraft, the organisation set out to prove that a flying policeman could contact headquarters as easily as a cop on road patrol. Conditions in the aircraft were somewhat cramped, but the demonstration was eminently successful. During the experiment, Police Commissioner Edward Mulrooney of New York conversed with Captain A.W. Wallander of the Police Air Service, as the latter flew at a height of two thousand feet above New York. Both aircraft were equipped with Western Electric shortwave radio telephone equipment, the message being picked up by a ground base at Whippany, New York State and transmitted via cable under the Hudson River to Police Headquarters. Incidentally, Captain O.N. Olley, senior pilot of Britain's prestigious passenger airline Imperial Airways, was a keenly interested member of the team in the Ford TriMotor.

Flying Policemen

With Western Electric Apparatus They Communicate With Headquarters as Easily as Any Other Bluecoat

"WHAT do you see?" asked Edward P. Mulrooney.

"Miles of water front and plenty of motor traffic," replied A. W. Wallander.

Mr. Mulrooney is Police Commissioner of New York City. He was sitting in his office at headquarters. Mr. Wallander is Captain of the Police Air Service. He was 2,000 feet up in the air flying over the city.

"It is beginning to snow up here," Mr. Wallander added. He had to convince his listeners he was not standing in a telephone booth around the corner.

Commissioner Mulrooney talked and listened for a half hour, took off his ear-phones, laid down his transmitter, smiled and commenced answering the questions of newspaper reporters. He had to put the ear-phones back on again to pose for photographers, a did other police officials who were present and H. N. Willets of the Commercial Department of our Company.

The idea, he explained, was to find out how radio-phones would help to coordinate the air service with the rest of the police force. The Western Electric Company had just demonstrated it. Apparently, he said, it was as easy for a flying policeman to telephone headquarters as it was for a policeman on his beat.

The Commissioner hinted that, with a policeman in the air able to keep in touch that way, it might be possible for him to assist in directing large-scale movements. Such things as traffic tangles and big crowds were hard to see from the ground. But in the air there are no corners to look around.

Earlier that day the two Bell Laboratories planes, a Ford Tri-motor and a Fairchild cabin plane, had taken off from Hadley Field and flown to New York.

Both planes were equipped with Western Electric short wave radio-phones. They made contact with the ground through Whippany, 40 miles away. From there the conversation was carried by wire across country and under the Hudson River to Police Headquarters.

At present flying policemen have no way of communicating with a reckless flier. However, the day will come when both police and private planes will be equipped with radio-phones. In that case, the flying cop will call across space to the offending flier, "Hey, you, over there! Pull up another thousand feet. You're flying too low."

In the Ford Tri-motor plane are (left to right) Arthur N. Chamberlin, Aviation Secretary to the Police Commissioner, talking into the "muzzle" mike; Rodman Wanamaker, 2nd, Aviation Aide to the Commissioner; O. N. Olley, Senior Pilot of the Imperial Airways, London; and Captain A. W. Wallander, of the Police Air Service

Scene at the Police Commissioner's office during the demonstration. In the center is H. N. Willets of the Western Electric Company, while Police Commissioner Edward P. Mulrooney is seen at the right engaged in telephone conversation with the fliers

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Above: "The day will come when both police and private planes will be equipped with radio-phones . . ."

White plumes of water . . .

The dedication of the commercial boffins is exemplary, and even in these days of imminent privatisation of everything in sight, the public needs such flair today, to be convinced of the effective benefits of new shortwave communication. In December 1930, Western Electric demonstrated the first application of their radio telephone to harbour craft, in this case the Foreboat, 'John Purroy Mitchell', stationed at New York Harbour, and the flagship for New York's fire-fighting fleet.

Western Electric's equipment – described as an 8A radio transmitter, and a shortwave 9B radio receiver – was chunky in

appearance, by today's standards. Fire Commissioner John J. Dorman of New York was able to converse with Deputy Chief McElligot, who was stationed at Marine Fire Headquarters on Lower Manhattan, about two miles away. Here, a shortwave radio telephone transmitter and receiver were in use for monitoring distress signals. That first, modest experiment at the end of 1930 really heralded a new age. As *Western Electric News* pointed out, the comments from ship to shore were 'but modest trail blazers for a momentous following . . . for another way had been found to save minutes in bringing the white plumes of water that cool off the red fevers that break out on the waterfront'.

"A new horror has been added to Chicago – a mobile loudspeaker

In the late 1920s, the Bell Telephone System opened trans-Atlantic telephone communication, as well as a link between the USA and Paris. But shortwave itself was the focus of attention. On December 8th 1929, using a transmitting station at Deal Beach, New Jersey, the first telephone call was made from the USA to a ship at sea – in this case, 'The Leviathan', and its master, Commodore Harold A. Cunningham. Calls from the 'Leviathan' to shore, came via a receiving station at Forked River, New Jersey, using (for the time) sensitive directional antennae. The confidence shown by the Bell entrepreneurs was impressive. On board the 'Leviathan', a small room was eqipped with a microphone transmitter, to permit passengers the use of the new radio telephone system. Whilst the US Navy Department had years before instituted a system for military use, this 1929 demonstration showed that shortwave radio communication had many commercial possibilities. Many advances separate that event and the current development of MARISAT (the world-wide navigational satellite system). Perhaps it's understandable that the US has the policy of involving business in space communications. Events have clearly shown that business can capture the public imagination – and generate use of the new communications on offer.

New York – that legendary Big Apple – was the home of the Bell Telephone System, at 195 Broadway. Maybe that accounts for the considerable number of innovations on show around New York in the pioneer years. Yet Chicago, America's second city, had no less flair. Projected in the movies as the home of gangsterdom (to the sorry exclusion of the city's true attractions) Chicago had to show that its police had all that was going, including radio. *Popular Wireless* showed a proper interest in the possibilities, and in the issue of February 10th 1934, gave readers the latest news:

sion quality for the radio ...

which it has been used. I think we will be equally surprised with the development of this new ship-to-shore service. The transoceanic service was opened with one long wave channel. There are now in use this long wave channel and three short wave channels. A telephone cable to supplement these channels will be operating in 1932. And early next year we shall start a radio telephone service to South America.

"In the telephone service we open today between the *Leviathan* and the Bell System, calls from telephones on land to the *Leviathan* will go through the transmitting station at Deal Beach, N. J. Calls from the *Leviathan* to telephones on land will come through the new receiving station at Forked River, N. J. On shore the receiving station and the transmitting station are separated. Not only that but they have ample room for directional antenna. On the ship, of course, both receiving and transmitting have to be done from the same point and the available space for antenna is limited. Moreover, the radio telegraphic traffic on a ship like the *Leviathan* is practically con-

S Mr. Gifford ... speaking he placed the call for Commodore Cunningham, aboard the *Leviathan*. When the latter answered, Mr. Gifford greeted him and said:

"Commodore Cunningham, I am glad to open this service with you, the senior ranking officer of the American Merchant Marine, and to the *Leviathan*,

Interior of the deck house on the *Leviathan* which houses the short wave radio telephone equipment. To the right is the receiving set where voices from shore telephones are received by radio from the Deal (N. J.) station

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A ship-to-shore telephone service presents a number of problems which are not present in point-to-point radio telephony. These problems arise principally from the fact that on shipboard the radio transmitting equipment and receiving apparatus must be located in close proximity to each other, while on land they may be widely separated.

Foreign service section of switchboard in the American Telephone and Telegraph Company's long distance office at 24 Walker Street, New York City. Voices going to or from radio telephone stations at Deal and Forked River, N. J., pass through this switchboard for routing to their destinations

"A new horror has been added to the once gangster-ridden populace of Chicago, in the form of a mobile loudspeaker police truck. The idea is this: the van is normally employed in patrolling the city, on the lookout for law-breakers of various kinds. On the van are mounted a powerful amplifier and speaker, with a microphone hanging down beside the driver, so that whatever he cares to announce is boomed out to the surrounding district. Persons attempting to cross the road, contrary to traffic regulations; commercial drivers and private car owners parking in the wrong places, or carrying out a risky manoeuvre, are apt to hear a stentorian voice drawing their (and everybody else's) attention to the 'crime' being committed, as the driver of the patrol spots the offender in the act. It is stated that the effects are salutory." Could be worth trying on the motorway, maybe in foggy conditions.

The significant phrase in the report is 'once gangster-ridden'; could it be that the crooks were too slow to monitor the police airwaves, and were thus run out of town? Did the Chicago police use codes that baffled the baddies?

Most observers would say that police shortwave radio certainly contributed to the cleaning up of the criminals. Maybe the shotguns came in handy, too. Today, whilst criminals are often well into electronic communication, they face the problem of scanner users. You can't say a thing on the air without someone hearing your dulcet tones. But so far, there is no report of the crooks, in Chicago or anywhere else, returning to semaphore flags for their quick words to buddies. In any case, the US scanner lobby, with its various publications and frequency reports, offers guidance on those frequencies used by the US constabulary, cavalry, and almost everyone else. Though they are honour bound not to mention the CIA.

The cops of Chicago are as busy as ever. If you are going that way for your holiday, you could drop them a line – well in advance – and ask if you can call and see what is happening in today's police radio communication. But you may find things a little quieter than the epic days mentioned in this article!

Top: The short wave equipment in the deck house of the Leviathan, once America's largest ship. Above: The long distance office at the American Telephone and Telegraph Company, in New York in 1930.

Acknowledgements are made to Amalgamated Press Ltd, proprietors of the journals, Wireless Constructor *and* Popular Wireless *for quotations in this feature.*

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The Case of the DX Man

A probably true story by A. Nolden, G5—

I met Eric Larby when I was a youth of 16 back in 1929. Eric was first licenced in 1926 and perhaps the only 'G' station in pre-WW2 days to hold a call containing the letter 'E'. The authorities at that time thought that a single dot might get lost in QRM or QRN and so make it difficult for a monitoring station to identify those breaking the terms of their licence.

Out of band operation, bad language or even using 'CQ' instead of 'Test' could lose one a licence. Many prospective amateurs asked the PMG's office to allocate them a callsign that was in some way linked to their names or initials. G5LC, the late Leslie Cooper and G2DC, the late Major Jack Drudge-Coates were both examples of this idea, and many more may be discovered when perusing an old callbook. For some unknown reason (perhaps the issuing clerk had been celebrating something rather heavily at the time) the call G2EL was issued and strangely never rescinded.

Eric Larby lived in an old former farmhouse near one of those weatherboard and tile-hung Wealden villages with a 'hurst' at the end of its name. He was a director and a major shareholder in one of our leading canned meat importing companies, and up to the age of fifty had remained a bachelor addicted to his hobby of amateur radio. Pauline became his wife in 1933. She was then just half his age but seemed devoted to him and showed no resentment of his leisure pursuit which so often kept him from the nuptial bed for night after night.

Considerable drift

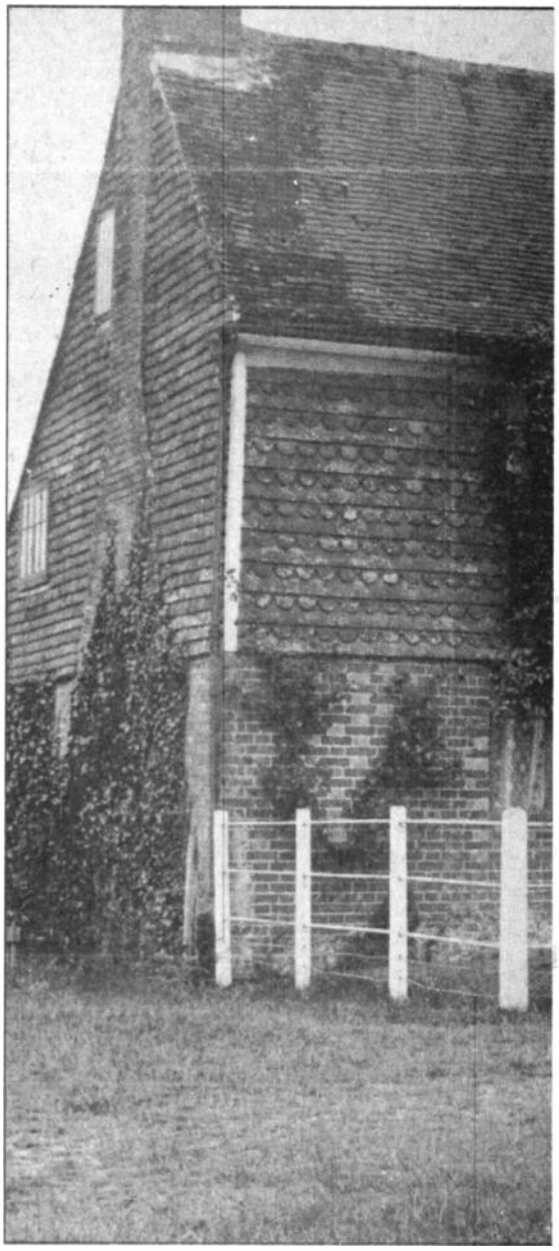
My own background is quite prosaic. The only son of a self-made and successful motor trader and garage owner (an Austin concessionnaire) I went into the family business which was located near Tunbridge Wells in Kent. Like so many scientifically-orientated youngsters of those days I became obsessed with wireless tinkering. This soon led me to listening on the short wave bands where I found Eric Larby.

He was my closest amateur so I made myself known and soon became a frequent visitor to his home where he encouraged me to apply for my first amateur licence. This was one of the so-called 'Artificial Aerial' licences distinguished by having a number '2' followed by three letters. There was no 'G' prefix allowed and theoretically, although one could build and test a transmitter, it was not supposed to radiate. Non-inductive resistive dummy loads were almost unknown then so electric light bulbs were used. One well-favoured artificial aerial was the 'dummy zepp' which had several feet of open wire line terminated by a bulb load. With just ten watts input, enough RF 'strayed' and enabled the occasional QSO with fully licenced operators.

I think the best DX using my 'dummy zepp' (which ran up into the roofspace) was a distance of more than 200 miles on 40 metres. With Eric's help I soon mastered Morse and gained my full licence in 1935 at the age of 22. My brand new G5 callsign in no way related to my name and it has not been allowed to lapse at any time. Although many years have been spent off the air the fear of having to take the RAE and another Morse test made me hold on to the old call at all costs.

Eric Larby came into transmitting just after the record breaking epoch of 1923/5 when world-wide DX expanded as the used wavelengths went down. By 1926, DX contacts on 40 metres and the 'new' 20 metre band were not uncommon between stations using quite modest equipment, and G2EL rapidly accumulated QSL cards from the six continents.

His licence was for 10 watts input and he stuck rigidly to this power when all around him many amateurs were using illegal QRO rigs and 'snatching' the DX away. Another quirk of Eric's was a reluctance to ever modernise his gear although he could easily afford such an exercise. When I was a frequent visitor to his shack in the 1930s he was still using the same self-excited push-pull TPTG oscillator that he made in 1926. A feature of this rig was that the anodes were supplied with about 350 volts AC and the filaments of the valves had 6 volts AC on them. This certainly gave G2EL a most characteristic note! His signal was also chirpy and had considerable drift – especially on 20 metres. The fact that he keyed the HT transformer primary did not help matters, and I found I could easily recognise his signals.



This was made even easier because of his unusual Morse which was sent on one of the 'new' McElroy mechanical bug keys recently imported from the States. He never seemed to master the right number of dots for the letter 'H'!

The first BERU (British Empire Radio Union) Contest was held in 1931 and won by a VK station. Eric entered this contest which then took place over a number of days, and was placed about half way down the result placings. a position that certainly displeased him for he had burnt gallons of the proverbial midnight oil in his efforts to succeed. For several years Eric persisted in the bettering of his first BERU score and also took part in other contests which were evolving; but he could never really compete with the 'big boys' some of whom were running up to a kilowatt and had rhombic antennas.

I told him not to take it all so seriously, but whenever the topics of DX chasing and contest working arose he became quite agitated and swore that one day he would show them all – and do it on ten watts!

"Just wait and see", he remarked. "I shall think of something". To my mind nothing

Eric Larby's house in Dorset. His shack was the top room on the left side of the building.

short of a miracle would enable that antiquated rig, the O-V-2 receiver and the end fed wire of indeterminate legth which ran from chimney stack to the elm tree at the foot of his garden, out-perform the rising generation of crystal controlled multi-stage rigs that were becoming fashionable.

A few weeks after receiving my full 'ticket' I heard Eric working some of the most fantastic DX on 80 metres. I couldn't even hear the far eastern and Pacific Islands stations that he contacted. Every day and night it was just the same: it seemed that every time G2EL put out a 'Test' call something rare and choice came back. Whenever a really unusual DX station called and invited the inevitable pile-up its operator always came back first to Eric! His signal sounded no different from its usual strength and other characteristics at my QTH some five miles from his place so I could not understand what was going on.

One evening Pauline Larby rang me. She sounded very worried and asked me to go over for lunch the next day. Eric would be out, she said, at a board meeting in London and would not be back until early evening and it was imperative that she saw me alone. She refused to proffer any further information over the telephone, and hung up.

The story she told me over lunch the next day was rather disturbing. It seemed that Eric had started making regular and frequent visits to a nearby south coast resort where he spent time with a certain Mr. Crowley who was living in one of the better hotels. I had never heard of this gentleman but Pauline assured me that he was one of the foremost exponents of witchcraft and black magic in Britain. His unconventional 'ceremonies' and what may more accurately be termed orgies had achieved a certain notoriety in the popular press and she feared that Eric might in no small way become corrupted and that the marriage might be placed in jeopardy. I could do little to re-assure her and left, feeling that I had let her down at a time when she most needed help.

A week or so later Pauline rang me again.

"It is alright", she said. "You know about that business we discussed recently? Well Eric has now promised me that he will never go anywher near that wicked charlatan again and I really believe him."

I told her how pleased and relieved I was now that the problem had been resolved and promised to call on them both at the weekend. Most of the Sunday was spent with Eric and Pauline and they seemed to be quite natural and at ease with one another. Eric became very tetchy however when I suggested we should go up to the rig and raise a little of that super DX he had been grabbing. It was suggested that if all I wanted to do was operate, I should go home to do it. We did, however, both go up to his shack for a short time and I was surprised to note that everything was just as it had been *before* his sudden eminence as a DX 'King'. The aerial too was just as I had formerly seen it; a rather droopy wire not more than 25 feet from the ground in the centre. Just before I left that evening Eric confided that he intended winning BERU next year.

Some exotic station . . .

It was not my style to be obsessive about amateur radio. I didn't strive to work every country known to man or be top dog in major contests, but in 1936 I was determined to enter for BERU, the real prestige event in the British amateur calendar. I could run 50 (illegal) watts, had just bought one of the newly imported Tobe single signal superhets and had a very respectable aerial system so could expect to do reasonably well in competition. During the contest, in the early spring, I often took time off to listen to Eric and note what he was working. Whenever I tuned to his frequency (we stayed on one frequency in those days) he always seemed to be in QSO with some exotic station. At breakfast time during the second leg of the contest he was working a long string of west coast Canadians that were about S1 with me. During the afternoon he exchanged reports with Empire stations in the near and far east that I hitherto had only dreamt about.

By the end of the contest it was obvious that he had at last pulled it off – the trophy would be his to receive and hold for a year. Maybe then, I felt, things would return once more to a state of normality. After finishing work at the garage the next evening I went straight round to see Eric and congratulate him upon his obvious success. He seemed however to be depressed rather than elated and was emphatic that he had no intention of sending in a log entry.

"You see I have done *too* well", he went on. "No one will believe that it was all done honestly. They will be saying that old "EL" has built himself a secret high power rig and got together other fancy equipment. Anyway, how does one explain being on every minute of the contest and never going QRT for meals or bed?"

I was tempted to ask him the same questions but thought better of it, made my usual polite goodbyes and drove off home.

The Case of the DX Man

We were very busy at the garage during that spring of 1936 and I had little time to spare for operating or visiting. My trips to see Eric and Pauline were few but eventually I managed to fit in a whole Saturday with the twosome. Pauline took me to one side and told me that Eric was spending much less time in his shack than previously. This was later confirmed when Eric announced that working DX became rather a bore after a time, but that he maintained a sked with one rather special station. When I asked who that station was he hastily changed the subject and was obviously not intent that I should know anything about the matter.

It all happened on Wednesday, May the fifth. It was mid-afternoon and I was in the office drinking tea with a couple of our mechanics when the phone rang. An obviously very agitated Pauline Larby implored me to go over there right away. She would not volunteer any information as to why, but as she was so distressed I made some excuse to father, downed tools and drove over.

Eric has gone!

"Eric has disappeared" cried Pauline hysterically when I arrived. "He has just vanished!"

Sure enough, he did not seem to be anywhere in the house. His car remained in the garage and all his outdoor clothes were intact and in their usual places. There was no note to say where he had gone or when he would return, and no one at hand or nearby had noticed him leave the house. "He went up to the shack after lunch", said Pauline, "and never came down again". She went on, "I've been indoors since he went up and he certainly has not come downstairs. The only other way out could be through a window, but they are so far from the ground."

I asked if she had really searched thoroughly all the rooms, attics, cupboards and closets and she assured me that it had been done without success. She then said that she thought something was 'a bit funny' in the shack. We both dashed up there immediately. It was a small room of the kind so often listed in house agents' literature as a 'child's bedroom' and measured some 10ft by 12ft with a small window looking out from one end of the property. At first nothing untoward was apparent but then I noticed that the wooden parquet floor between Eric's metal chair and the operating table was scorched and browned. Beneath the bench lay an amorphous mass of a metallic nature which I picked up to examine.

It was what had once been Eric's prized gold pocket watch and chain, a sort of family heirloom. Now it was hardly recognisable as a former timepiece. The gold case and chain together with its brass and steel innards were fused together into a distorted lump. I held it up for Pauline to examine, but she screamed and ran back downstairs. I continued in my close examination of the shack and soon discovered that the rig was still switched on and operational on the 40 metre band.

I switched everything off and went back down with the log book; it might, I though, contain some clues as to Eric's disappearance and his earlier behaviour. Examination revealed that during the previous three weeks Eric's contacts had all been with one station. The callsign was DE5 IL, which at first seemed not unusual, for by that time German amateurs were using similar calls.

It was odd though that only one station featured in the log. There seemed to be no set time or frequency band for the contacts which had taken place at all hours of the day or night. The only other snippet of information was that during his first QSO with the German, Eric had written down 'Nick' in the 'name of op.' column. Nothing indicated the station's QTH or any other detail.

On my advice Pauline phoned the police. They soon arrived but had no success in their search of the house and its outbuildings. Having been assured that the distraught Pauline would be spending the next few days and nights with a cousin at Eridge I left her for home at about 5pm.

Time quickly passed and nothing more was heard nor seen of Eric Larby. He was officially listed as a Missing Person, and after a few months the affair had been forgotten by all but Pauline, myself and a very few close friends. Eric had never been very sociable and did not make friends easily. I became quite a regular visitor to the house and Pauline seemed to appreciate my calls. One day I slipped up to the shack and switched on the rig. Everything worked normally, the way one would expect an obsolete ten watter to do. Making contacts was far from easy and a frequent return was 'TNX OM UR RST 555 VY RUFF RAC NOTE ES CHIRP'. Trying for DX only brought a QSO from a W2 and a report of 435. Later I got just 'QRZ? G?' from a ZS6 station.

The G2EL magic had vanished with its owner. So I pulled the big switch and resolved never to use that gear any more. I went down and told Pauline that I thought the shack should be cleared. She agreed and later I managed to scrape £5 for everything at a club junk sale. I kept the log book and with Pauline's permission took it home with me.

We gradually saw more of each other as time went on and we became rather more than just friends. The War came along in 1939 and I joined the Signals eventually attaining the rank of Captain. Pauline went into the WAAF and was at several Bomber Stations in Yorkshire until her demob in 1945. We were married in 1943 when I was on a long embarkation leave, for by then the statutory seven years had elapsed since Eric's disappearance. Although I was in close contact with the many amateur stations set up by service personnel in the Mediterranean area where I had a roving commission as a WT Station Inspector, I never mentioned that I was a pre-war amateur, and never did any operating. Pauline sold the old house after the war, and I sold the family motor business which father had left me when he died in 1941.

Pauline, of course, had inherited Eric's business interests so between us we were quite comfortably off. Up to last year I had never felt any urge to get back on the air, but a chance purchase of a glossy radio magazine when on a long train journey set up the feeling that on approaching 70 years of age it must be a question of now or never, so I splashed out and bought some shiny new gear. I set up a Trio transceiver, a three-element tribander on a 60ft crank-up tower, a very long wire and all the other bits and pieces which go to make up a station. We now lived in a converted mill in Dorset in what should have been a fine QTH away from man-made electrical noise.

Everything has gone sour now, and I am worried sick. I have not told Pauline what I am now about to relate, for I do not know what result it might have or what it might induce her to do.

Dared call it back

As soon as the new rig had been installed and tested on the air by the bright young man from the local amateur radio emporium I ventured on to the 'boys' band'. Good old forty metres! Although a little rusty with the key I managed a fair CQ and sat back to listen for replies. Back came an imperious S8 'buzz-saw' signal which wobbled about through the receiver passband. It called me for what seemed an age and then signed "DE G2EL K".

Fearing my imagination had got the better of me I made a rapid QSY to 80 metres and called again. The same thing happened! Next I called and worked a G station in Cumbria and had a quite normal QSO. As soon as I signed, I was called once more by the thing calling itself G2EL! Even on SSB I was constantly followed through the bands and called by that insistent persistent rough old CW signal. I once dared call it back but did not receive any sensible reply; just my call repeated over and over.

Yesterday I told Pauline, now a sprightly old lady of 72 that I decided that I didn't think much of amateur radio these days, and that I intended selling up the complete station to the first bidder. A look of relief and gratitude then welled into her eyes, and she did not answer; she just squeezed my hand.

A few moments ago I took yet another look at Eric's old log book. A flash of enlightenment has just revealed something that was there all the time awaiting comprehension. The number five may also be written the old way, the Roman way, as a V.....

A final thought has struck me. If G2EL is still alive somewhere 'pounding brass' he will be 100 years old next week!

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By Rev. George Dobbs G3RJV

Looking at the advertisements in radio magazines, a beginner would be excused thinking that all radio amateurs use multi-band beams with rotators on tall towers or expensive commercial verticals. But that is far from the truth. Most of us simply use wire antennas.

Very often these might be dipoles or other versions of the tuned wire antenna but few of these are multiband in their basic form. The average amateur frequently has to make do with compromise antennas to work several bands from the same system. This requires some means of matching the antenna to the rig and this is usually an Antenna Tuning Unit (ATU). The text books are full of circuits and ideas for ATUs; most work well, some are for specialist systems and some are simply just too complex for the job in hand.

We are to look at an ATU which is about the simplest arrangement possible, and seems to meet a wide variety of needs. Many amateurs are reduced to having to work with a length of wire, perhaps in a 'dogleg' around the available garden space, tuned up to work several HF bands. The L Match is perhaps the simplest and easiest way to tune up an endfed length of wire. It is also an ideal ATU for the short wave listener who may be trying to plug a length of wire into his receiver.

A bit of wire that costs next to nothing

What does an ATU do and how good is it at its job? The ideal of any transmitter is to dissipate, or lose, as much of the radio frequency power as possible through the antenna. In order to do this the transmitter must be matched as closely as possible into the antenna. The antenna of whatever sort will have an impedance, as will the transmitter output. Modern transmitters have a nominal output impedance of 50 Ohms so the antenna ought to be matched to this value. A length of wire used as an antenna will vary in impedance from band to band and, putting it crudely, what the ATU does is to make the transmitter "see" 50 Ohms at the antenna. This is done by means of tuned circuits which electrically tune the antenna to offer a suitable impedance to the transmitter. If more than one band is contemplated with the same length of wire, some means of varying the tuned circuit must be built into the antenna tuning unit.

How good are they? Well naturally a bit of wire is not going to perform as well as a beam or a wire antenna tuned for one small frequency range. However, we are comparing expensive arrangements or frequency-dependent antennas against a bit of wire which costs next to nothing,

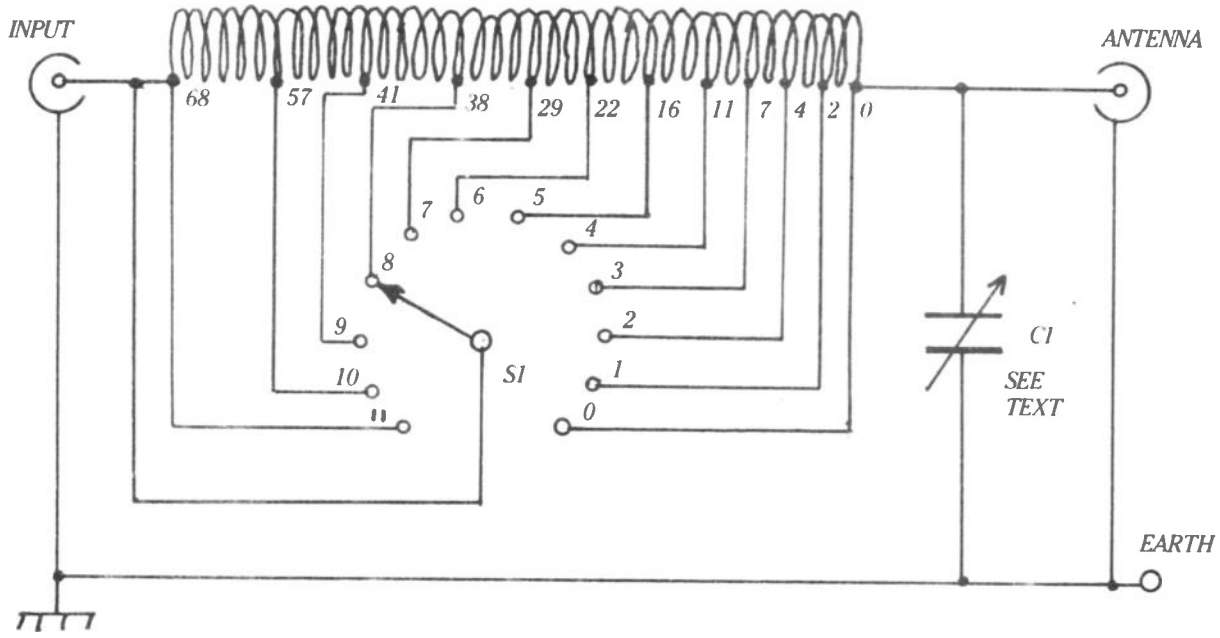
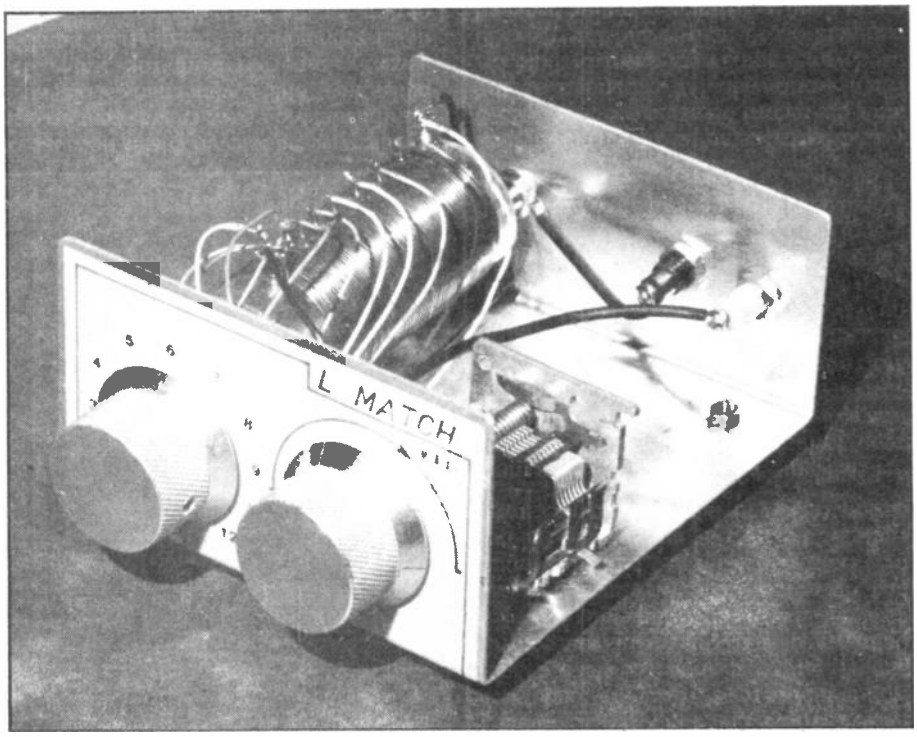


Fig 1
L MATCH CIRCUIT



strung up around a garden or open space. I have used random lengths of wire in all sorts of situations tuned up with a Z Match, often with a transmitter power of two or three watts and been amazed by stuff I have worked. I enjoy portable operation with low power (QRP) equipment and well recall a week spent in Wales with a very basic two watt transceiver in a terrible site.

I was in a cottage deep down in a valley with a steep slope rising directly from the back of the cottage to 1,000 feet. I ran out about 90 feet of wire to a short tree on the bank above the cottage, tuned it with an L Match ATU against a counterpoise and worked 26 countries in five evenings on seven and 14MHz with the two watts. No real DX, but good reliable reports and

Far left: The L Match circuit showing all basic points. Left: What the finished product looks like. Note the expensive-looking controls – which you should be able to find in your scrap box! Below left: Layout as seen from the top, minus connections. Below: See text for more details, but this list explains the numbers of turns you require for the coil.

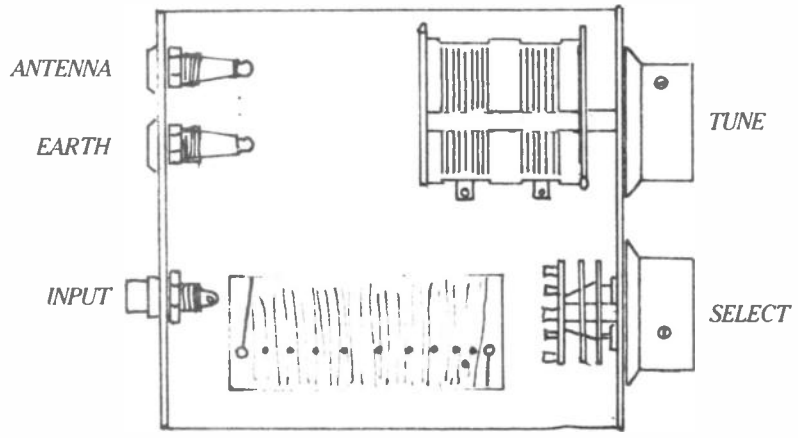


Fig 2
LAYOUT (TOP VIEW)
(without connections)

COIL L DETAIL OF TURNS		
0	TURNS	START
2	"	
4	"	
7	"	
11	"	
16	"	TAPPINGS
22	"	
29	"	
38	"	
47	"	
57	"	
68	"	END

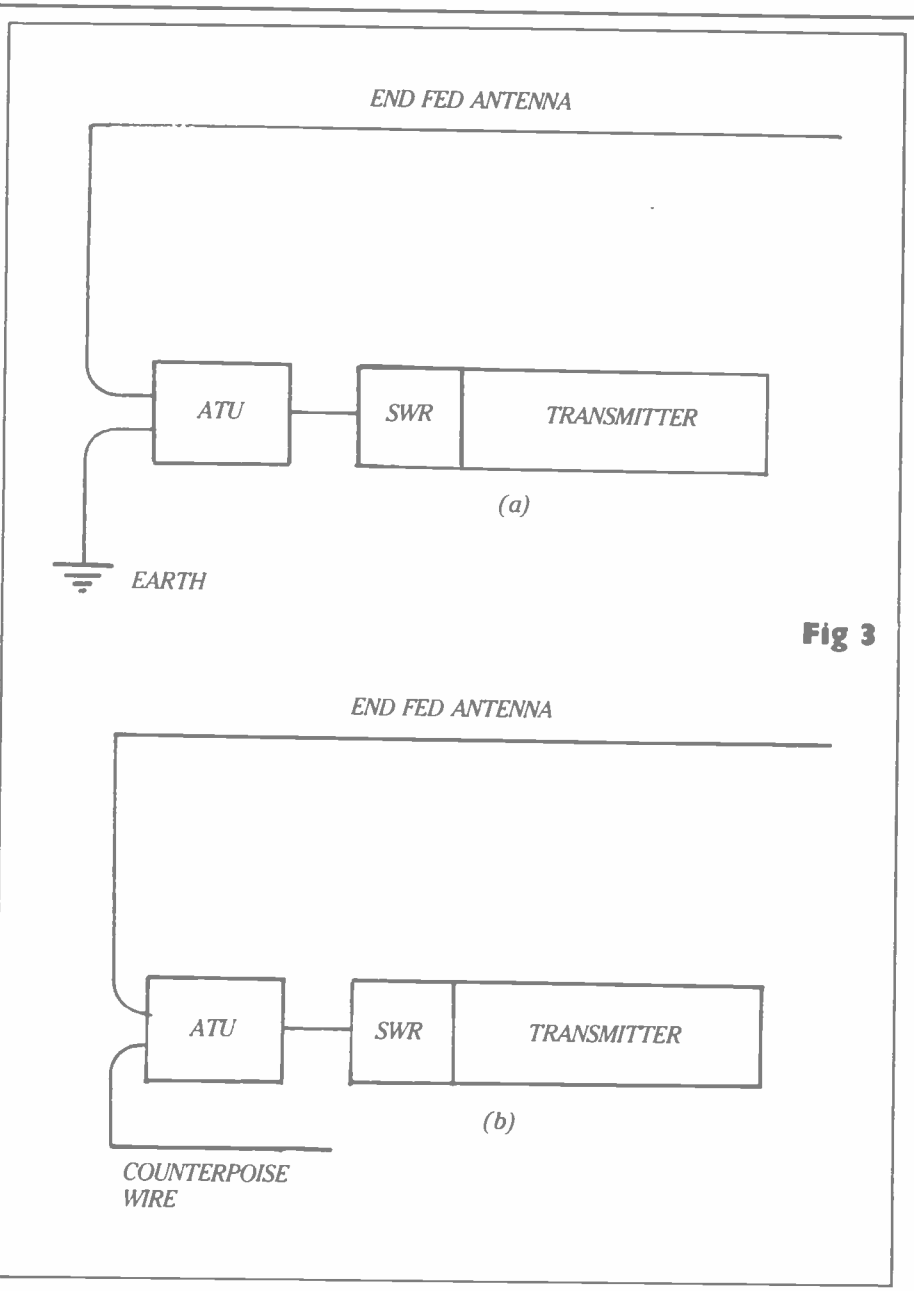


Fig 3

QSOs. The antenna cost next to nothing and the ATU was a collection of junk box bits. So even if you do have a sophisticated antenna at the home QTH, build an L Match – it could come in useful. It is about the simplest thing an amateur can build and there should be one on every amateur's or SWL's shelf.

Figure 1 shows the circuit of the basic L Match ATU. Nothing to it, is there? The input goes to a variable inductor. This is an homewound coil with switchable tappings. The antenna is connected to the other end of the coil from which a variable capacitor goes to ground. All the components should be from the junk box or, if you haven't got a junk box, scrounged from friends and radio mates. The ATU is suitable for almost any legal RF power. The coil should present no problems but if anything over 100 watts is contemplated, the capacitor C1 should have widely spaced plates. The chief component requirement is cheapness. If you spend a lot of money on an ATU, you have failed!

Capacitors from old valve radios are ideal

The coil L1 is wound on a section of plastic wastepipe some 1¼in outer diameter and around 3in long. It should be easy to find a suitable offcut at a plumbers but anything of similar dimensions will serve. The coil is wound with enamelled copper wire of 22swg. Again, almost any similar enamelled copper wire will do the job. 22swg is roughly 2mm thick in its enamelled form, or another way of checking if the gauge is about right is to see how many turns go onto a former. 22swg enamelled wire should give about 30 turns to the inch, so if you have some scrap enamelled copper wire that does roughly that, it will be OK for the coil.

Begin the coil by anchoring the starting point. I used handy little things called turret tags which can fit into a hole drilled in the former. Drilling a couple of holes about a quarter of an inch apart and wrapping a complete turn through the holes does the job just as well. Allow 3-4in of wire loose at the start for connection to the antenna socket. We begin at the antenna end, so wind two turns on the former and pull them tight. The first tapping is now made. This done by pulling out about a quarter to half an inch of wire at right angles to the former. This doubled back to the former surface, forming a tight U-hump. One or two twists can be added to the tapping point to help it hold out from the former. Begin winding again and add two more turns, making the total number of turns four, and form another tapping point. Although the tappings ought to be in a line across the former so that the tap point is the exact number of turns which have been counted, the first three or four tappings are very close and it is easier to stagger them slightly. The winding continues with tappings made at 2, 4, 7, 11, 16, 22, 29, 38, 47, 57 and 68 turns and the coil finishes at the 68th turn which becomes the input end. An examination of the photograph will show what the completed coil looks like.

End fed wire in a typical arrangement

The switch, S1, is a single pole 12-way switch. This is one item you may have to pay good money to buy. It is a standard item and a large number of component dealers stock a suitable switch. The constructor will have to sort out which of the array of contacts on the back of the switch is which. In most switches this can be done by a simple inspection of the switch in action, seeing where the contact arm moves. The variable capacitor can be any airspaced component of maximum capacitance in the range 200 to 500pF.

Capacitors from old valve radios are ideal, the wider the vane spacing the better. I used a completely unknown variable capacitor bought for 25p at an amateur radio rally. It has two ganged sets of vanes of differing sizes with about 16 vanes in each gang. I found that joining both sets of vanes in parallel gave me a suitable value for the ATU. Rummage around and see what can be found and try it, but if powers above 100 watts are being used, try for a wide spaced component. The input and output terminations for the ATU are whatever is standard in the shack. I used the cheap phono plugs and sockets to the input from the transmitter but this just happens to be the termination I use for

my QRP equipment and probably the more usual SO529 socket will be the choice for most stations. The antenna and earth connections will be to lengths of wire so almost any type of socket of screw terminal will serve the purpose.

The photographs and Fig 2 show the layout of the ATU. The actual layout is quite unimportant although it is best compact but not cramped. I used a simple home-made U-shaped chassis bent from aluminium with a base, a front and a back. A bit like the good old 1920 "have a look at what's inside" type of construction. The dimensions are some 4in x 5in x 2½in high. Again almost any type of mounting would do although it is not a good idea to build ATUs into a confined metal case.

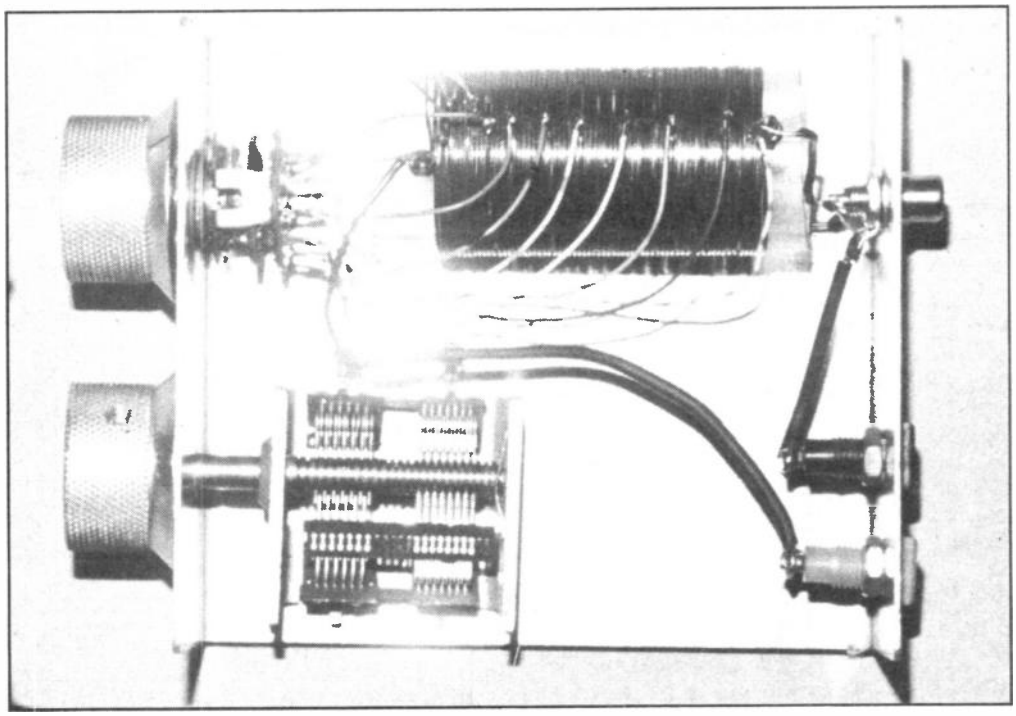
The front panel is finished off in my usual way by using a piece of tinted paper cut to fit the panel, after it has been drilled, and lettered. I use a Rotring pen with stencils, but rubdown lettering produces neat results. The finished paper mask is pasted onto the front panel and finished off with a covering of clear plastic film of the sort used to cover books. The coil is held above the base with standoff spacers and two 6ba nuts and bolts.

I have used them laying across the shack floor . . .

Begin the wiring with the switch tappings on the coil. It is helpful to use a variety of coloured wires for the leads between the switch contacts and the coil. This a great aid in identification. The only probable mistake that can be made in this circuit is to wrongly wire the switch to the coil. Solder the leads onto the switch before it is mounted on the front panel and then make the connections to the tappings on the coil. These wires should not be too long but spacing them slightly gives no problems in operation and certainly makes the wiring up much easier. The rest of the connections are then made. This is not a difficult task as five wires complete the construction. My wiring can be seen on the photographs. Do not forget to connect the earth terminal to the screened portion of the input connector and to the metal frame of the ATU case. This must be about the simplest bit of electronic construction. There should be no problems even if it is the first thing you have built.

The usual way to feed an endfed length of wire is to load it against earth or ground. However, "radio ground" or earth does not always have to mean connection to a large earth spike in a nearby section of the garden. In practice good electrical earths,

Far left: Endfed wire antenna diagrams. See text for details. Below: Photograph of the top view.



especially for RF applications, are hard to achieve. Not only is it often inconvenient to get that classical earth spike into a suitable spot in the mother earth but the lead lengths between the earth and the equipment can present problems. Think about it. It only requires relatively short runs of cable for the lead to be a quarter wave or more on some of the higher HF bands. Earths can be a real problem especially if the shack is upstairs. For many years I have not used earths for loading up endfed wires but prefer to use tuned counterpoises for the band in use.

Using the ATU is very simple

The tuned counterpoise is a length of wire, any cheap plastic covered copper wire, cut to a quarter wave for the band in question and used in place of the earth or ground contact. Fig 3(a) shows a typical arrangement for using an endfed wire antenna with an earth connection. This is standard practice for such a setup. Fig 3(b) shows how the endfed antenna is used with a counterpoise wire. The wire is an artificial electric ground being a quarter wave long at the required frequency, one end connected as the earth connection to the equipment and the other end left free. A tuned counterpoise will only work over a relatively small frequency range so one is required for each band to be used. Two or more may be connected to the ATU and can be left in place for multiband operation.

Counterpoise placement is not critical although they should not be buried but run above ground if possible under the path of the antenna. However, I have used them laying along the shack floor, dropping out of windows, running along garden bushes and the bottom of fences. Just try to get a straight clear run if this is possible and a few inches above ground again if possible. Touching the ground or large metal objects can detune the counterpoise. A chart of suitable counterpoise lengths for various HF bands is shown in Fig 4. Try the idea and like me, you may never use an earth again.

Using the ATU to tune up a transmitter is very simple. The antenna and earth, or counterpoise, is connected to the ATU. The transmitter should be fitted with an SWR meter or have an external SWR meter. If the drive can be adjusted, reduce this so that the tuning up can be done with a small amount of RF power. The antenna length will vary according to circumstances, but the L Match copes within the range of 50 to 100 feet.

BAND	*REQUIRED COUNTERPOISE*
160 LOW	*123' 0"*
160 HIGH	*120' 0"*
80	*63' 0"*
40	*32' 6"*
20	*16' 6"*
15	*11' 0"*
10	*8' 3"*

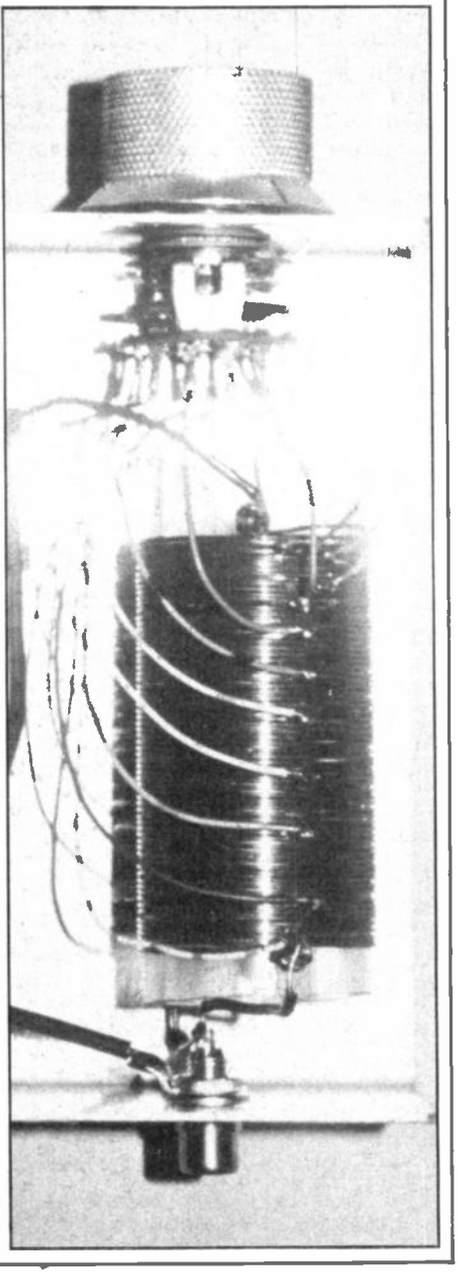
Fig 4 SUGGESTED COUNTERPOISE LENGTHS

A few watts is plenty . . .

Longer and shorter wires can also be tuned but tuner adjustment is very critical with short lengths of wire. Apply some power to the antenna tuner; a few watts is plenty. Adjust the sensitivity of the SWR meter, or adjust the power level, to give full scale deflection on the meter in the FORWARD position. Switch the SWR meter to REVERSE and switch the coil for the lowest reading. Then the capacitor, C1, can be adjusted to give the lowest possible reading.

It may be that similar low readings can be obtained in more than one switch position on the coil. If so, use the one that gives the highest forward reading for a low reverse reading. The short wave listener can use the L Match ahead of his receiver simply by switching the coil and finding the most sensitive position, then peaking with the capacitor. If more than a few watts is used to set up the ATU with a transmitter, it is best to remove the RF power before changing the switch positions on S1 to prevent switch flash.

So that is the L Match – one of the simplest items of equipment for the radio amateur to build and use and an asset in any radio shack.



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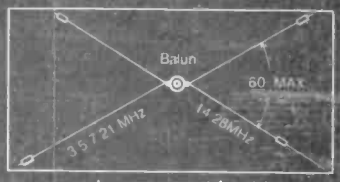

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To compliment the excellent IC-720A HF Transceiver, ICOM have produced the IC-2KL linear amplifier. It is of a similar size and matches the IC-720A perfectly. It produces 500W output on SSB, CW, AM and RTTY needing 80-100W of drive. As with the IC-720A it will operate from 1.6MHz to 30MHz continuously at full output power, but you still need an antenna that matches. It will follow the IC-720A automatically changing bands WITH NO TUNING – the operating is done from the prime-mover.

This automatic facility can be overriden for use on rigs other than the IC-720A, but can be added to the IC-701, IC-730, IC-740 The IC-2KL employs a heat pipe cooling system for the heatsink of the power transistors. This is a new technology used to transfer the heat, and has a high conductance, several hundred times that of copper, plus a very quick response.

The IC-2KL has a matching power supply the IC-2KLPS delivering 40vDC at 25A continuous for 10 minutes maximum.

IC-2KL + PSU £1149 inc.

CUE DEE antennas

The BEST in recent tests and really well made too. Send for a catalogue of these DX antennas. Here's part of the range:-

4el 2m yagi VHF	4144A	8 dBd	£24.93
10el 2m yagi VHF	10144	11.4 dBd	£45.16
15el 2m yagi VHF	15144	14 dBd	£63.00
17el 70cm yagi UHF	17432	14.5 dBd	£48.00
4/5el HF Beam	DUO 2	(14/21 MHz) 9/8 dBd	£356.71

All matching cables, clamps and booms available for stacking 10 and 15 element yagis.

Agents (phone first – all evenings and weekends only, except Scotland) **Scotland** – Jack GM8 GEC (031 665 2420) Midlands – Tony G8AVH (021 329-2305) North West – Gordon G3LEQ Knutsford (0565) 4040 Answerphone available

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Thanet Electronics
143 Reculver Road, Herne Bay, Kent. Tel: (022 73) 63859.

Same day despatch if possible

Datong MK Morse Keyboard

Amateur Radio tests the Datong Electronics MK Morse Keyboard, an excellent space-age alternative to the traditional straight key or paddle.

It's nice to be able to fly the British flag in this age of electronic wonder widgets from the Land of the Rising Sun, and it's great to be able to look at British products for the amateur. You wont find multi-mode transceivers made in the Land of Hope and Glory any more, but you will find things like transverters, front-end boards and clever filters made by small companies up and down the land.

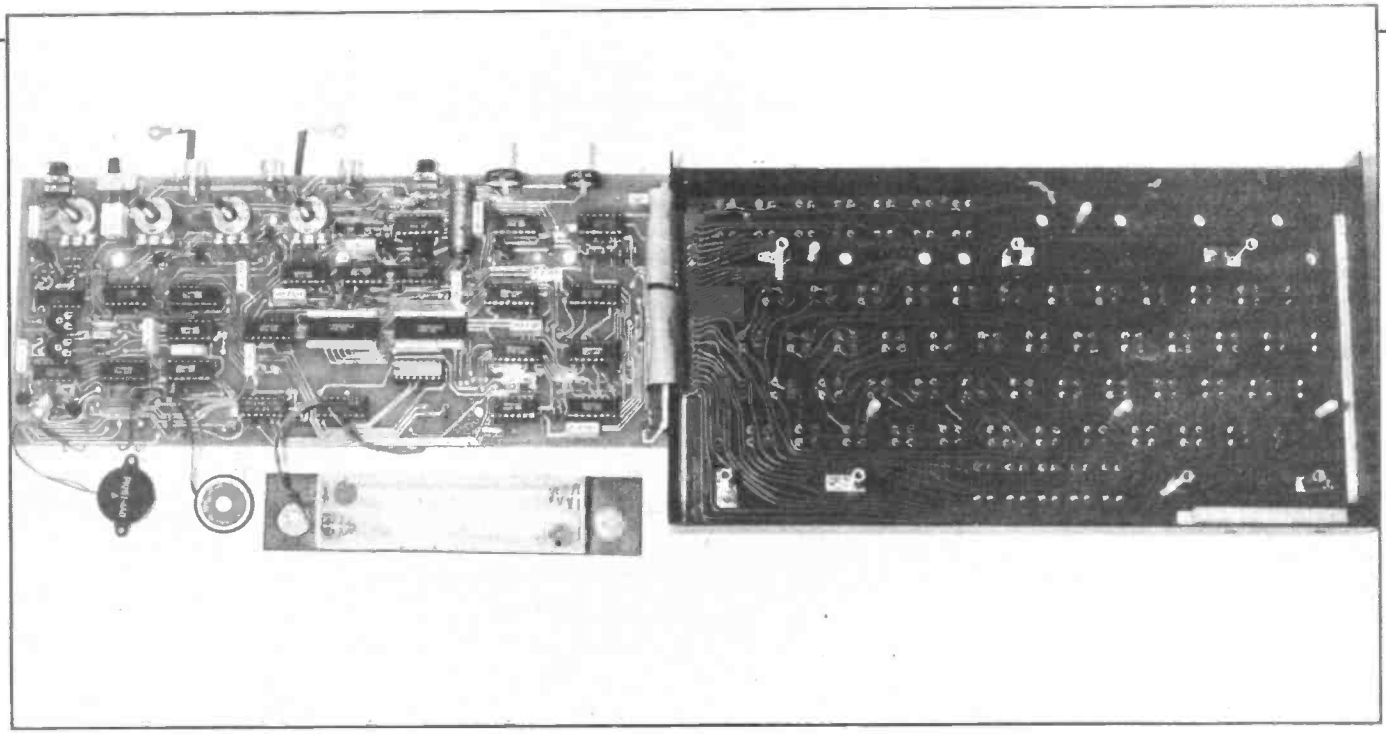
They're usually well made, purposefully designed and confer a touch of individuality to even the most oriental amateur station. We looked at a product from our very own Microwave Modules last month and this time we thought we'd have a sniff round something from the well-known firm of Datong up in Leeds. It's a Morse keyboard, basically, although it'll do rather more to earn its corn than that simple description lets on.

Datong are a highly innovative company that make some really handy gadgets; they seem to have a knack of spotting a gap in the market and making some slightly offbeat design to plug it. As far as we can remember, their first-ever product was an RF speech processor that wiped the floor with the crop of audio compressors and what-have-you that were around at the time; it produced lovely compressed audio at the receiving end and must have been worth 10dB in any contest where it was in use. Mind you, it gave linears a hard time – we remember seeing the anode current in a 6-40a sitting more or less constant at about 90 milliamps although we were using SSB at the time! Yes, Brian, we *did* have too much compression in . . .

"Take away the pain of sending Morse and replace it with a typewriter keyboard"

Datong have also been renowned for some very clever audio filters over the years, and we'll hopefully review one in a subsequent issue. However, we'd better get back to our keyboard - suffice it to say that Dr. D.A.Tong is a clever man with an eye for an original and innovative circuit and he's also published some good articles over the years. The latest brainchild from Spence Mills (is trouble 't mill?) is this Morse keyboard.. The basic idea of it is to take what some might consider to be the pain of sending Morse away and replace it with a standard typewriter-like keyboard that generates Morse characters with which to key your super high-power transmitter. This is the basic function of the Datong Model MK, although as we'll see it'll do a lot more than that.

As well as generating straight Morse at practically any speed you like - from a snail's-pace 5wpm to an ear-shattering 132wpm, which ought to be more than enough for the meteor-scatter folk who like to send as much data as possible in a short space of time - there are four memories available in the MK which can store up to 64 characters in CMOS. The advantage of this latter point is that you don't lose the memories even if you switch off. In fact the entire device is CMOS-based, which means that it has a meagre appetite for current (it draws about 3mA from its internal batteries, which translates to about 300 hours of use if you bash away for around an hour a day



The innards of the Datong MK exposed for your edification and delight – beautifully and carefully built to the best British standards.

and use Duracells). It has an internal buffer memory, so that you can peck away at the keyboard and even if you're the world's worst typist you'll still get FOC-type Morse coming out at t'other end.

The nice thing about the memory facilities is that you can either use them independently, say for storing CQ messages or what have you, or you can merge them all together if you need to. You can also interrupt a message from memory simply by typing in something from the keyboard, so that if you're a contest whiz you can have a standard reply programmed into memory and simply type in callsigns and reports as you go. As you'll see, this feature really works.

Let's begin at the beginning. The MK arrived at the office packed in an enormous amount of bubble plastic and cardboard courtesy of Her Majesty's Mail; either they've learnt from bitter experience in Leeds or they're not taking any chances but we've never seen packaging this good before and we'd guess that their return rate of damaged keyboards must be zero. It took us five minutes and a Stanley knife to persuade the keyboard that Bicester air wasn't going to do it an injury, until after the struggle it reposed on the Editor's desk. As usual, Technical Man came sniffing around for circuits, handbooks and other impedimenta but he was disappointed this time - we gave him the handbook, which looked good and comprehensive, but there was nary a trace of a circuit diagram for him to suck his teeth over. We guess that Messrs. Datong *aren't* exactly falling overthemselves for some Clever Dick to duplicate one and save money, and we can't say that we blame them too much although it might be nice to have some insight into how the thing works so that you can fix it if it happens to go wrong.

"MK comes in a matt black powder-finish steel case, with a heavy, solid feel to it"

It was certainly one of the most well-made things we've seen for a while; Datong seem to share with Microwave Modules the idea that if it's worth doing it's worth doing well. None of your thin alloy boxes here. The MK comes in a matt black powder-finish steel case, no less, and it's got a heavy and solid feel to it. The keyboard is definitely different. It looks like one of those nasty things you find on low-cost home computers, that's to say a membrane thing with no feel to it and about as much reliability. However, when you poke at a letter key with your digit, you feel a positive "click" that's distinctly unlike any other keyboard you ever tried. There are small key switches with a very low travel and they're covered with the plastic membrane - definitely not to be confused with the cheap and cheerful things you find elsewhere and nicely done so that when you spill your coffee over it at four in the morning in the middle of the CW contest you're not suddenly off the air. According to Datong the plastic is, in fact, polycarbonate, which is pretty well rip-proof and extremely unlikely to get damaged in any way at all. Very natty.

The keys take up about three-quarters of the keyboard, with controls for the volume of the sidetone (yes, folks, it contains its own sidetone generator if you happen to have a transmitter that doesn't produce any), a speed control which works in two ranges, a weighting control for those who have their own preference in this area and a variable delay which serves to give you time between the messages coming out of memory. To the right of these, as you can see from the pictures, there are the keys for getting into the memories and for replaying messages from them.

Stately silence

On the back-drop are sundry sockets for keying the Tx, extracting audio output and so on; we liked the separate sockets for positive and negative keying outputs especially, since it means that the keyboard will work either with a modern transceiver or your old favourite Top Band Special with grid-block keying. There's also an input for an external power source (being CMOS-based, the thing isn't at all fussy about the exact voltage as long as it's somewhere between four and 15) and a couple of preset controls to add some inter-character delay for Morse practice and a volume control for the little "peep" that sounds each time you press a key. Self and Technical Brain Box had a violent disagreement over this last night. I like to have some confirmation of the fact that the key I pressed has actually done its stuff, especially with an unfamiliar keyboard such as this one, whereas he couldn't stand the thing and obviously prefers to send his Morse in stately silence except for the sidetone. It's a good job the MK can do both, or there'd have been blood spilt and we'd certainly have tested Mr Datong's claim that you can wipe the keyboard clean.....

Anyway, the first job was to put some batteries in and try the MK without a transmitter to get the feel of it. You can either run it from four HP7s or thereabouts or plug in an external power supply; in fact we didn't have a power supply handy at the time because they were in use next door for some project or other (to judge from the howls of rage they weren't doing too well with it either) so we took some batteries out of something else. Only snag here was that the keyboard didn't work.....so we sent someone out to the supermarket to get some new ones in case the originals were flat. But it didn't want to work either, even with those. Ulp - visions of deadlines and what-the-hell-else-can-we-review? In desperation, we nicked a PSU from next door and imagine our relief when it worked. Memo to Datong: when you get the review unit, it wasn't us, it was always like that! Presumably a small funny somewhere. The LED lit for about a second and then it went out and you couldn't get a peep out of it in "internal battery" mode.

"In the meantime there was this perfect Morse coming out"

Anyway, having sorted out that little snag we settled down with the instructions and got the feel of it. The keyboard definitely took a little getting used to. It was like a cross between a touch-sensitive one and a keystroke type such as typewriters have and until we got the feel of it we were producing some comical characters! The buffer memory worked a treat. You quickly got a feel for when you had to slow down a bit because the buffer was full, and in the meantime there was this perfect Morse coming out –in fact, the difference between the keys you passed and the Morse coming out was a bit disconcerting at first but it took no time at all to get the feel of it. If you've ever sent a Telex in real time you'll know the feeling. We then tried putting messages in memory and getting them out again and this seemed to work just fine.

The character set also includes handy things like AR and BT, as well as some of the more obscure ones available with the shift key, so there's no limit to what you can send – you can even do things like brackets if you want to confuse your average amateur! All the controls seemed to do their stuff, and all in all we'd say that you could get the best out of the MK after about an hour or so of practice.

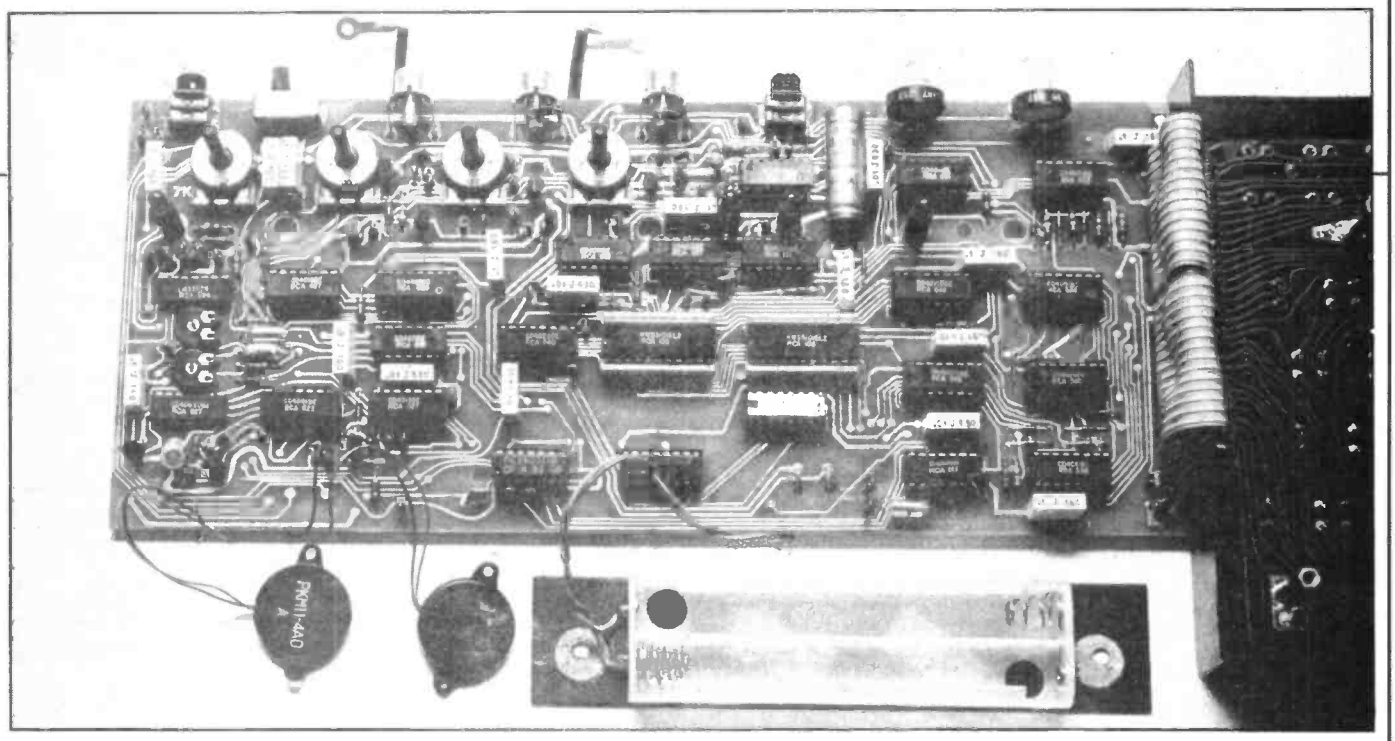
So it was then time to go on the air with it, and our first foray was on 7MHz after work. The first contact was with an OE station and then we settled down to a good QSO. Using the keyboard is distinctly different from using any other method of sending Morse and it took a little while before we really got used to the idea – however, it's certainly easy to use. In fact we'd call the MK very "user-friendly" and it's clear that the man who designed it and thought about what the functions it ought to have, did so from the point of view of a user. This is a nice change from the designers of some equipment we've seen, who surely can never have actually meant anyone to *operate* their gear!

No problems

The next step was to ask a colleague to try it out in his full-legal-limit 144MHz station for a couple of MS skeds he had. He said that it took him about half and hour to get the best out of it, but that he did complete with an SM and an HG station using the MK, which can't be bad for a piece of gear you've never seen in your life before. He uses a homebrew keyer with some clever memory, but he said that he'd certainly be happy using it in a high-power situation (ie, the sort of power levels that cause trouble for things that aren't well screened and decoupled) which is good news.

So the final stage was to use it for a week or so and try it on our various bands and in various situations for ourselves. The verdict is that if you feel that this way of sending Morse is for you (which we'll come back to in a moment) the Datong MK is the way to go. We didn't experience the slightest problem with it, apart from the teensy snag with the batteries we mentioned earlier, and there was never any problem in using the full legal limit on all the HF bands.

It's nice to use, with one minor exception – and maybe this is a personal thing anyway. This is that the "space" bar on a keyboard is usually hit with the side of the thumb if you're even slightly out of the one-finger typing stage and the space bar on the Datong keyboard is (a) rather



A close-up view of the main electronics of the Datong MK; very tasty.

shorter than the equivalent on a typewriter and (b) needs the same pressure as the other keys. You have to make a slightly more positive effort than usual to send a space, and it would have been nice if that character *was* just a touch-sensitive part of the board instead of a switch. However, that's a personal view and it didn't take too long to get used to it.

Just to finish with, we had a look inside and found an impeccably built piece of equipment. The PCB has to be one of the nicest we've ever seen –exquisite soldering and defluxing and good-quality components artistically laid out. Very British, somehow, and displaying that certain flair that's a treat when you see it.

So if you want a Morse keyboard, then there's little doubt in our minds that the Datong MK is superb piece of equipment. It's well thought out, beautifully made and looks as though it ought to stand up to years of use. It'll certainly outlast many rigs themselves. The only slight reservation we have isn't at all to do with the MK except insofar as it embodies a philosophy which we're not sure we agree with. It goes something like this. Part of the fun of sending Morse is the physical act of manipulating a straight key or paddle or whatever; you're directly in touch with what you're doing.

With a keyboard, it's as though there's a gap between you and what you're saying – it becomes somehow *slightly less fun*, if that makes any sense and the sensual aspect and satisfaction of making nice Morse sounds isn't there any more. The other small point is just to wonder whether machine-sent Morse isn't slightly missing the point. You still need to *receive* it, after all, and there's no way that buying a Morse keyboard will suddenly turn you into a superb CW artist with your nomination for the First-Class Operator's Club in the next post. If your inclinations lie that way that's fine – but we have a funny feeling in our bones that we can't quite get rid of that using a keyboard to generate and send Morse isn't quite in harmony with the nature of Morse itself. So we just wonder who'd benefit from it.

If you're a senior citizen who's been sending the stuff all your life but those fingers aren't up to it any more, a keyboard might be the answer to your prayers – equally, if you're one of the new breed who's thoroughly at home on a keyboard and indeed who can't write a letter unless it's done on a word-processor, fine. But if you're keen enough on Morse and use it often enough, you've probably got a treasured keyer or straight key or Vibroplex or something and that's all part of how you use the mode – in fact, we'd be extremely interested in hearing what you feel about this topic (because maybe it's us) but we wonder just how many CW fans would enjoy (or indeed do enjoy) using keyboards, or how many of you think that sending it manually is somehow bound up with the whole idea of Morse.

In the office we're neither fanatics dedicated to CW or Morse-haters – we'd say we're about average. We like it, and enjoy using it, and we have about 50% of our contacts on the key if you count local nattering on 144MHz and so on. How do all you CW users out there feel about Morse keyboards? Is it us, or have we got hold of the wrong end of the stick, or what?

Be that as it may, the Datong MK does a superb job of what it was designed to do, and if you're into machine-sent Morse we'd have no hesitation in recommending it. Next thing will probably be a Morse decoder, and then we'll all start wondering why we don't go to RTTY instead!

WHAT

The idea of this feature is to provide an easy-to-understand guide to all the currently available wirelesses of interest to the amateur and SWL; we list HF transceivers, VHF transceivers, VHF and UHF hand-helds, mobiles and HF receivers. Where

HF transceivers

Icom IC720A	£690	Good performer; includes general coverage Rx
Icom IC730	£580	Good, aimed at mobile use, but nice
Icom IC740	£725	Lovely rig – see review in last issue
Trio TS530S	£520	Very good rig for the newcomer; reliable
Trio TS830S	£645	We love this one – see our review
TS930S	£1000 approx	We don't know anyone who has one
Trio TS430S	£698	Very new
Yaesu FT102	£785	Nice – see review last issue for full info
Yaesu FT980	£1115	New, and we haven't yet seen one
Yaesu FT1	£1349	It's a lot of radio, but a lot of bread too
Yaesu FT902DM	£885	Rugged, reliable, nice machine
FT101Z	£559	Has got whiskers now, but a good old rig
FT707	£509	Didn't like this one much, but it's adequate.
Drake TR7A	£1199	A lovely machine, great signal handling
Drake TR5	£657	We'd love to review one . . .
Collins KWM380	£2195	It ought to be good for the price!
KW/Ten-Tec Argosy	£?	A good name, but we don't know the rig.

VHF transceivers

Trio TS780	£799	Covers 2m and 70cm; good reputation; bit deaf!
Yaesu FT290R	£265	Base-cum-portable 2m rig; rather nice multimode
Yaesu FT790R	£325	Ditto for 432MHz
Trio TR9130	£395	Very nice 144MHz multimode – reliable and solid
Icom IC251E	£499	Good 144MHz multimode, even better with Mutek front-end board
Icom IC451E	£630	Ditto for 432MHz
Yaesu FT726	£649	Brand new

VHF and UHF portables

Icom IC2E	£159	Super 144MHz FM handheld; cousin of the IC4E
Icom IC4E	£199	We loved this – see our review last issue but one
FDK Palm II	£109	144MHz 6-channel FM hand-held
FDK Palm IV	£109	Ditto for 432MHz
Azden PCS300	£179	144MHz synthesised handheld; good Rx

RADIO?

we know something about the radio we've appended a comment or two – if the column's blank it doesn't mean that we'd be sued if we said what we thought, but that we haven't come across one or heard anything either way about it.

Trio TR2300	£144	Big portable FM 144MHz box
Trio TR2500	£220	Keypad-synthesised 144MHz handheld; quite nice
Trio TR3500	£?	As above but very new
Icom IC202	£169	SSB 144MHz "portable", still going strong
Icom IC402	£245	ditto for 432MHz
Yaesu FT208R	£199	2.5w FM 144MHz hand-held – eats batteries!
Yaesu FT708R	£230	1w FM 432MHz hand-held – very good Rx.

VHF and UHF mobiles

There are many and they change almost every month, also allow for changes and new introductuions.

FDK M700AX	£180	144MHz 25watt FM – nice audio and good Rx
FDK M750AX	£269	144MHz multimode, 10 watts
Trio TR7730	£268	25watt 144MHz mobile, nice to use
Trio TR7800	£257	Much as above only bigger!
Trio TR8400	£299	A mobile 432MHz FM machine, good Rx, apparently
Trio TR9500	£428	Multimode mobile 10watt 432MHz
Yaesu FT230R	£239	25watts on 144MHz mobile/base station (FM)
Yaesu FT730R	£285	Ditto on 432MHz – 10watts. Rx a bit deaf
Yaesu 480R	£369	Multimode 144MHz rig; some have had problems
Yaesu FT780R	£325	Ditto for 432MHz
Yaesu FT720	£199/229	You can get a 144 or 432MHz head for these
Icom IC25E	£269	Nice 144MHz FM mobile rig – tiny, two VFOs
Icom IC290E	£379	144MHz multimode with a 25watt brother (IC290H)
Standard C5800E	£359	Lovely 25watt 144MHz multimode
KDK FM2030	£199	Compact mobile/base 144MHz 25watt FM; good

HF receivers

Trio R1000	£297	Synthesised, good performer
Trio R2000	£391	Lots of facilities,
Icom IC-R70	£469	See our review
Yaesu FRG7	£199	The old "Frog"
Yaesu FRG7700	£330	Reputedly rather good.
NRD515	£985	Very nice, although not without its faults

A New Look at Wire Aerials: I

•END FED• •WIRE AERIALS•

By John D. Heys, G3BDQ

This writer has used all kinds of wire aerials on the HF bands during the past 37 years, but to date has never actually used a rotary beam. However, despite this self-imposed restriction, a satisfying tally of DX has been worked to a total of more than 300 countries on all the bands from 28 to 1.8MHz from seven different urban or semi-rural locations.

This is the first of a number of articles attempting to remove the mystique and avoid some of the tedious mathematical gobbledegook which seems to envelop much of the available literature on HF aerial construction and design.

Many proud holders of a shiny new G4 callsign have been tempted into the purchase of the inevitable 'troika' tower, three-element tri-bander, and rotator. Total expenditure on this little lot (not forgetting incidental expenses, labour, hardware, cable etc) can amount to a sum greater than that lavished upon the rest of the station!

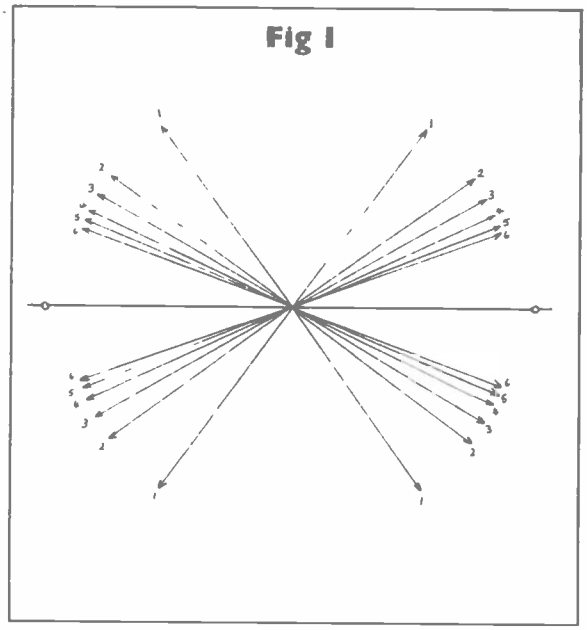
Having a tenuous but identifiable Scottish ancestory the writer has always been more than a little cautious when investing in radio gear, and so far has resisted the alluring advertising copy of the beam purveyors, and instead undertaken a cheap but rewarding series of experiments with simple wire antennas. These antennas have never cost more than a few pounds and much of the hardware can be used over and over again.

A whole mythology akin to present day fairy tales which involves so-called 'wonder aerials' has developed over the years, and we are still being subjected to articles on some freshly devised variety, which it is claimed cannot fail to let you hook that elusive DX! Older readers may remember such former oddities as the T2FD, the 'underground antenna' or the 'NOUGO' (No, you go!) which for a time beguiled many of us into believing that 'at a stroke' we could build 'Chinese copies' and then our troubles would be over. Sadly such enthusiasms were quickly lost when field tests showed that DX results and signal reports were better on the old trusty dipole or bit of wire.

Antenna length

There is no magic aerial, but there are lots of lousy ones! When a transmitter output of, say, ten watts is coupled to an aerial most of that power ought to be usefully radiated. It should not heat up loading coils, become lost in a cat's cradle of feed lines, co-ax and 'bazookas', or shoot skywards at high angles. It is hoped that this article will describe a cheap but efficient way to gain respectable results on all the HF bands with the minimum of disturbance to the pocket, the planning authorities or the neighbours.

Fig 1



Simplified diagram showing the horizontal radiation pattern (main lobes only) of long wire aerials. The numbers refer to the number of wavelengths in the wire, and it can be seen that wires with more than five wavelengths show little change in the angle of maximum radiation. Long wire antenna gain over a dipole is directly proportional to the number of wavelengths. At four wavelengths (136 feet at 28MHz) the gain is 3dB and is just a little more than 6dB at eight wavelengths long.

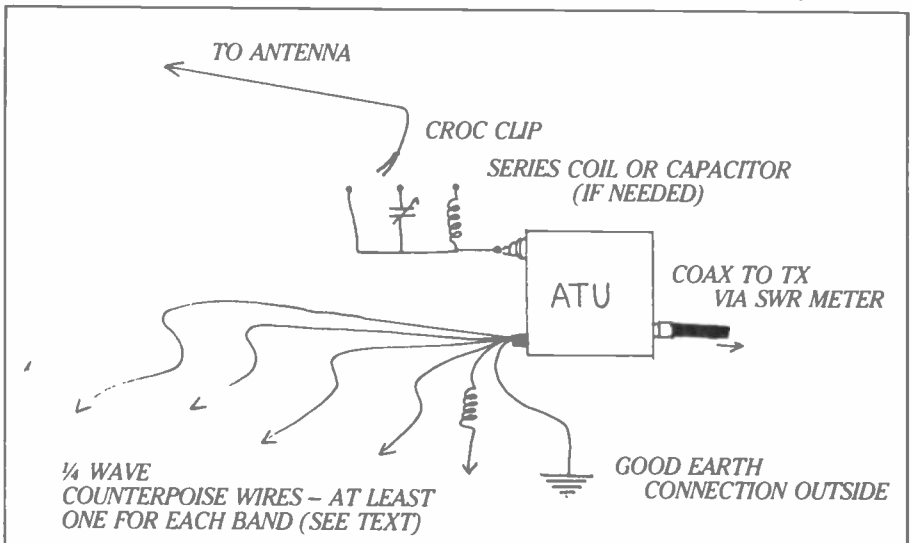


Fig 2
AERIAL INPUT ARRANGEMENT

Contrary to popular belief, end fed wire aerials can be of *any length* on *any band* and they will still radiate satisfactorily. Should DX working be contemplated, the minimum length should be more than a half wave at the operating frequency. Shorter wires can be loaded against ground or counterpoise systems as Marconi aerials on the lower frequency bands (3.5 and 1.8MHz) and the writer well remembers a not-too-serious afternoon in the late 1940s when a metal statuette on the operating table was loaded up on Top Band and used to achieve S9 AM reports from Eastbourne some 15 miles over the bay. On another occasion a two-foot bottom-loaded whip held in the workbench vice was being tuned to 3.7MHz for mobile use and test calls brought back good reports from stations more than 100 miles distant.

It is not suggested that these results could be easily repeated, but both examples help to demonstrate that almost any piece of wire or metal will radiate when it is correctly tuned and matched to a transmitter. At this point it is important to stress that there are certain wire lengths that are best avoided. Contrary to common practice, wires 132, 66 or 33 feet long are perhaps just about the worst lengths for end fed wires. Many stations contacted

over the years seem to be using such wire lengths which would be ideal if they were centre fed as resonant half waves, but which can give rise to all kinds of matching problems when end fed. On Top Band particularly the 132-footer is a disaster if any kind of DX working is contemplated. Being just a quarter wave of wire the maximum current point which contributes most to the radiation of the signal is down at the bottom, often in the shack or running near the house wall or guttering.

A ⅜-wave wire on 1.8MHz (about 180 feet) will put the current maxima high up away from the building where it can do most good, and an added bonus is the fact that a wire ⅜-wave long has a feed impedance of around 50ohms which makes it easy to match to the transmitter. The pernicious practice of using wires which are self-resonant at the operating frequencies must, I feel, be attributed to a kind of hangover from the past when the Hertz aerial was first adopted by amateurs. Then such resonant wires were either end 'Zepp' fed with open line or made into dipoles, and it is odd that even today, former ideas have such a strong influence. Many amateurs think that unless an end fed wire is made self resonant it cannot work!

Matching problems

The plaintive cry that 'this antenna won't load properly' must often be attributed to the fact that the wire in question is presenting either a very high or a very low impedance to the ATU. Contrary to popular belief ATUs cannot match 'anything into anything'. They most certainly jib at extremes of impedance; conditions induced by having either an exactly even or odd number of quarter wavelengths in the wire. It may at this stage be in order to warn intending purchasers of commercial ATUs to be sure that the devices can cope with a wide range of aerial impedances. Most of the so called 'Autotune' ATUs are not suitable for end fed wire aerials and are designed for use with co-axial inputs. Attempts to dispense with an ATU and run the aerial wire straight into the transceiver is another exercise which courts disaster.

Modern transceivers, be they solid state or with valved output stages, are designed to match into low impedance loads. Impedances not far removed from the nominal 50ohms will be difficult to match, could produce arcing across the 'load' capacitor and even damage the output stage. The use of an ATU means that there is also another tuned circuit at signal frequency in the system and therefore less likelihood of harmonic radiation. Modern rigs are well designed and well engineered but they still produce an appreciable level of harmonic at up to five times the operating frequency.

Now we have the 10MHz band and the other 'new' bands it is becoming more difficult to determine a length of wire that will not present 'difficult' feed impedances. The writer's end fed wire gave no trouble on the original six HF bands but just would not load up at all on 10MHz. A series capacitor and a series inductance were both tried in turn just in front of the ATU and within five minutes it was found that a coil was needed. A simple 'croc' clip arrangement allowed the coil to come in the circuit when the 10MHz band was used, and enabled the usual unity SWR readings to be obtained. Should your wire of indeterminate length (avoiding the lengths mentioned earlier) not lead easily on any particular band try the series capacitor or series inductance dodge. One of them MUST work for you!

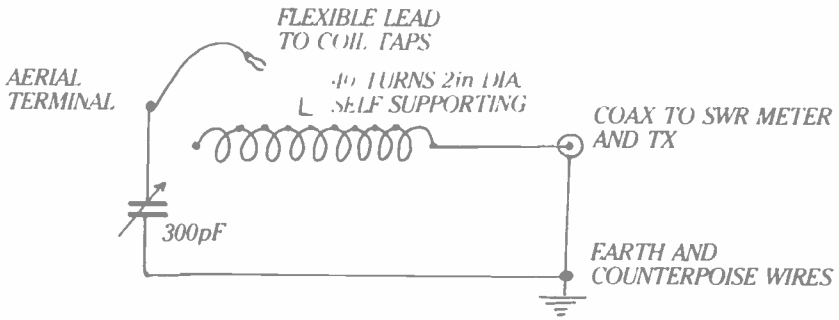


Fig 3
SIMPLE L-NETWORK MULTIBAND ATU

Perhaps one of the few disadvantages of an end fed wire is that RF is necessarily present on the wire between the ATU and where the wire comes into the shack. This can sometimes give rise to annoying and often startling effects if not countered. Amateurs have regaled the writer with tales of shocks or sparks coming off their mikes, rig cabinets or other hardware and all kinds of dire effects upon electronic keyers. Outboard 'add on' units such as speech processors or audio filters have also been known to behave strangely in the presence of RF fields, for often they are inadequately screened and housed in plastic boxes.

Earths and counterpoises

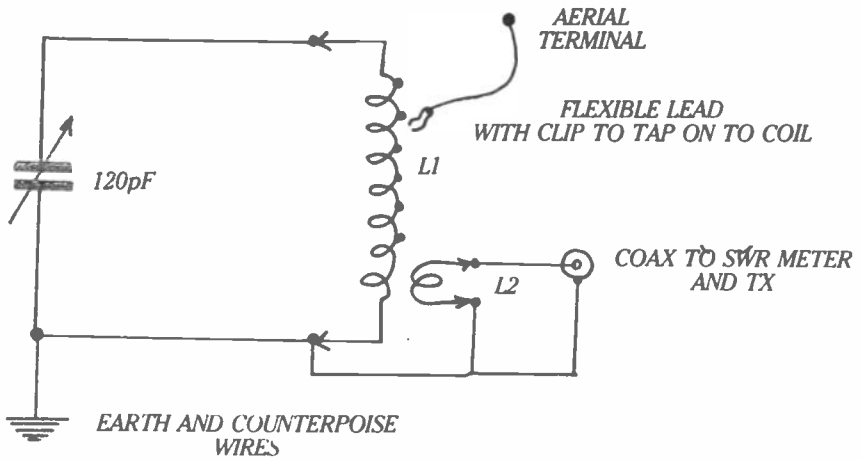
These unwanted phenomena are often more common when the shack is located upstairs and when the earth lead is long. Even an eight foot earth wire is almost a quarter wavelength on 28MHz and it will present quite a high impedance at the shack end. We must really regard most conventional earths as useless on the higher frequency bands but the problem can be easily overcome by using a multi-band counterpoise system. This sounds quite frightening and may suggest spider webs of wires strung out at lethal heights all over the garden, but in fact it can be made quite easily and will cause no nuisance.

ALL wires have a high impedance to RF at the distant unconnected end and measurements to work out feed impedance must work back from that point. If the wire is cut to be a ¼-wavelength long it will behave as a very low impedance at the operating frequency where it joins the ATU earth terminal. Fortunately, ¼-wave wires do not seem to be particularly frequency conscious and wires cut to length for mid-band operation work well over a whole band. By using a ¼-wave wire instead of an external earth (for obvious safety reasons a conventional earth connection must be used also) any 'RF in the shack' problems will be killed stone dead, and often it will 'tame' some end fed wires which are tricky to match on the ATU. The counterpoise can run around the shack floor, under the carpet, along the wall or the picture rail. The longer ones used on 3.5 or 1.8MHz are best out of doors and can follow the house wall or, when possible, go off inside a boundary hedge or along a fence down the garden. If two or three such ¼-wave wires can be arranged for 1.8MHz, operations on that band will be much enhanced. Any kind of insulated wire may be used for these 'artificial earths'.

One elegant solution is to use a length of multi-wire 'rainbow' ribbon and cut out sections so that each amateur band has its own residual quarter wavelength. The ends of these wires can have quite high RF voltages on them in operation so arrange that the ends are taped and well away from young or inquisitive fingers. All the counterpoise wires join together at the earth connection on the ATU. Suggested lengths for the bands from 28 to 1.8MHz are:

28MHz – 8ft 3ins
24MHz – 9ft 6ins
18MHz – 13ft 3ins
14MHz – 16ft 6ins
10MHz – 23ft 6ins
7MHz – 33ft
3.5MHz – 65ft
1.8MHz – 122ft

Should it still remain impossible to put out a good length on one of the lower frequency bands, all is not lost! An 'artificial' quarter-wave counterpoise can be made up using a coil in series with a much shorter piece of wire. It is difficult to give details of coil sizes but an experimental unit designed for 14MHz worked quite well



L1=PLUG-IN COILS TO SUIT BAND
28MHz 2uH
21MHz 4uH
18MHz 4uH
14MHz 7uH
10MHz 9uH
7MHz 15uH
3.5MHz 27uH

L2=2 TURN LINK WINDINGS

Fig 4
PARALLEL TUNED CIRCUIT ATU

and was made by first measuring out the full quarter wavelength of insulated bell wire and then winding about three-quarters of this on a 1½in former. The remaining wire was trimmed back until everything was resonant on 14MHz. A dip oscillator makes this easy, but it can be achieved with 'cut and try'.

Directivity and gain

Your end fed wire will probably be a 'long wire' on the three higher frequency bands and in some directions will give considerable gain over a half-wave dipole. It is surprising how often one reads of 50 or 60 foot 'long wires' being used (sometimes even on 80 or 160 metres). A wire can just about qualify for the description when it is about two wavelengths long and then it will show some 1.3dB gain over a dipole. To get real and useful gain from long wires they must be from five to ten wavelengths long, and a 350ft wire used on 28MHz will outperform most three-element beams along its major radiation lobes in the direction of the wire at each end. Long wires also have many minor lobes in their radiation patterns and these tend to make the beasts useful all round radiators.

The only nulls appear to be at right angles to the run of the wire. If the long wire can be arranged to slope at an angle of some 15 to 20 degrees it can give really useful low angle radiation on the higher frequencies and put big signals at extreme range. Most of this gain is just off the line of the wire towards the lower end and even greater gain will come if the ground slopes away too in the same direction. Theoretically as one lengthens the end fed wire the gain rises linearly, but in practice there creeps in the factor of diminishing returns! Really long wires, 1000ft or more, seem to have their length advantages overtaken by wire resistance. An old timer friend some years ago who had extensive real estate put up such a wire and told me that with 150 watts of RF going in to it at the shack end there was hardly a sniff at the far end. It behaved like a long wire with a grounded resistive termination, a technique used to make long wires unidirectional.

The end fed wire is ideal where the shack is in the house and there is an adjacent garden. Centre fed aerials are a difficult proposition in such circumstances unless there is garden on both sides of the house or an outside shack. The latter is an expensive item if it is to be warm and dry – two important factors where electronic equipment is to be housed. If the garden is small, say with only 50 feet or so from house to the far aerial support, there will still be enough space for a useful end fed aerial, for the total length will include the downlead.

Some practical points

Three years ago the writer decided upon a spell of HF band operation after spending some yers on VHF and built a weird 'state-of-the-art circa 1948' breadboard two-valve CW rig using a couple of 6AG7 valves. It was capable of about ten watts input on 7 and 14MHz, had no 'frills' apart from a voltage stabilised supply for the oscillator section and it looked awful! About 40 feet of wire was run out from just above the upstairs shack window to a convenient tree in the front garden. At no point was this wire higher than 25 feet. By 'canny' operating (tail ending etc) it was possible over a few weeks to work all continents on 14MHz, often receiving 569 chirp reports from VK, ZL and ZS stations. It also gave good European coverage on 7MHz with S8 to 9 reports being commonplace.

Encouraged by these results a decent 190-footer was then erected which went up to a short but stout mast on a chimney stack and then sloped down the garden to a 20-foot scaffold pole tied into an old apple tree. This wire remains in use with a TS530S and has helped to fill two Log Books with DX contacts on all bands.

Having an end fed wire in a straight line is to be preferred, but any bends or zig-zags will not stop it from working. If it is not straight the radiation pattern will be something of a mystery and remain unpredictable. Long wires can be used successfully even when much closer to the ground than most other aerials. Even at 20-25 feet good results may be obtained but of course there will be a great improvement if at least one end is raised to 40 feet or more. It need hardly be mentioned that the antenna must run as far as possible from TV aerials – a consideration applicable to all aerial types. Remembering the inverse square law theory helps; each time you double the distance between transmitting antenna and TV aerial you will reduce unwanted pick up by four times. When young and foolish, the writer ran an end fed wire through the shack wall and into a bedroom where it progressed along the middle of the ceiling to gain an exit at the window. An at first unrecognised phenomenon was that when the 150 watter was keyed on 7MHz the electric light in the bedroom lit to about ¼ brilliance! This oddity was only discovered when an elderly relative sleeping in the bedroom happened to awake in the small hours when G3BDQ was DXing. The moral of this tale is that at all costs don't try to have indoor end fed wires, it is certain to lead to trouble!

The ATU

An ATU is essential as has already been stressed and there is the choice of building one or getting a commercial unit. Two simple ATU circuits are shown, one being of the parallel tuned type and the other based upon the L-network. This second type is perhaps the easier to construct for it does not need plug-in coils for each band or any adjustable link windings. Messrs Tandy now sell 40-foot coils of thick (approx 10swg) aluminium 'earth' wire which can be easily made up into self-supporting coils mounted on insulating pillars and having soldering lugs screwed to the ends. The ubiquitous 'croc' clip will allow tapping along the coil for operation on the different bands. The tuning capacitor must have rotor/starter spacing adequate for the power to be used. If more than about 50 watts is used, transmitting type variable capacitors are needed to prevent 'flash over' but below that power level, components ought to be satisfactory.

An SWR meter must always be in circuit between the transmitter and the ATU when initially tuning up on each band. The SWR should, ideally, be zero at all times but certain antenna lengths could be 'awkward' and prevent this on one or two bands. So long as the SWR is no higher than about 1-1.5 there is no cause for worry and the power loss will be insignificant (under 3%) but by using the additional capacitor or inductor technique explained previously, any mismatch should be completely eliminated.

It ought to go without saying that preliminary transmitter tuning should take place with a dummy load in place of the ATU and then all ATU adjustments be made with the transmitter power at a minimum. The drive control on most modern rigs will enable the output to be kept to one watt or less. As he is now getting old (and lazy, according to the XYL!) the writer is more often tempted to buy rather than construct gear; recently, and for the first time, actually splashed out for a Trio AT230 all-band ATU with inbuilt SWR and Power Meter. This unit has a power rating of 200 watts and can be used with most available transceivers and most types of wire or beam antennas.

It is always good practice to try out a new antenna system with QRP. Should a few hours on the different bands be very disappointing it is then perhaps as well to go back to the drawing board and produce another antenna. If, on the other hand, contacts come easily with fair reports, it will show that the sky wire is working and those extra watts will boost the overall performance.

Hardware

Some published articles about aerials give little or no information on the practical aspects of their construction or erection. Others deal with the subject as though the prospective user was going to be subject to stringent Admiralty regulations or that the antenna was expected to stay aloft in all conditions ranging from sub-arctic to tropical hurricane weather for at least the next half century! Most amateurs prefer to experiment with their antennas and will want to get wires up and down quickly and easily at quite frequent intervals. Permanent installations and lashings to inaccessible places are never a good idea. Masts and poles cost money and the writer uses trees and his house as aerial supports whenever possible, a practice which also limits confrontations with the Planners and neighbours who value their panoramic vistas.

Pulleys are an abomination, for even the high grade and expensive rust-proof marine types to be found in yachting stores may give rise to problems. Cords have an uncanny ability to wedge themselves in pulleys, so for many years now the writer has used (instead) porcelain or toughened glass egg insulators which have no moving parts and have such smooth surfaces that friction is minimal. Where the fixing point is difficult to reach or on a big mast which needs Herculean effort to raise and lower, remember to initially put up at least one spare 'egg' and running halyard (in a long loop to the ground) which will be available if the first one has problems. An acquaintance who is a devotee of 'belt and braces' technology has in addition a strong brass hoop fixed at the top of his 40-foot mast.

This resembles a netball goal without the net and is his last line of defence should both existing halyards become unserviceable. A weighted string, a ladder together with infinite patience on a calm dry day would enable him to run a replacement halyard through the hoop. Before WW2 ordinary plain or waxed rope halyards made from vegetable fibre were the only sorts available, but for the last 30 years or more varieties of extremely strong and long lasting man-made cords have appeared. The nylon types seem almost immortal and the writer still has some in outdoor use which have been there for at least 20 years. They show no signs of deterioration except for discolouration. A good source for similar ropes are yachting shops, but most good hardware stores have Nylofil or similar braided cords. These have tremendous wet and dry strength and there is no need to get the really thick kinds; wire aerials never weigh more than a few pounds.

If an end fed wire is to be longer than about 50 feet it is best to use 14swg hard drawn copper which will resist stretching. There is nothing so unsightly as a long 'droopy' wire running down a garden, which apart from its negative aesthetic appeal will also have a reduced DX performance. Hard drawn copper can be tensioned and then will not sag with age or when carrying ice loading. Tensioning safely is no problem if rigid supports are used at each end but the use of trees or a swaying mast will court disaster in stormy weather unless simple precautions are taken. If the lower end of the halyard which runs through an 'egg' pulley is tied to a suitable weight any movement of the antenna supports is easily compensated for. A plastic two gallon jerry-can is fine as a counterweight, for the actual weight can be adjusted by adding or removing water. Some authorities have suggested holed buckets containing gravel or pebbles but these are not likely to endear themselves to the XYL or close neighbours when they bang against the support in strong winds!

Both ends of an end fed wire aerial are important; the centre can look after itself. At the far end where there is always high RF voltage some good insulation is required. Two high quality glass or polypropylene strain insulators in series with at least two metres of a nylon or similar rope going from them to the fixing egg insulator pulley are needed. Avoid using wire at any point between the end of the antenna and the run-up halyard. The egg insulator pulley may be fixed to the mast or other support with strong wire. Unwanted wire coat-hangers provide a plentiful source of really strong wire and the better quality types seem to almost rust proof. A single run of wire without joins is best for the aerial, but if joining is unavoidable there is really no need to solder the join. If both pieces of wire are well twisted to make a secure mechanical join all will be well.

Purists may well disagree on this point but experience has proved that there is nothing to be gained by soldering, and that any soldered joins soon deteriorate when subjected to the weather, particularly in coastal locations. RF seems to disregard the patina on the wire and it easily runs over joins with no seeming loss. RF certainly does not behave like DC current.

A typical side elevation which shows alternative end fed wire arrangements. The sloping wire gives an enhanced gain towards the slope and this will be even better if the ground also slopes away in the same direction. Suitable trees or other buildings may be substituted for the mast at the end of the garden. This diagram is not to scale and the wire would run much farther from the house if space was available.

Fig 5

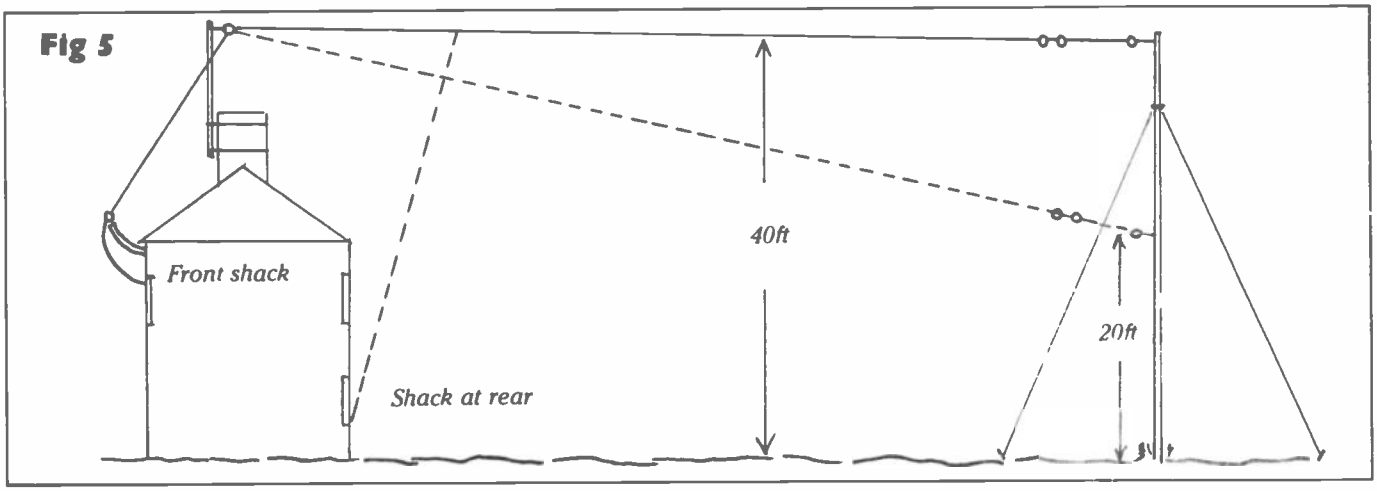
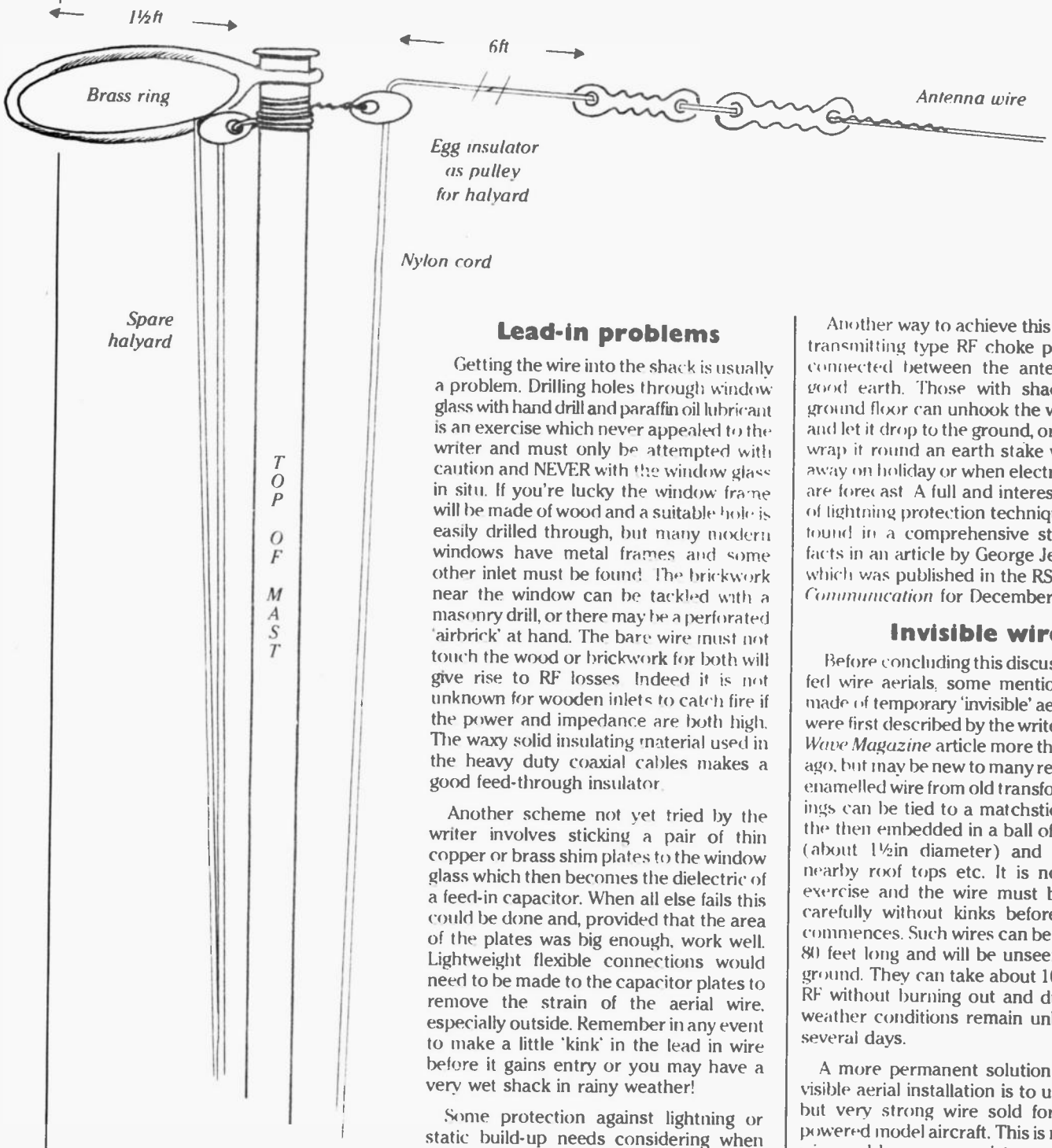


Fig 6
'BELT AND BRACES' MAST HEAD



Lead-in problems

Getting the wire into the shack is usually a problem. Drilling holes through window glass with hand drill and paraffin oil lubricant is an exercise which never appealed to the writer and must only be attempted with caution and NEVER with the window glass in situ. If you're lucky the window frame will be made of wood and a suitable hole is easily drilled through, but many modern windows have metal frames and some other inlet must be found. The brickwork near the window can be tackled with a masonry drill, or there may be a perforated 'airbrick' at hand. The bare wire must not touch the wood or brickwork for both will give rise to RF losses. Indeed it is not unknown for wooden inlets to catch fire if the power and impedance are both high. The waxy solid insulating material used in the heavy duty coaxial cables makes a good feed-through insulator.

Another scheme not yet tried by the writer involves sticking a pair of thin copper or brass shim plates to the window glass which then becomes the dielectric of a feed-in capacitor. When all else fails this could be done and, provided that the area of the plates was big enough, work well. Lightweight flexible connections would need to be made to the capacitor plates to remove the strain of the aerial wire, especially outside. Remember in any event to make a little 'kink' in the lead in wire before it gains entry or you may have a very wet shack in rainy weather!

Some protection against lightning or static build-up needs considering when long outdoor wires are being used. This is particularly important when the wire is very long (more than 300 feet) or sited well up above any surrounding objects. An actual lightning strike must inevitably damage radio gear and perhaps other property too, but such incidents are not common. Long wires have a natural propensity to attract static charges but these will be safely dissipated to earth via the ATU or by clipping the antenna to earth in the shack in very unsettled weather.

Another way to achieve this is to have a transmitting type RF choke permanently connected between the antenna and a good earth. Those with shacks on the ground floor can unhook the wire outside and let it drop to the ground, or better still, wrap it round an earth stake when going away on holiday or when electrical storms are forecast. A full and interesting review of lightning protection techniques may be found in a comprehensive study of the facts in an article by George Jessop, G6JP which was published in the RSGB's *Radio Communication* for December 1982.

Invisible wires

Before concluding this discussion of end fed wire aerials, some mention must be made of temporary 'invisible' aerials. These were first described by the writer in a *Short Wave Magazine* article more than 30 years ago, but may be new to many readers. Thin enamelled wire from old transformer windings can be tied to a matchstick which is the then embedded in a ball of Plasticene (about 1½in diameter) and flung over nearby roof tops etc. It is not an easy exercise and the wire must be laid out carefully without kinks before throwing commences. Such wires can be up to 70 or 80 feet long and will be unseen from the ground. They can take about 100 watts of RF without burning out and during calm weather conditions remain unbroken for several days.

A more permanent solution to the invisible aerial installation is to use the thin but very strong wire sold for tethering powered model aircraft. This is not copper wire and has some resistance which will result in some power losses, but it could be one way to operate in locations where all outside wires are taboo. Tiny insulators for these invisible wires can be fabricated from many common plastic materials such as that used for bottles etc.

It is hoped that the often disregarded and despised end fed wire aerial will be at least given a try by some of the readers of this article. Go and buy yourself a coil of wire, you have nothing to lose!

CLUB NEWS

Tell others about what's happening in your club – give us the information and we will try and print it here.

Spalding & D AR Society

Spalding is known for its tulips and gardens, and these will be an extra attraction during the club's annual Mobile Rally, being held on Sunday, June 5th. It will be held at Springfields, starting at 11am. There is a trade exhibition, bring and buy stalls, raffles, and a visit from Miss Tulipland. On site are superb bars and restaurants which makes the event one for the family to enjoy.

Entry is 50p and visits to the gardens are free. There's also a talk-in on S22 and SU8. Contact Ian Buffham G3TMA at 45 Grange Drive, Spalding, Lincs PE11 2DX for details.

South Cotswold AR Society

This is a relatively new club, having been formed in October 1982, by a nucleus of 10 members who have now grown to 30 at the time of writing. They meet at the Scout HQ, Dr. Browns Road, Minchinghampton, and new members are always welcomed.

Members have a good cross section of interests, including lectures on RTTY and top band mobile. Meetings are held on the second and fourth Wednesdays of each month – one of these meetings involves a specific subject or practical demonstration. The club's pet project at present is the acquisition of an HF rig. Anybody interested should get in touch with the club chairman R.J. Burnett G4RJB at Nailsworth 2874.

Swale AR Club

On the 18th of April, Phil Crouder gives a talk on resuscitation, to Swale ARC at Nina's Restaurant, 43 High Street, Sittingbourne, Kent, an this is part of a general programme of events to be held throughout the year. The talk begins at 7.30pm.

The club intends running its own RAE course aimed at the December 1983 exam, and they will also arrange CW instruction. Anybody interested should turn up at a club meeting before April 11th.

Lincoln SW Club

On May 8th, there's the Lincoln Hamfest which is organised by the above club, and it will be held on the Lincolnshire Showground, which is four miles north of the city on the A15. It opens at 11am and finishes at 5.30pm.

It's a family day out, with a competition to win an FT29OR, trade stands, bring and buy stalls, raffles, model aircraft display, facilities for the disabled, and so on. There is also a talk in on 133MHz (S22) and 432MHz (SU8). The club meets usually at the City Engineers Club, Central Depot, Waterside South, Lincoln. More information about both these items from Pam Rose G8VRJ, of the club's address.

Maidstone AR Society

The last time the club ran their Mobile Rally it attracted over 1000 people. This year they expect a considerable increase because the rally will be vastly improved, and it will be one of the few rallies in the south east, and London areas.

It will be run at the YMCA Sports Centre, Melrose Close, off Cripple Street, Maidstone, Kent, on Sunday, May 1st from 11am to 5pm. At the time of writing this, more space was being allocated to the rally due to demand for trade space. All the usual features will be there, including bring and buy stands, bookstall, while there will be special items to interest the XYL and junior operator. So it's a fun day for the whole family. Admission is 50p and car parking is free. There's a talk-in on S22 by GB2YSC, and further information about the rally is available from G4FCE-QTHR.

Swansea AR Society

This club meets on the first and third Thursdays of each month in the Lecture Room 'N' (fourth floor), Applied Sciences Building, Swansea University, at 7.30pm.

CW classes are held until 8pm and meetings often consist of talks/demonstrations/films. The society's TS530 rig is also available in their shack after every meeting. Their second annual Amateur Radio Trade Rally will be held on Sunday, April 10th in the Patti Pavilion (next to St. Helens County Cricket Ground), on the Swansea-Mumbles coast road. A4067. Features include trade stands, local repeater groups, bring and buy, RSGB bookstall, operational HF/VHF stations, SS2 talk in from GB2SWR, licensed bar, refreshments etc. Start and finish is 10.30am to 5pm, and more information is available from Roger Williams GW4HSH, QTHR. Telephone Swansea 404422.

Edgware & D RS

In April, the Edgware club will be organising a visit to Lowe Electronics on the 14th, and more info can be obtained from the secretary Howard Drury G4HMD, of 11 Batchworth Lane, Northwood.

Meetings are held on the second and fourth Thursdays of each month at 8pm at 145 Orange Hill Road, Burnt Oak, Edgware. There is also a club net at 22.00 on 1.875MHz, and slow Morse at meetings, and G3ASR on 1.875 and 144.175MHz (a1/A3j) as follows – Mondays 20.30 to 22.00 (clock) at 4-14 words per minute. Plus each month on the first and third Thursdays from 19.30 to 21.00, 8-16 wpm.

Swindon & D ARC

The club is to repeat their successful Radio and Electronics Rally on May 15th, and it will be held at the same venue as last year, namely Park School, Marlowe Avenue, Swindon, Wilts. Doors open at 10am.

There will be more attractions this year, for both the enthusiast and the whole family with film show, and many trade people represented. Ample parking space is free but refreshments and drinks will carry a small charge! There is also a talk-in on 2m (S22) and on 70cm (SU8) which can't be bad.

For more information contact K.A. Saunders G8SFM at "Tamarisk", Tetbury Lane, Leighterton, Gloucs.

Cheshunt & D AR Club

This club meets every Wednesday evening at the Church Room, Church Lane, Workley, nr Cheshunt, Herts. In April, the events include the following: April 6th BBC micro and the amateur, by Dennis G3TIK. April 20th Shacks – a slide show by Roger G8LNM, and April 27th RAE revision.

More information about this lively club from Roger Frisby G40AA, 2 Westfield Road, Hoddesdon, Herts. Telephone 09924 64795.

Fareham & D AR Club

The club meets at the Portchester Communuty Centre, Westlands Grove, Portchester, on Wednesday evenings at 7.30, and the programme for April includes the following: April 6th RTTY, April 13th on the air/natter May 7th DF project night.

The club has about 30 members, and they welcome new members to their events and contests. They plan to operate in the major 144MHz contests this year, plus HF contests if interest is there. Incidentally, the club also has HF and VHF radio stations. More information about future activities in the next issue of Amateur Radio. Man to contact about the club is Brian Davey,G4ITG, Secretary, 31 Somerville Drive, Fareham,Hants.

CLUB NEWS

Cambridgeshire Repeater Group

This group was formed last year in order to help fund the use of repeaters in the county and thereabouts, One of these repeaters, GB3PI has, since 1973, been sited at the Pye Telecommunications site at Barkway. GB3PY and GB3PT are also on Pye sites (as indeed are many other repeaters throughout the country).

Until now, these sites have been provided free of charge by Pye, but under the present economic climate etc. the company are now to charge what they call a nominal sum per year per repeater.

A figure of £150 has been discussed, which means in effect, that the CRG needs around £600 a year for site rental (assuming another repeater, GB3PS, goes into service). The club's newsletter Editor, Mike Watson, G4CWI, says that the club has sufficient funds to keep GB3PI going for 12 months, and GB3PT and GB3PY for six months, although GB3PS doesn't look too hopeful at the moment

So, the group was formed, and since then the members have sort of split quite conveniently down the middle some of them becoming responsible for the administration and technical aspects, and the rest gravitating towards the events sub-committee.

'Since then, we have all felt a growing awareness of what we have let ourselves in for,' says Mike Watson, 'and we plan to try several ideas to raise funds, of which the junk sale is the first, and to follow will come dinner dances,discos,lectures and so on'.

To hand is some information about the repeater GB3PI, which is located at Barkway, near Royston, 475ft ASl. Aerials are two dipoles on north side of the tower - Tx and.185ft AGL, and Rx ant.235ftAGL. Both are fed with low loss Heliax coax and a cup of tea! Transmitter frequency is 145.750MHz. Pye T402 running 30w output after the filters . Deviation is plus/minus 5kHz.

Logic comes courtesy of Dick Pope, G4HXH: Access requires 1750 plus/minus 24Hz tone and some spoken audio. PI will reply with a short pip. Time out is 120 seconds. If you do not wait for the pip you get the balance of the previous 120s period. If you are a choppy signal, the repeater will not send a pip, but the timer will reset.

At time out, through audio is cut off and replaced by an engaged tone. A stronger station can temporarily recover talk by sending a toneburst. When the repeater is not in use, and an unaccustomed carrier is present, the repeater will send an intermittent engaged tone.

East Suffolk Wireless Revival

This popular annual mobile rally for radio amateurs happens on the Bank Holiday Sunday, May 29th at the usual venue of the Civil Service Sportsground, The Hollies, Straight Road, Ipswich (between Bucklesham Road and Felixstowe Road A45, and adjacent to the Suffolk Show Ground.).

The rally opens at 10am and will be similar to previous events except that the Bring and Buy will be replaced by a "fleamarket" and "car boot sale". The transceiver clinic and aerial testing range will be there as usual, in addition to the traders and stands, and displays for the whole family.

This rally, in the heart of Constable (not policemen!) country and the East Anglian touring region, including the new and spectacular Orwell Bridge, makes an extremely good day out for the enthusiast and the family. If you're interested in taking a stall, get in touch with George Spencer G6CRN, 83 Tuddenham Avenue, Ipswich IP4 2HG (0473 218285); Jack Tootill G41FF, 76 Fircroft Road, Ipswich IP1 6PX (0473 44047), can answer general enquiries. The rally is organised by Ipswich Radio Club and Martlesham Radio Society.

Biggin Hill AR Club

The BHARC's 1983 programme includes a number of interesting meetings at the Biggin Hill Memorial Library, all starting at 8pm on the following dates: March 22nd Junk Sale, April 19th Home construction techniques, by Ian Daniels, May 10th Visit to Kent police HQ (advance bookings only), May 17th follow up to April's meeting, May 24th follow up to Kent police meeting. Pat Hawker, who writes for Amatuer Radio, spoke to the club on February 15th on the subject of 'Secret listeners'.Intriguing.For further information, contact Ian Mitchell, G4NSD, Secretary, at 37a The Grove, Biggin Hill, Westerham, Kent

Royal Naval AR Society

It's an outing for the whole family, and extremely useful to anybody interested in mobile amateur radio. It is the RNARS Mobile Rally 1983 and it takes place on Sunday June 12th at HMS Mercury, near Petersfield, Hampshire, starting at 10.30 and finishing at 17.30.

Events include model steam train rides, radio controlled boats, archery, and there will be hot and cold meals laid on, along with the inevitable drinks. Trade stands stands will be there, under canvas, and they include the RSGB and Rallymaps of West Wellow. Further details from A.G. Walker G4DIU, 103 Torrington Road, North End, Portsmouth PO2 QTN or from HQ station G3BZU.

Stratford-upon-Avon & D AR Club

This club meets at The Control Tower, Bearley Radio Station, Bearley, near Stratford, and their problem is wide of scope and interest. Among those recommended: April 14th 'So you think you could still pass the RAE?', April 25th setting up an amateur station for the first time, May 9th techniques of home construction by Vic Peake G4GEP, May 23rd discussion on crime prevention and insurance as it relates to the amateur, June 13th activity night, test your rig on equipment provided at the club room, June 20th making use of Oscar, by Glen Ross G8MWR.

Denby Dale (Pie Hall) & D AR Society

Noggin and natter nights are held on alternative Wednesdays (punctuated by a few fox hunts) while other dates for meetings include the following: April 13th visit from Lowe Electronics, April 24th Drayton Manor Rally, April 30/May 1st 144MHz QRP contest, May 11th Northern Communications G3UGF, May 15th Northern Mobile Rally, May 25th surplus sale. Meetings are held at the Pie Hall, Denby Dale, Huddersfield.

G-QRP Club

Information is also available on the Late Spring QRP SSB Activity Weekend on May 7/8th, and the Late Summer QRP CW Activity Weekend (sponsored by the World QRP Federation) on September 10/11th. Main purpose of the last-mentioned weekend is to promote intercontinental QRP QSOs, and member clubs of the World Federation are invited to suggest their own times and frequencies in accordance with propagation conditions. For Europe the following are suggested:
0700 - 0800 Europe - Oceana
0800 - 0900 Europe - Japan
1600 - 1800 Europe - North America
1900 - 2000 Europe - South America/Africa. All of these on the highest HF band which is open. Remaining times for general QRR QSOs on 3560, 7030, 10106, 14060, 21060, and 28060.

CLUB NEWS

Civil Service AR Society

The new address of G.H. Costin G4GFU, Hon. Secretary of the CSARS, is: The Rosary, London Road, Ryarsh, West Malling, Kent. Everybody write to him.

Swansea RACC

Anyone who thinks home construction is dead should hi-tail it down to the South Dock area of Swansea where the lads of the Swansea Radio Amateur Constructors' Club are rebuilding a derelict attic in a "preservation order" row (not row as in argument!) of 19th century buildings.

When the rebuilding is finished, the plan is to build the club station from scratch. Members include RAE passes from December when Colin GW4PYK coached the lads to a 99% pass (one lad dropped on the regs) including many double D and C results. He is now coaching a class of 30 for the May RAE.

Regular Morse transmissions are also made, and once the club workshop is finished Morse lessons will be held there. Your contact here is Trevor Morgan GW4OXB, 1 Jersey Street, Hafod, Swansea.

Scottish Amateur Radio Convention

Following the success of the Scottish Amateur Radio Convention held in Glasgow three years ago, the West of Scotland ARS is once again organising this year's event. Date Saturday 27th August, venue Cardonald College, Mosspark, Glasgow.

Glasgow is ideally placed within easy reach of all main centres of radio amateur population in Scotland and the north of England expect that attendance records are certain to be exceeded once again.

There are plans to make this year's convention the best-ever. On the Saturday evening there will be a dinner-dance in the Bellahouston Hotel nearby, we have arranged a 50% discount from normal rates for anyone wishing to stay there during the Convention period. More information from the Secretary, Ian McGarvie GM4JDU, 3 Kelso Avenue, Paisley, PA2 9JE. Phone: office/home 050 581 2708.

N.W. of Ireland AR Society

North-West of Ireland Amateur Radio Society meetings take place on the first Monday in each month, in Prehen Municipal Boathouse, Victoria Road, Prehen, Londonderry at 7.30pm. At the April meeting an Inter-Club Quiz will take place, between four local clubs, competing for the 'John McKinney G13KSY' Memorial Trophy.

Further details on this and other club activities, can be obtained from Ian Fulton G14OUN on tel. 0504 84 529.

Radio Society of Harrow

Membership of this club stands at about 150 and is still rising, according to Peter Marcham G3YXZ, Publicity Officer. That's good news for the club, which holds meetings at the Harrow Arts Centre, High Road, Harrow Weald, Middlesex (opposite the Alma pub).

Future meetings include: April 8th informal and practical/beginners'DF hunt, April 15th demonstration of colour SSTV, April 22nd talk on long distance communication, April 29th computer games evening, May 6th informal and practical evening, May 13th surplus equipment sale,May 20th informal and practical evening,May 27th talk on fault finding. There's a licensed bar, coffee and biscuits available at the club, and meetings begin at 8pm.

Echelford AR Society

EARS, as they are known, produce a useful and interesting newsletter with information on previous and future meetings, constructional projects and the like. Their programme for April includes, on the 11th, the AGM plus a video film, and on the 28th, a bring and buy sale at the club meeting place, The Hall, St. Martin's Court, Kingston Crescent, Ashford, Middlesex. More info though, from the Secretary, Anton Matthews G3VFB, at 01-892-2229.

Barry College of Further Education Radio Society

The Welsh Amateur Mobile Rally will be held at the Barry Memorial Hall, Barry, on Sunday, May 24th, and this year there will be demonstrations of various aspects of amateur radio, along with the usual trade stands etc. There will also be a talk in on S22 (145 550MHz), while the doors open to visitors at 10am.

The society meets on Thursday evenings at the Annex, Weycock Cross, Barry, and meetings begin at 7.45pm. There's a Morse class held in the upper room, and a lecture or discussion in the lower room. Man to contact is Simon Lloyd Hughes, 1 Min YM Mor, Barry, South Glamorgan.

Jersey Amateur Electronics Club

For an island-based club (off the mainland of an island . . .) there is a goodly range of activities at their meeting place, Communicare Centre, St. Brelade, Jersey.

On April 13th, there is a microcomputer demonstration (Vic 20, ZX Spectrum and Genie disc system) by Brian Johnson, Mick Haigh, and Phil Johnson; May 11th junk and used gear on sale, bring an buy; June 8th building foxhunt equipment and demonstration; July 13th foxhunt – Geoff GJ4ICD is the fox on 145.575, meet at second layby Victoria Avenue at 19.45. Prizes and drinks after! The fox will tell you where to get the drinks . . .

More information from Phil Johnson GJ8KNV at St. Brelade 53333.

Milton Keynes & D AR Society

On April 11th the Milton Keynes ARS will have as their event "Wheatstones great invention" while on May 9th the society have their quiz context against Leighton and Linslade Radio Club. Meetings are held at 8pm at Lovat Hall, Silver Street, Newport Pagnell, Bucks, on the second Mondays of the month.

On April 25th, starting at 7.15pm is a VHF radio direction finding contest, while Morse classes are held every Thursday in Bletchley. Secretary of the club is David White G3ZPA, Rose Cottage, Shenley Brook End, Milton Keynes. Telephone MK 501310.

Ipswich Radio Club

The club's activities during April and May include the following: April 6 open meeting of the Ipswich UHF Repeater Group, April 13 ignition interference suppression, by Pat Gillen G4GVW, April 27 AGM, May 11 D.F. Hunt – concluding at the clubroom, May 25 final planning for the East Suffolk Wireless Revival. On June 8 there is a treasure hunt, although more information can be obtained from Jack Tootill G4IFF, 76 Fircroft Road, Ipswich, Suffolk IP1 6PX. Telephone Ipswich 44047.

Bury Radio Society

On April 12th, the BRS will be host to Trevor Hopkins G8TYY who will talk on 23cm and repeaters. Meetings are normally held at the Mosses Community Centre, Cecil Street, Bury, Lancs. every Tueday evening, at 8pm. Main meetings are held on the second Tuesday of each month, and newcomers are invited to contact the Hon. Secretary Brian Tyldesley G6OKE, of 4 Colne Road, Burnley, Lancs. Telephone Burnley 24254 for further details.

Droitwich AR Club

This club have been given a "special" callsign – GB2PWB – which stands for Prince Williams Birthday! They meet at the Scout HQ, North Street, Droitwich, on the first Monday of each month, and from June 3rd to the 30th the callsign will be activated by club members during the 28-day period. This is also the club's birthday (June 18th) as they were formed one year ago.

Classified Ads

● **KW2000 TRANSCEIVER** six bands 10-160m, 90Wp.e.p., mains P.S.U. KW600 Linear Amplifier 600Wp.e.p. KW107 Supermatch ATU/SWR meter/ dummy load. All v.g.c. with manuals and serviced/checked by KW. £350 ono. May split, individual prices negotiable. G4GXM QTHR. Tel: Hitchin 53001.

● **ICOM IC2E** 1 year old leather case, Nicads charger. Remote microphone etc. Box instructions £125. William Garrett G6GCB, 9 London Road, Holybourne, Alton Hants.

● **PARTRIDGE JOYFRAME** Multiband Antenna RX version cost £60 will accept £30. Buyer collects, phone Locks Heath 84340 (near Southampton).

● **WANTED:** Eddystone 640 Receiver. Heath RA1 Receiver. KW EEZ-Match ATU. 80 Metre FT243 band crystals. R.Q. Marris, 35 Kingswood House, Farnham Road, Slough, Berks.

● **WANTED:** KW2000 HF Transceiver, or similar, for school use. About £100 available. R.B. McCartney GM4BDJ, Science Dept. Langholm Academy, Langholm, Dumfriesshire 0541 80418.

● **FOR SALE:** R107 Receiver 2.8mcs – 18mcs ex-MOD in working order. Needs exterior touching up. £25 ono. Phone Newcastle-upon-Tyne 0632 642552.

● **WANTED:** Yaesu FRG7 or Trio R600, must be in good condition. Ring Hull 868085 after 6pm.

● **SONY ICF6800W** Communications and general receiver for sale FM/VHF AM, .5-30MHz continuous coverage, mains/ battery, LSB/USB/CW, filters, excellent condition, new cost £416, bargain at £140 with manual. Phone Clark, Bulls Green 219 (Herts).

● **YAESU FRG7** Communications receiver – 0.5-30MHz. Hardly used, mint condition. Original box and instruction book. £125. John Warner, Kimberley, Westoby Lane, Barrow-on-Humber, South Humberside. Phone 0469 30067.

● **COMMTRON X11** 26.515 to 27.855MHz AM FM £50. Also Ham Thunderbird 5/8 wave antenna, £25. Wanted 15 amp 12 volts power pack, please phone after 5pm, Heywood (Lancs) 623148.

● **TRIO R1000** Gen coverage RX 200kHz – 30.0MHz AC or 12V. AM. SSB. Excellent condition, little used. £205. G8TUL, 11 Willaston Avenue, Blacko Nelson. Tel: Nelson 68548.

● **YAESU FT902DM** brand new unused perfect £800. Yaesu FT480R one year old used only few hours with Drae power supply £360. Heathkit de-luxe antenna tuner SA-2060 brand new unused £260. D.A.J. Menzies, 11 Glebe Road, Newton Mearns, Glasgow. Tel: 041 639 2173.

● **FOR SALE:** SX200 Scanning Monitor Receiver as new AM & FM. All bands 26-58, 58-88, 108-180, 380-514MHz £200. Tel: Cambridge 892861.

● **HAM INTERNATIONAL** Multimode II USB, LSR, AM, FM, good condition from 28MHz 26 MHz £100: Eddystone RX year of make 1946 PSU FU102. Separate unit open to offers. Peter Tatham Flat 9, 12 Calder Road, Lower Hopton, Mirfield, West Yorkshire WF14.

● **SUPERSTAR 2000** 26-28.3MHz on AM, FM, USB, SB +CW. Brilliant set with slow motion K/C shift fitted. Also with power mike and RF Amplifier £175 ono. Tel: St Helens 33310.

● **CB POWER AMPLIFIER** Bremi-BRL 200 Input 1-6 watts output. 100W AM and FM. SSB-1-12 watts, output 200 watts. Excellent condition. £70 ono. Tel: St Helens 33310.

● **WANTED:** an address of a supplier who deals in HV Transformers and good quality s/hand valves eg. 4-400A, 833's etc. Tel: St. Helens 33310.

● **WANTED:** Manual for Tele-equipment D53A Scope. Buy or borrow for photostats, prompt return plus all costs. Contact Tony G4PNM not QTHR after 5pm. Please Tel: (0203) 318301.

● **PYE "CAMBRIDGE"** 7W. 4M. A.M. Xtalled 70.26, .365, .4 MHz. Storno "Viscount" 10W. 2M. FM Xtalled 50, 520, 522, R5, R7. Control unit and cables, etc. Offers. Buyers collect. A.W. McNeill, 40 Turnpike Road, Newbury, Berks. GRI3 3AS. Tel: Newbury 40750.

● **SALE:** Hammerlund HQ120X RX. Two owners only. Collectors item in USA. Minor mods. Handbook matching speaker. Full history spares etc. £240 cash and collect, or arrange SAE. G8GI QTHR (0780) 64204 (evenings).

● **BRAUN T1000CD** general coverage. Receiver cost £360 also Yaesu FRG7700 for exchange. Music centre or anything of interest. Any radio can go both 100% perfect. No time wasters. First come first served. David Wright, 42 Wealdstone, Woodside, Telford, Salop.

● **10M FM RIG**, R&EW DNT conversion. 29.30 – 29.69MHz, £50. 10M SSB/AM Rig, 28.50 – 28.95MHz, £75. GM4 DHJ. Tel: (Glasgow) 041 889 9010.

● **EDDYSTONE 880/2** for repair. I urgently require the services of a competent technician to bring this RX back to good health between 14-30MHz, have w/s manual. P. Jones, 27 Dunstable Road, Studham, Beds.

● **SX-200N** Scanning Receiver, mint condition. Full service manual plus Discone Broadband antenna. £180 G6 LMO. Tel: Maidenhead 27236.

● **EXCHANGE:** Acorn Atom 12K+12K PSU manuals, cassettes plus PRO, PROII Metal Detector, very sensitive with three discriminate modes. Total value of both £250 will swap for 2M, HF, or any radio equipment. Tel: Fairseat (Kent) 832942.

● **WEST TOWER** 60ft Lattice Tower. Free standing. Complete with base, never used due to failure to obtain planning permission. Offers around £400. Tel: Rotherham 540753 for further details. Ask for Steve.

● **CB MAXCOM 16E**, new unused £20. Used Maxcom 16E, Astatic Mobile Mike £20. Antennas: T40, Mag Mount £10. K40, Gutter Mount £18. Astatic D104 Desk Mike £20. All ono. Ring Royston 61102.

● **WANTED:** by home brewer 8 20pf 3kv capacitors or VCs similar range will pay postage etc. H Cheetham, 14 Castleton Ave, Carlton, Nottm. Tel: 0602 871910.

● **MORSE DECODER CWR600** decodes CW and RTTY on to your domestic TV screen. Excellent for learning morse. Still under guarantee. Can be seen working. Price only £125. Charles Elliott, 78B Hendon Lane, London N3 1SC. Tel: 01-346 8597.

● **S.A.E. ENQUIRIES** invited for Silent Key's Labgear SSB Manpack Transmitter – Receivers four xtal – controlled channels in range 2MHz to 11MHz. Thurlow. G3WW QTHR 0354 740255.

● **SALE** S.T.E. Milan Arac-170 Multimode 28-30MHz. and 430-440MHz receiver, speaker, manual. Little used, mint with new 145MHz Converter £100. Roberts, GW6AYM, QTHR, Swansea 204146.

● **SWOP AE1 CAMERA** and extras. Medals, military models, for Gen-Cov Yaesu FRG7700 or similiar. Not FRG7. Wanted ex W.D. RX AR88 HRO etc. The lot for RA117E. Phone 0908 566222 Ext 35 (office hours) Dave. Milton Keynes.

● **R.A.E. HOME COURSE** Complete 20 lessons. New condition, cost £60, will accept £25 ono. Post paid. Telephone Harleston 852 733 (Norfolk).

● **SALE: MIZUHO SB-2M** SSB/ CW TX/RX 1 watt with Nicads and charger. £50. Eddystone EC10 £50. Microwave modules 2 metre converter £7. All plus postage or collect. Phone Jones G8DYV 03745-53923 (South Benfleet).

● **WANTED:** For The Wireless Museum. Old radio books, magazines, catalogues, QSL-cards, service sheets, manuals. keys, valves, components, knobs. Cartridge player. Gamages catalogue. Collection arranged. Details pse. Curator – G3KPO. Ryde 0983 62513.

● **BFO FOR GRUNDIG** Satellit for sale, boxed, unused. Also wanted urgently manuals for T1154 and R1155, together with any information. Beg borrow or pay for photocopy. Tel: Shirley RS45124 01-381 0802. Mornings or 01.30-03.30hrs.

● **TS120S, PS30, SP120.** Securicor arranged. Not used mobile. £360. G4NTX QTHR. Tel: Wadebridge (020881) 3386.

● **COLLINS RECEIVER** wanted. Treweek. 01-409 2579 office hours.

● **QUARTZ CRYSTALS** 10kHz – 100MHz £1.00 each. Specs available. V. Jakomin, 69 Angus Close, Chessington, Surrey. Tel: 01-391 0545 evenings.

● **813 VALVES** New boxed qty 26. £18 each. Phone J. Reece 0202 578896.

● **WANTED:** Large quantity of CV4046 (TT15) (CV415) valves must be new call 0202 578896.

● **GRUNDIG 1400** Professional, only 4 months old. Hardly used, like new £130. 15 Penrallt St, Machynlleth, Powys.

● **WANTED:** Valve No. 6JB 6A 26-30MHZ 250Wp.e.p. replacement for ZETAGI BV131 or information. Tel: Liverpool 480 0491. 21 Charlwood Ave, Huyton, Liverpool.

● **OFFERS** wanted for old radio books (hard backs), News Chronicle Wireless Constructors Encyclopedia; FJ Camm Newnes, Everymans Wireless Book; FJ Camm, 1934; The Manual of Modern Radio, J Scott-Taggart, 1933; The Book of Practical Radio, J Scott-Taggart, 1934; Handbook of Wireless Telegraphy (Vol.2), HMSO 1938; Radio Constuctors Manual No.1, Lewis George (not hardback) 1945. All in good condition, or in exchange for good HF RX or WHY. Mr. J.R. Brien, 25 Marston Ave, Dagenham, Essex. Tel: 01 593 4439.

● **EDDYSTONE** 888A. **RX** in good working order, would exchange for AR88D Receiver with S Meter. Prefer with no mods. Mr H.H. Davey, 33 Moorlane, Maulden, Beds. MK45-2DJ. Tel: Ampthill 404165.

● **TR9000** 2 metre multimode base/mobile rig. V.G.C. £225. No offers. Tel: Medway 726185.

● **TASCO TELESCOPE** for sale, 500mm lens. Two interchangeable eyepieces, one prism based. 50 times magnification factor, v.g.c. only two months old. Retail price £40. Price £27. 31 The Linkway, Brighton, Sussex. BN1 7EJ.

● **COMMUNICATIONS** receiver Eddystone 358X 90KCS-30MCS for sale. Good condition, new valves. etc. Buyer inspects and collects. £60. J.M. Thomson, 2 Wilton Hill, Hawick, TD9 8BA. Roxburghshire, Scotland. Tel. Hawick 5089.

● **SONY ICF-2001** FM/AM P.L.L. synthesized receiver, ranges 76-108 MHz and 150-29,999kHz with S.S.8. compensator. Computer tuning system by keyboard and L.C.D. Brand new £120 ono. Tel. Stevenage (0438) 57275 (evenings).

FOR SALE relistic D4 100L coms. RX 150 KS, 30MHz AM/SSB/Cm. 6 months old. Good condition £75 ono. Buyer collects or add postage. Tel: Wilmslow 527250.

● **SOKA747** SSB 560W (Yaesu FTDX560) 80-10m. One owner. No mods. SMC serviced. Spare output valves. £175. Collected Ware, Herts. Ask for Sked. Tel: 09203564 ask for Max (G3WMB) but only genuine enquiries please.

● **RTTY RECTIFIER** 66B 160-80+80 £15. Rectifier 26B 80+80 £10. Low pass filter 4B. £2. TG988 unit £2. Telephone Bournemouth 0202-707013.

● **FRG7.** Good condition. Tel: Luton 36919.

WANTED: Welz AC38M or Amtech 200B or 300B or similar A.T.U. Cheap. Write to: A. Moody, 29 Elmlea Drive, Olney, Bucks. Mk46 5HU or phone 0234 711865.

● **EXCHANGE SONY** TC765 reel to reel recorder as new condition, current list price c.£600 for Icom IC740 or Yaesu FT102 or similar. Possible cash adjustment. Dawson, 86 Earlsdon Avenue South, Coventry. Tel: 0203 711658.

HAM INTERNATIONAL Concorde I USB LSB-AM-FM CW 26 to 28megs £120 or nearest offer. Can be converted 28 to 30megs. Hallecrafters UHF receiver with boots and circuits £35 or nearest offer or will swop for 2mtr rig. R. Sweet, 32 Sunningdale Avenue, Upper Colwyn Bay, Colwyn Bay, Clwyd. Tel: 0492-2637.

● **YAESU FRDX400S** receiver 160-10mts. C.B. 10MHz 2+6mts converters. F.M. filters, calibrator, squelch, fan for P.S.U., built-in speaker, complete with 200 watt antenna tuner. No split. Will post anywhere. Phone Jon, BRS45205, Berkhamsted (04427) 4175.

WANTED: Partridge variable frequency antenna (V.F.A.) quote price, excluding carriage to Hemingway, 77 Ethelburga Tower, Rosenau Road, London SW11.

● **FT290R WANTED.** Hallicrafters S27 for disposal, free collected. Collins. Tel: 01-579 9455.

● **G. WHIP** multi mobile three band automatic selection antenna plus LF coils with chrome swivel base £40. Marconi Kestrel, marine receiver. 500 KE/S 4.5 MC/S £25. Ring Basingstoke 65126 or write G30AZ QTHR.

● **REALISTIC TRC-2000** 40 channel 27MHz CB RF & MIC Cain controls, microphone. Kobishi power pack, 240 mains to 13.8 DC. Micronta F/S & SWR meter. Sirtel DV 27 antenna and coax complete. All legal equipment £80. All excellent condition with brochures. Mr. L.E. Tagliaferro, 9 Tugwell Road, Hampden Park, Eastbourne, Sussex BN22 9LH. Tel. (0323) 54244.

● **FOR SALE:** Hygain 5 model 8795. AM, FM, USB, LSB and CW. £100 or part exchange for a full coverage receiver. Enquiries telephone Pulham Market 762 (Norfolk) evenings.

● **NATO 2000** £130 owing to anticipation of passing exam. Cannon AE1 camera as new with zoom lense. £120 or v.n.o. also Vibrom tripod exchange for FT480R. Phone Burton-on-Trent 221870.

● **BEARCAT 220** scanner 12V-240V 38.000 frequency's discone antenna coax £200. Ham int. Jumbo £200. Yaesu FV901DM synthesized scanning VFO £210. All boxed as new. Please telephone Coventry 21810.

● **CATHOLIC AMATEURS** – Thanks to Amateur Radio Magazine new members are joining daily. Why not join them and get to know your fellow Catholic amateurs. Particulars G3AKG QTHR.
Peter J. Fay, 116 Lowfield Road, Caversham, Reading RG4 0PB. Tel: 0734 476718.

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● **RECEIVER TYPESHED** coastal Radio Ltd. Edinburgh 7 with power supply unit. 2M band etc. in full working order and in nice condition. £50. 28 Orchard Way, Bognor Regis, Sussex PO22 9HL

● **YAESU** FT707 FP707 FC707 FV-707DM and rack plus Sigma 4 £750 ono. Mr. B. Blackburn, 339 Station Road, Hayes, Middlesex. Tel: 573-8972 (01)

● **COMPLETE BASE** station 560 watts. Pep input FT x 401 matching external FV401 VFO matching loudspeaker, clynamanic mic, spare valves, manuals, professionally overhauled, mint condition. Buyer collects £250 ono. G4KUA QTHR. Tel: 0233-82-285.

● **AR88 COMPLETE** unmodified, working well. Original handbook tools. Also frequency meter, BC211AF. New unused complete with calibration book handbook. Offers. J.B. Sewell, 16 Stirling Drive, Burnside, Rutherglen. Tel. 041-634 4464.

● **ORIGINAL RCA AR88**speaker, mint £14. Admiralty s/state, SSB/RTTY converter for B40 series RX complete mounting tray, connectors and manual as new £50. Mmt 144/28 with data and test figures, perfect £85. CT212 manual £6.50. All plus postage G3GUU QTHR. C.H. Hall, Southplanks, Garstang Road, Barton, Preston, Lancs. PR3 5AB. Tel: 0995-40387.

● **TRIO TS 830S** or Yaesu FT107M Warc bands, both excellent condition £575 or exchange either for KW2000B with cash adjustment G4IZG 0903-41109.

● **WKS 1001**. AM-SSB 26-965-28.805 MHz £50, Major 588 SSB/AM/FM £70, Wagner 40ch SSB/AM £40, both the latter sets convertable to 10mtrs, for further details. Tel. 0427-5848 (North Lincs).

● **HEATHKIT RA-1** receiver. Six band 10M-160M built-in ATU. Good condition. Exchange for 2M beam/rotator or w.h.y. Tel: Sherborne 812330 (Dorset) evenings.

● **TWO PYE** Bantam transceivers No.1B (GPO Mark I) on 2 metres Nos. R7. R20 crystals fitted complete with handsets and Nicads £25 each. 1HB. FM. Bantam 156MHz offers. 1 LB.FM Bantam 81MHz offe. Two Pye pocket fones TX:RX suitable 70CM. Offers Worthing 66329.

● **FOR SALE** receiver 1155H transmitter KW Viceroy 80-10M. SSB AM GW power PSU, complete homestudy course for RAE. Offers for any of the above to Mr. J. Creasey G4 RIP, Rose Cottage, Six House Bank, West Pinchbeck, Spalding, Lincs.

HEATHKIT HW12 80 metre 200 watt SSB transceiver complete mobile, bench, power packs, manuals valves, exchange for general coverage receiver 2 metre equipment w.h.y. Cash settlement. Mr. W. Ball, 6 Coronation Drive, Penketh, Warrington, Cheshire. Tel: 2381.

● **SUPERSTAR 360FM** 25.5MHz 28.5MHz AM/FM/CW/SSB superhi med- low low-low and superlow bands £150. Contact V. Wood, PO Box 1 St. Coloumb Major, Cornwall. Telephone Newquay 2201 X461 and leave your telephone number.

● **SWAP 220LBs** weight training set, bench, stands for H.F. transceiver for sale. Sentinel 2 metre 28-30. 144-146 converter £10. Mr. D. Yeoman, 24 Oakleigh Drive, Peterborough PE20BD. Tel: 232211. Peterborough.

● **FRG7700** mint condition with optional R&E.W. SSB, buffer mixer, CW and control modules to convert into 1 to 30 meg. RX-TX. needs only FM module and P.A. to complete exchange for FT101ZD-FT707 etc. with any necessary cash adjustment. Phone after 6pm. Mr. V.T. Brown, 242 Little Wakering Road, Wakering, Southend, Essex SS30JN. Tel: Southend 218646.

● **HAM INTERNATIONAL** jumbo base station AM-FM-USB-LSB 29.965 to 28-305MHz as new (boxed) little used £185 ono. Mr. R.J. Lindley, 23 Quadrant Close, Murdishaw, Runcorn, Cheshire. Tel: Runcorn 711393.

● **CO8RA 148GTL-DX** base mike plus hand mike power pack mag mount antenna. Good condition £140 ono. Reasons – upgrading. Mr R.J. Lindley, 23 Quadrant Close, Murdishaw, Runcorn, Cheshire. Tel: Runcorn 711393.

● **ICOM IC202S** QRP PT2(pip) Beacon Xtal new nicads, need cash bad £125 ono. Rig unused since 07-82. Derek Andrews 01-863 3978 evenings/weekends. Wanted TR2200G/GX in g.c. w.h.y?. (73/88 DE GHEZZ).

● **TRIO TS 8305** excellent condition £575 ono. Yaesu FT107M P5U FP107E, black front WARC excellent condition £575 ono or exchanges w.h.y. Tel: Worthing 41109.

● **EDDYSTONE 840A** communnications receiver. Good clean condition, suit beginner S.W.L £40 + carriage. Worthing 66329.

● **FOR SALE TRIO** TR3200 70CM V.H.F. portable six channels fitted nicads £100. Skyleader super clubman, two channel radio control extra crystals £50. Phone Alan G4NMA Walkern (043886) 505.

● **SUPERSTAR 360** AM/FM USB/LSB CW/KC shift, built in SWR meter, standard mike plus Turner Roadking power mike Zetagi 200 watt linear ½ wave di-pole SWR/matcher power-meter £220. Will not separate. Phone 061-962 6920.

FOR SALE: FT480R 2M multimode transceiver £280. Sota 40W linear amp £40 or swap for good TS830S or FT101ZD FM plus cash difference G40XD. Tel: Hitchin (0462) 35248 after 6pm.

● **FOR SALE:** DX200 receiver. Covers 140KHz to 30MHz. Has AM, CW, SSB. Received hams in Australia and Japan with indoor aerial. £60 ono. Delivery F.O.C. 100 miles. Collins 01-579 9455.

● **WANTED KW2000 A** or **B** in good condition. Will collect within 50 miles or meet Mr Wilson, 1 Paddock Park, New Bristol Road, Weston-S-Mare, Avon. Tel: 0934 32434.

● **WANTED URGENTLY** MR1000A VHF/FM scanning receiver (Nicads, charger and crystals for repeater outputs R2/R3. If you have them) will pay carriage. All letters answered. Mark Cooper, 33 Park View, Royston, Barnsley, South Yorks S71 4AA.

● **3 ELEMENT MINI** beam and rotator c/w control. Ariel, new £50. Tel: 029-922 279 (lows, Top, Worcs.

● **HAM INTERNATIONAL** Concorde II USB, LSB, AM, FM, 5KC shift. Excellent condition £100 with mains transformer. 3-element Yagi plus rotator 25 metres RG58. CD-AX. £50. Ham international 100W linear amplifier £40. Tel: Lincoln 792564.

● **DX200 COMMUNICATIONS** receiver unused £75 ono. Phone Tommy 051-228 6728.

● **FOR SALE.** Unused complete correspondence course for R.A.E. examination offered at under half price. £30 to include p&p. Tel: (03952) 78181.

● **AZDEN PCS2800** 28MHz to 30MHz mobile transceiver, keyboard entry, digital frequency display, etc. would exchange for FT290R C58, IC202 or Mizuho SB2X with cash adjustment. Phone 0554-820282 ask for Richard GW6 TAM evenings only.

● **'LOWE' SRX-30** general coverage receiver. 0.5 to 30MHz little used, in excellent condition. Ideal for newcomer to short wave listening. £90 ono. A. Harvey, 31 Ivanhoe Road, Edenthorpe, Doncaster. Tel: 0302 884338.

WANTED: 13-8V 10A power supply in good working order. Southend (0702) 529094.

● **TS820 HF** transceiver mint condition inc. CW filter, inverter and SP820 speaker haggle or swop for darkroom equipment. Neil Fuller. Tel: 01-640 1349 Ansaphone.

● **FDK PALMSIZER II** good working con. complete with ni/cads charger rubber duck aerial lead can work mobile £65. Phone Leigh Lancs. 675445 have got a new TR2300 is reason for sale. Stephen Balon, 18 Knowsley Street, Leigh, Lancs. Tel: 0942 (675445).

● **WORKBENCHES FEW** only, secondhand benches 3'high, 4'7" wide, 3' deep formica top, instrument shelf, 2 drawers, very heavy construction, backboard and sidescreen, A1 condition, cost over £200 to make £80 each. Phone available. Dave Brown. Tel: 042486 3464 anytime.

● **SWOP REGENCY** multi frequency programmable scanning receiver, similar to Bearcat mains battery power memory etc. Wanted Yaesu FTV 901R transverter or FC902 A.T.V. or quality 2 metre rig. Ring Brownhills 2606 after 6pm.

● **HAMMARLUND** exchange, Sony professional SP600 Mizuho SB2M. CRF320 REC communications with low linear cost £900 as new receiver for £450 or exchange. £70 good order Datong PCI for FT101ZD. General coverage Trio TS515 converter. Transceiver £200. Tel: 0642 211685.

● **FOR SALE** or exchange Cinerex STD8 Super cine projector and screen movie light. £65 or swap for any good condition short wave receiver. Phone 0278/423288.

● **HY-GAIN** 8795 transceiver. Full coverage from 25.965MHz to 28.005MHz, AM, FM, USB, LSB, CW, in four bands of 50. As new £160.00. Tel: Chester 311496.

● **TRIO TS515** HF transceiver and mains PSU £175. G3XAQ QTHR. Phone Canterbury 52131 after 6pm.

● **TRIO TR7800** 2M transceiver. Never used, very good condition, complete with manual, mounting bracket, mic £230 ono. Ring 01-397 7249 – Pete.

● **WANTED:** Trio external speaker unit model SP820 or SP230. Tel: (0373) 64694 near Bath.

● **ZX81 16K RAM** plus software trio, 9R-59D, 0-30MHz valve receiver, swop UHF-VHF. Gen. Cov. Rec. or W.H.Y. Cardiff 0222 731070.

● **SALE. MICROWAVE** Associates 10GHz Gunnplexer transceiver with self calibrating wavemeter, cross coupler. PW dish, 10 inch dish with waveguide feed. Spare gunndiodes, etc. £90 ono. Ring 0453-83-3411 or 045345461 evenings and weekends.

● **EXCHANGE VIC20** computer with cassette and high-res. cartridge, two manuals and tapes for older HF transceiver or w.h.y. G6 SHZ 0935 812330. Sherborne, (Dorset).

● **YAESU FRG7700** receiver with fitted memory unit, plus FRT7700 tuner and FRV7700 VHF converter, all as new, bargain. £400. Shure 444 microphone £18. Telephone Shoreham, Sussex 3552. QTHR G3MIN.

● **WANTED: AR88,** preferably in working order, but anything considered, phone Gloucester (0452) 67377 weekends and after 4.30pm weekdays.

BELCOM LS102L transceiver, all modes inc. CW, 26-30 MEGS, digital readout in 1kh steps, fast and slow, 6 months old. Not used mobile £150 no offers. Zetagi transmatch 25-30 megs to suit, as new £25, or would exchange. Both for an AEA inc. MBA-RO code reader. Mr. N.E. Suffolk, 2 Tamerton Road, Eyres Monsell Est. Leicester. Tel: Leicester 782711.

● **EXCHANGE GOOD** quality 35mm photographic enlarger with dishes, trays, colour printing, filters, paper, tanks, etc. for communications receiver value of my equipment about £150-£170. Phone Worthing, Sussex 206920 evenings.

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Synthesiser Transmit Amp	A-X3U-06F	27.60	17.40
Synthesiser Modulator	MOD1	8.10	4.75
Bandpass Filter	BPF 433	6.10	3.25
PIN RF Switch	PSI 433	9.10	7.75
Converter (2M or 10M i.f.)	70RX2/2	27.10	20.10
FM Package 2 (Synthesised)	70PAC2	163.00	126.00
TV Products			
Receive Converter (Ch 36)	TVUP2	26.95	19.60
Pattern Generator	TVPG1	39.95	32.53
TV Modulator	TVM1	8.10	5.30
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Power Amplifiers (FM/CW Use)			
50mW to 500MW	70FM1	14.65	8.85
500mW to 3W	70FM3	19.65	13.25
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Bipolar Miniature (13dB gain)	70PA2	7.90	5.95
MOSFET Miniature (14dB gain)	70PA3	8.25	6.80
RF Switched (30W Max)	70PA2/S	21.10	14.75
2M EQUIPMENT			
Transceiver Kits and Accessories			
FM Transmitter (1.5W)	144FM2T	36.40	22.25
FM Receiver	144FM2R	64.35	45.76
Synthesiser (2 pcb's)	144SY25B	78.25	59.95
Synth Mult/Amp (1.5W o/p)	SY2T	26.85	19.40
Bandpass Filter	BPF 144	6.10	3.25
PIN RF Switch	PSI 144	9.10	7.75
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1.5W to 10W FM (No Changeover)	144FM10A	18.95	13.95
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FM Receiver	4FM2R	61.65	43.15
Pre-Amplifier	4PA4	10.95	7.95
Pre-Amplifier, RF Switched	4PA4/S	18.95	14.40
6M EQUIPMENT			
Converter (2M)	6RX2	27.60	19.95

Enquiries by post should contain a SAE. Please restrict telephone technical enquiries between 6pm and 9pm in the evening on either 0256 24611 or 07356 5324. Access and Barclaycard orders can be taken on 07356 5324.

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Amateur Radio Exchange, ACTON 01-992 5765
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● **TRIO JR310** receiver, 80-10 meter plus 27.000 to 27.600 v.g.c. £65.00. Tel: Hurst Green (Sussex) 0580-86-222.

● **YAESU FR101DD** +2m-6m FM digital readout, hardly used £370 ono. Wanted Datong morse tutor. Zeiss Notorem 8x32 BMC as new £75 ono. Phone 01-500-5395.

YAESU FT707 transceiver FP707 power pack FC707 antenna, tuner, crystalled up. Good condition. £650 ono. Tel: 061-865 2955.

● **EXCHANGE WANTED FOR** 2 meter converter 144-146MHz to 4-6MHz recal frequency counter, to 300kHz. Will swop for dip meter covering 1-8MHz to 250MHz. Phone Tamworth 51591 anytime.

● **FOR SALE** Zetagi BV131 200W linear amplifier AM, FM, SSB, Zetagi M27, aerial matchbox, will handle 1KW as new, used once, only £65. Mundell 140 Mount Road, Chessington, Surrey. Tel: 01-391 2305.

● **RACAL RA17 MKII** in superb condition. Sell £140 or any P/X considered. Ring 0453 882164 (Stroud, Glos.)

● **TRIO R2000**, as new, outstanding performance, with instructions and maker's box, etc. £325 carriage paid. Tel: 031-664 0595 after 7pm.

● **HAM MAJOR** SSB/AM/FM £60 ono. GP27 £12 PSU £7. £70 the lot. Heckmondwike 409310 or exchange. 2M HF gear.

● **REALISTIC DX302** receiver 10KHz 30MHz digital readout, as new £175 ono. R. Steel, 2 Windermere Close, Southfield Lea, Cramlington, Northumberland. Phone Cramlington 737630.

● **TR2300**, Nicads, charger, reverse repeater, helical plus MML 144/30LS 30 watt amp. £160. G3RFI. Tel: 0767 260800.

● **FIFTY/SIXTY** American octal and E series etc. valves, new and used untested. Also AR88D and SX28 handbooks. Sundry resistors, capacitors, electrolytics, etc. Offered as one lot £45. Phone Guildford (0483) 60535.

● **FOR SALE** National Panasonic DR28. General coverage receiver £95 ono. AR88. General coverage receiver £55 ono. Jones, 11 Trinity Court, Aylesford, Maidstone. Tel: Medway 47171 Ext 50 (during working hours).

● **ICOM 701** H.F. transceiver for sale with P.S.U. & desk mike, less than 10 hours use, snip at £550. Ring Graham G41VN on 0493 728194 (Gt. Yarmouth).

● **LINER 2** SSB mobile £75. Europa "A" transverter 28/144 MHz £50. Vibroplex deluxe £19. Garex twomobile AM/FM transceiver 2 metres 6 chanel mobile £65. H.F. SWR bridge 3-30MHz single meter £3.50. David White, Rose Cottage, Shenley-Brook-End. Milton Keynes, Bucks. Milton Keynes (0908) 501310.

● **TRIO TS120S 220w** P.E.P. HF transceiver (12 volt) £300. Microwave modules 70cm-10m Transverter £70. 15EL 70CM quad loop antenna (needs connector) £10. 12v C.B. P.S.U. £4.50. 2M 14EL Parabeam £20. Tel: Dave G4GSR. Tel: 051-428 1845, 051-227 1919.

● **WANTED:** Hallicrafters SX28(A) must be complete. No mods. Also handbook for SX25 super defiant. R.M. Dotchin G3WEP, 2 The Crescent, Shortstown, Bedford MK42 0UJ.

● **ICOM IC251E** 2m Multimode Tx/Rx base station, mint £425. Icom ICS desk mike, Icom Ichmio fist scanning mike, offers, Daiwa RM940 infrared Mike. No connections £30. G410F. Tel: 01-486 8286.

● **WANTED SMCHF5V** and radial kit, monitor 'scope also signal generator QTHR. D.M. Peach, G3VXS, 56 Basford Park Road, Maybank, Newcastle-under-Lyme, ST5 0PS. Tel: 0782 625661.

● **FOR SALE** realistic DX100C RX and wire ant £65, 3 element 10/11m Yagi £30 5/8 omnidirectional 10/11M, reace RS107, transceiver test master £30. Phone Roger on Wilmslow 527250 (after 4.30 on weekdays)

● **WANTED RECEIVERS S640** CR100. RAI and vintage R.A.F. R1084. Write Marris, 35 Kingswood House, Farnham Road, Slough, Berks, SL2 1DA.

● **WANTED MARCONI** cavity filters, type number W38420E D.D. or any cavity filters wanted for local repeater group. Please contact Mike anytime after 12 on West Drayton 43524.

● **SELLING PANASONIC** D.R.49, FM88-108MHz short wave 1.6. 30MHz receiver double super heterodyne digital display tape in/out. BFO mains battery £150. 1 year old. C. Ames, 45 Rosedale Grove, Spring Bank West, Hull, North Humberside, HU5 5BY. Tel: (0482) 503482.

NATO 2000 200 channel 5-mode AM/FM/SSB/CW including UK FM channel mobile transceiver as new £110. Phone Yateley 872167 after 6.30pm.

● **WANTED "CODAR"** preselector PR40 or "Hamgear" preselector, must be in good working order. Write state price to L. Day, 48 Kirkby Road, Scunthorpe, South Humberside DN17 2JZ.

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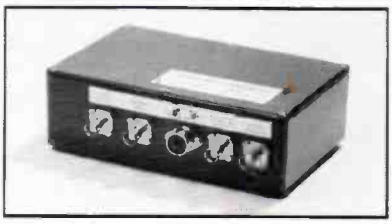

MMT432/144-R pictured

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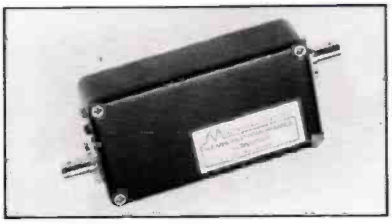

MMC144/28 pictured

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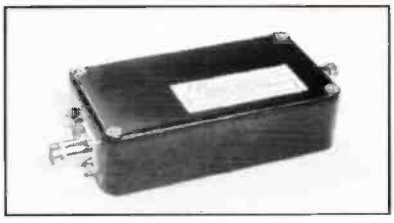

MMA144V pictured

MMT432/28-S

This all-mode linear transverter allows your 28MHz transceiver to operate on the popular 70cm band. Providing an output of 10 watts RMS, and incorporating a low-noise receive converter, this product represents a cost-effective means of moving up to one of the few peaceful amateur bands. A frequency shift, allowing coverage of 432-434MHz and 434-436MHz, both from 28-30MHz equipment means that the simplex, repeater and satellite portions of 70cm can be utilised.

Price: **£159** inc VAT (p&p £2.50)

MMT432/144-R

This product, which is similar to the MMT432/28-S above, is intended for use with a 2 metre transceiver, to provide coverage of the 70cm band. The basic specification is the same, with the exception that this unit incorporates a repeater shift of 1.6MHz for simple access of the many UK repeaters. The transverter is supplied with a suitable attenuator to allow use with transceivers having an output power of 10 watts. (Alternative types to order).

Price: £184 inc VAT (p&p £2.50)

MMC50/28

6 METRE RECEIVE CONVERTER

Input frequency range	: 50-52MHz
Output frequency range	: 28-30MHz
Overall gain	: 30dB typ.
Noise figure	: 2.5dB or better

Price: **£29.90** inc VAT (p&p £1.00)

MMC70/28

4 METRE RECEIVE CONVERTER

Input frequency range	: 70-72MHz
Output frequency range	: 28-30MHz
Overall gain	: 30dB typ.
Noise figure	: 2.5dB or better

Price: **£29.90** inc VAT (p&p £1.00)

MMC144/28

2 METRE RECEIVE CONVERTER

Input frequency range	: 144-146MHz
Output frequency range	: 28-30MHz
Overall gain	: 30dB typ.
Noise figure	: 2.5dB or better

Price: **£29.90** inc VAT (p&p £1.00)

MMC432/28-S & 144-S

70cm RECEIVE CONVERTER

Input frequency ranges	: 432-434MHz & 434-436MHz
Output frequency range	: MMC432/28-S 28-30MHz MMC432/144-S 144-146MHz
Overall gain	: 30dB typ.
Noise figure	: 3dB or better

Price: **£37.90** inc VAT (p&p £1.00)

MMA144V

This RF switched low-noise receive pre-amplifier utilises the proven 3SK88 in a noise matched design. Providing a power gain of 15dB and having a noise figure of better than 1.3dB, this unit will accept a through power of 100 watts.

Price: **£34.90** inc VAT (p&p £1.00)

MMA1296

This low-noise 1296MHz preamplifier comprises a two-stage preamp and a high technology micro-strip interstage filter.

Power gain	: 18dB typ.
Noise figure	: 2.9dB max.
Frequency coverage	: 1250-1300MHz

Price: **£34.90** inc VAT (p&p £1.00)

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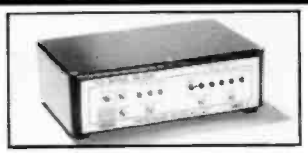

MMS1 pictured

MMSI - £115 inc VAT (p&p £2.50)

This speech-synthesised morse tutor produces random morse, in various group lengths, and at speeds in the range 2-20wpm and provides speech response to the pupil, to enable a check to be made on his/her receiving ability. the unit is designed around a microprocessor and is a perfect and accurate means for the individual to learn morse code.

MMS2 - £169 inc VAT (p&p £2.50)

This advanced Morse Trainer is based on the MMS1, and includes all the above facilities, with the addition that the pupil may key his own morse into the unit so that he can perfect his sending ability. As this is a more advanced product, the speed range is 6-32 wpm.

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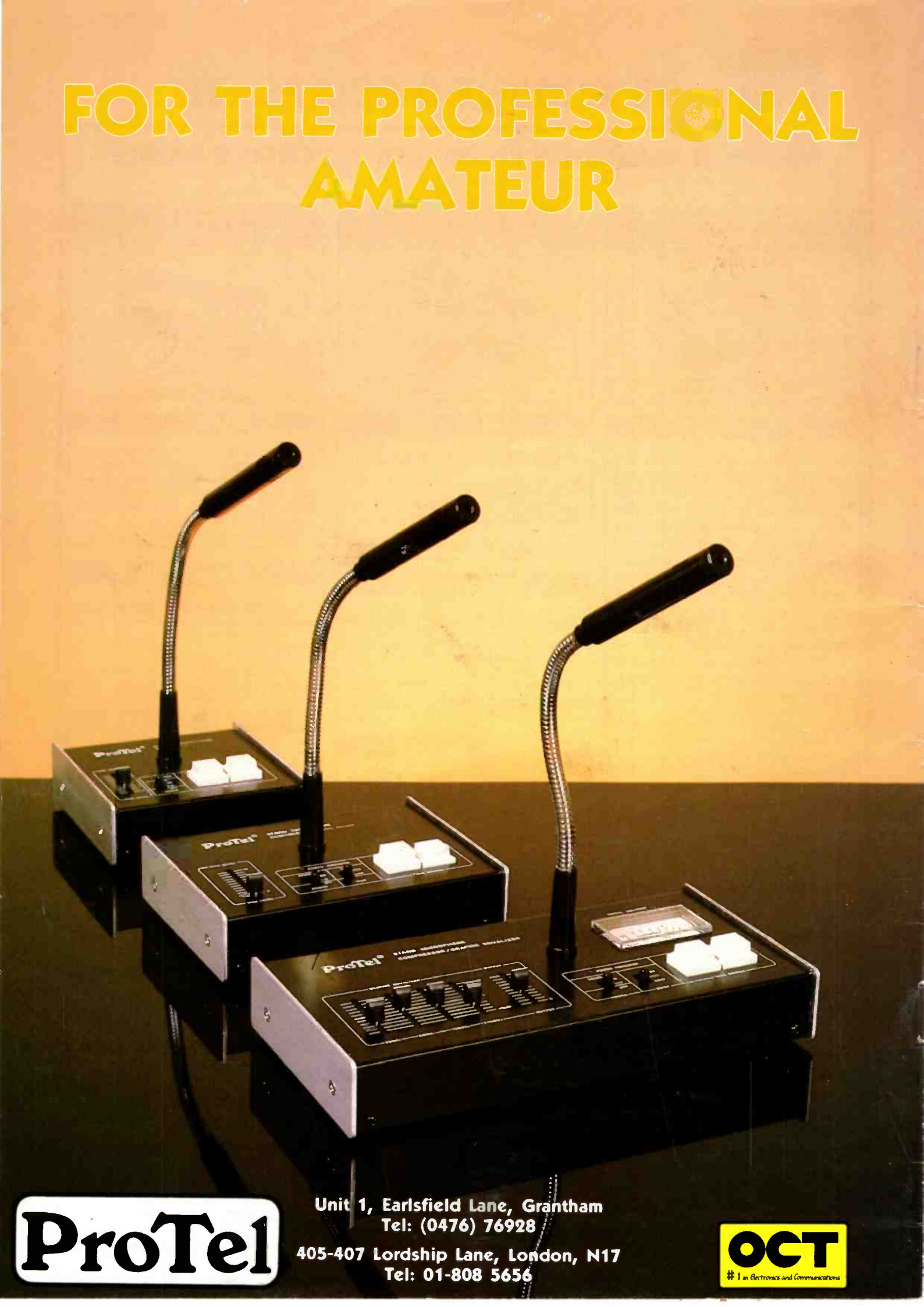

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