

Amateur

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RADIO

For all two-way radio enthusiasts

What Radio?
Price chart

RSGB's
David Evans
questioned

Pass the
RAE

Transverters
vs
black boxes

Centre-fed
aerials
explained



Two top multimodes - tested by
Angus McKenzie G3 OSS

G4JDT
HARVEY

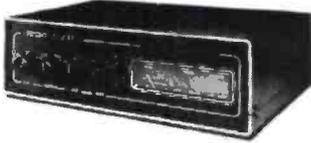
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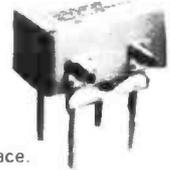


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Amateur RADIO

4 Current comment

Probably the only thing in the magazine that the Editor actually writes personally...

6 Your letters

Where it's your turn to write to the Editor and give him a piece of your mind. Complimentary letters only, please.

8 Straight and level

Amateur Radio magazine's news pages, really. News and views of things happening now, and including rumours of things that might happen in the near future.

10 SWL

Specially for the shortwave listener. Information useful to you while you're tuning the knobs.



12 NEC Exhibitionism

Yes, we went along to the RSGB Exhibition. If you didn't, this is a description of what it was like, who was there, (and who wasn't) and what they had on offer.

18 Shoptalk

News of things put on the market recently, like Datong's new automatic audio notch filter, and Bi-Pak's new sound-effects device.

20 Angus McKenzie report: Two top multimodes tested

G3OSS compares two of the best multimode portables available. Full handling and technical descriptions plus an easy-reference guide to the specifications.

26 Interview: David Evans, G3OUF

Editor Drake interviews the General Manager/Secretary of the RSGB, David Evans, G3OUF, about the present, and future of the amateur's "representative body" in the UK. A rare insight into the thinking behind the RSGB's actions.

32 Starting from scratch: Procedures

At some time or another, you'll need to learn about making that first contact. Here, Nigel Gresley points you in the right direction, and talks you through a typical conversation from start to finish.

38 What Radio?

Price and specification comparison chart, along with helpful comments by the staff of Amateur Radio.

40 Shortwave and the fourth dimension

It was Hugo Gernsback who first linked shortwave with science fiction. It was also he who has a moon crater named after him, and is called the "father of modern wireless". David Lazell reports on this fascinating man.

44 Top hand-held: TR3500

Angus McKenzie, G3OSS, continues his comparison report on hand-helds with a summary of the popular Trio rig.

46 Pass the RAE: 2

In order to have the best chance of passing, you'll want to understand the basic workings of atoms, and how they fit into the radio amateur's scheme of things. Nigel Gresley explains in words of two syllables.

50 Transverters vs black boxes

Another article from the prolific pen of Angus McKenzie, G3OSS. Here, he compares the two modes, and discusses the pros and cons of using HF rigs with transverters for VHF/UHF.

54 A fresh look at wire aerials: 2

All you need to know about centre fed tops and the like. Written by John D. Heys, G3BDQ, the man who probably knows as much about the subject as anybody. Lots of practical and useful information.

59 Trying out transformers

How to discover whether that old transformer you found at the junk sale really works; plus where to find them in the first place. Ken Williams, an amateur, reports.

62 Sussing a synthesiser

We got our hands on a Wood and Douglas synthesiser kit and built it

from scratch. It was much more involved than we first thought; here, we tell you what to expect from such a project and what sort of work is involved.

67 Club news

News and views from clubs nationwide. Send us your newsletters and future programmes and we'll tell the world about them.

69 Amateur answers

We answer your technical and non-technical questions. Write to Editor about your personal and private problems...

70 Free classified ads

Advertise, free of charge, your radio equipment, spares, rigs etc. Or you could put in a free "wanted" ad. Either way, you'll need to complete the form on this page.

74 Engraving offer

Badges and plaques at low, low prices! a final opportunity to take advantage of Amateur Radio's special bargain offer.

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Front cover: The two portable multimodes reviewed in this issue – Yaesu FT790R and FT290R, pictured by Tony Large. We would like to thank SMC Ltd., of Southampton, for the loan of the equipment tested by Angus McKenzie, G3OSS.

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CURRENT COMMENT

Another bumper fun magazine with free KWM-380 in each issue; well, we wish there were, and in fact we are working on some special offers and top prizes in competition to brighten up your amateur life which we'll tell you all about next month.

Technical Bod suggested a free 47K with each issue, so we took him out and shot him – believe that if you like! Seriously, we're thinking about some form of nasty torture especially since he keeps asking me what the resonant frequency of 1nF in parallel with 1mH is. Well, search me mate, too technical for me, pause as blunt object crashes into the curiously egg-shaped Technical Skull . . .

Oh, the fun we have. Anyway, here's another spiffing magazine in which we include Angus Mackenzie, the General Manager of the Radio Society of Great Britain (fanfare on trumpet, rolls of thunder) things on centrefed antennas and all sorts of other things. There's also the second part of our series on how to pass the RAE, in which we delve into basic electrical theory and a bit of physics and chemistry on the side. Broadens the mind, this job . . .

We've been doing quite a lot of operating of late and general listening around the bands, especially on 144MHz, and it's

Introducing you to this month's issue

interesting to hear some of the things that get said. What happened was that we actually took a weekend off (shock! horror!) and took the gear up to a cottage in Cheshire which belongs to some old friends of ours; we then spent most of the weekend listening and having the occasional contact using an IC-211E of dubious vintage and a 4-element quad borrowed from a nearby club.

What was nice was the general standard of operating on 144MHz, especially amongst those on whose licences the ink could hardly have been dry. We get a lot of letters about operating standards and how terrible all these ex-CB G6s are, but we have to say that if a weekend in Cheshire is anything to go by it's a lot less of a problem than some would have us believe. Almost everyone had the calling channel-and-then-QSY procedures sussed out, we didn't hear a single case of bad manners all weekend and it was all pretty good stuff.

There were a few things that bothered us a little; bearing in mind that within the spirit of the amateur licence and the traditions that have grown up over the years people do their own

thing, it's perhaps not our place to criticise. But it's a shame that some people give each other signal reports of S-nothing simply because no-one has ever told them about the RST code and explained that the S-meter on a rig is about as useful for giving signal reports as a 3kV supply is to an op-amp.

It's a pity that many stations seem afraid to tell others when their transmissions sound awful for one reason or another – one chap we heard was having trouble with a 4CX250 linear of some sort and he sounded terrible and took up half the band in doing so. No-one said a dicky-bird to him, yet he knew there was something wrong and was trying to do something about it. It's quite easy to say to someone: "Well, your audio is almost unreadable and your signal is about 20kHz wide – can I help you try and sort it out?" instead of: "Oh yes, sounds good to me, very fine".

The amateur licence says something about "self-training", so maybe a bit more of that wouldn't come amiss. And the only other thing that got a bit frustrating was the number of stations who set up a QSO on 144.300MHz and then resolutely

refused to QSY more than 10 or 20kHz HF or LF. As usual, when people do that they seldom bother to check the frequency first before they slide up or down, and the net result is often confusion and a lost contact. There's plenty of room on 144MHz, chaps, can't we spread the contacts out a bit more – ie from about 144.16 to 144.495?

But apart from those things, it was nice to hear some activity and some really interesting contacts going on. We listened to one contact between a new G6 and a new-ish G4, and both were obviously interested in ships and shipping. They'd obviously never met and yet there was an interesting and civilised conversation going on, in good range and depth, that took me back to the old-timers I used to hear on 80 when I was younger.

So whatever people say, things don't seem too bad for this hobby of ours. After all, it's about people, isn't it? And they don't change much. Let's hope that we can go on getting better and having more of the civilised things and less of the Heard Island-standard of operating. Not VKOHI, you understand, but those desperate to work him – as we mentioned last month, some of those were the worst we've ever heard!

73 de Chris Drake

Amateur RADIO

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Whatever Next?



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LETTERS

Random wire aerial

First of all I commend you on your presentation and content of the mag. I have only recently taken an interest in SWL by purchasing an Amstrad multi-band radio primarily for aircraft monitoring at air displays. The SW bands reception of this radio is disappointing but for 35 quid, beggars can't be choosers.

So I erected a 30ft random wire outside and soldered the downlead to the built-in aerial via lucar connectors and have managed to get as far as R. Israel, RSO, South Africa and R. Canada. So this brings me to the reason for my letter to you.

Having read your March 83 edition and noting the test report on the Icom IC R70 (and I understand the majority of technical phrases, the rest I will look up), could you test in further issues, say, the Trio 600, 1000, 2000, and the Yaesu FRG 7, 7700, etc? I am considering taking the first step up the equipment ladder as it were, but before I do, an unbiased test report on such equipment would be a great help. Forking out £250-400 plus and not being satisfied at a later date with your receiving set is an expensive mistake. I would like (if possible) to get it right first time.

Further, could you do an issue on aerials for these sets, and compare, say, random wire, and ATUs and active antennas, as in my case (presumably there are more like me) I have a small garden and little space for a large aerial configurations?

**D. Briggs,
South Kirkby, West Yorks.**

Thanks for the comments, and we'll plan some receiver tests for future issues-Ed.

Patrick's day

Most interesting article on wartime radio by Pat Hawker. Watch out *PW* and *Radcom* – you'll soon be in second place.

**T. Delahunty
Doncaster, Yorks.**

Congratulations on a superb magazine. "The Secrets of Wartime Radio" by Pat Hawker, G3VA, made very

interesting reading. I was wondering whether you could publish some construction articles for very cheap, very simple radios that do not require a garden of about 200 yards long. Perhaps even with valves – remember valves? – big glass things with glowing tops!

**David Harrison (15),
Burgess Hill, West Sussex.**

I have just read the March copy of *Amateur Radio*, and particularly enjoyed the article by Pat Hawker on wartime radio. I do not know whether Mr. Hawker has written any full length books on this subject; if he has I would like to read any titles that you may be able to advise me of. I feel that if he has not done so, his style of writing would be ideal for a book, similar to *Ultra goes to war*, by Ronald Lewin.

I am keen that some literature may become available to cover communications development during the second war, because it was a time when extremely rapid development became possible. There are many books written on the "engines of war" but none that give any mention of the radio equipment fitted to them.

I have an interest in radio history, probably because I was a REME Telecommunications mechanic from about 1958 to 1968 and worked on such things as W/S 19, 18, 38, 53, 52, AR88, 31, A41, 62, C12, B44 C42 (they look very boring when listed as numbers don't they?) and I now work in the electronics field, which includes commercial radio equipment repairs.

However, I cannot believe that I am the only one interested in such matters. So if there is an author interested in a little research into the equipments, and the old soldiers' stories that must surely go with them, I am sure that he would have a ready-made public.

There is no great problem in obtaining modern technical information, so as far as I am concerned; a few pages of

your magazine could be devoted to stories of a non-technical nature, or of personalities connected with radio. In connection with the above, I also find the article "The Classics: The Rascal RA17" of great interest and hope to see it as a long series of articles.

Thankyou for an excellent magazine, and if this letter is not to be published, please convey my thanks to Pat Hawker for an excellent short article, and persuade him to write more of this type for us.

**R.D. Beck,
Lydd, Romney Marsh, Kent.**

Vega beater?

Your article on "Receivers on a Budget" by David Lazell has interested me greatly. You see, I am a *Woman*, just a shortwave listener on broadcast bands, and have since Christmas endeavoured to find out more about my very exciting "armchair on the world" as I call it.

Why are we listeners to radio networks of the world (and also women) thought of as non-existent...? I am 60 years old, taken up a hobby which has fascinated me for many years, but have no desire to become a "ham" – my brain could not cope with the electronics of RAE examination, and I have no one to help me! But I have logged every English-speaking station, placing it on cassette, and typed back my notes, in order to keep a record.

My point in writing is that I have been given a Vega (Russian) portable B210 by my family, built myself an ATU, and a young friend has made me a preselector. A long wire running east/west of about 20 metres gives me wonderful worldwide coverage. I know I am "plugging" the USSR, but this set cost my family £30 – there was nothing on the English market as far as they could find within such a reasonable price bracket. Do you not dare review a product from Russia?

As a pensioner I am unlikely to be able to aspire to anything more expensive, but I would dearly love to think there were others around who could, or do, find

this such an absorbing subject. Can you please tell me if we are catered for anywhere, in print, other than yourselves? I have endeavoured to find a club in my area, but all are far too technical for me, so I continue alone, very happy and learning so much in the process.

Please keep the format you have adopted already; I love the "fun" language. You always make me smile as I learn... it's great. Don't get too brainy please.

**Jean Fletcher (Mrs),
"Dunkirk", 5 Highridge
Green, Bishopsworth,
Bristol BS13 8AT.**

Well, readers, anybody in the Bristol area who can help regarding a local club that isn't overly technical? Write to Jean at her home address – Ed.

Carruthers reports in

I am pleased to note your editor is left handed – so am I. Most intelligent people are. I am also pleased to note that the "Ringing True" article seems to be written specifically with me in mind, and I will "keep my pecker up and get on with it!"

Seriously though, I have bought your mag from the beginning, and like it.

**Tony Carruthers,
Worthing, Sussex.**

I'm left handed too, so I must agree with that. Furthermore it's my right hand that makes all the mistakes – Alan (the keyboard operator)

Not technical enough?

I have enjoyed the magazine and found several of the articles interesting. However, I am not sure I agree with your philosophy of trying to avoid technicalities. I think this insults the intelligence of those who do understand them, and also leads to the suggestion that perhaps the writer doesn't really know what he is talking about!

Don't forget the oft-quoted clause in the licence about "self-training in wireless telegraphy." If someone reads something he doesn't understand in an article, and

LETTERS

goes away and finds out about it, then something useful has been achieved. If he chooses to remain in ignorance, then that's up to him. With best 73s.

Julian Moss, G4ILO,
Colchester, Essex.

Good point, G4ILO, and one to watch. - Ed.

Spy radio book

I am writing to say how much I enjoyed the article by Pat Hawker, G3VA, on wartime radio. I would be interested to know whether Mr. Hawker or anyone else, has considered a book on the exploits of wartime operators with particular reference to the equipments used.

A glance through the "for sale" and "wanted" columns of most radio magazines shows that B2s and the like are now much sought-after collectors' items. There are hundreds of specialist books on aircraft, uniforms, etc. on sale, so I am sure a detailed study of "spy rigs" would find a good market amongst collectors and amateurs, and may possibly save a few rigs from the scrapheap.

Thanks for an interesting magazine. I think its style is more in keeping with the present state of the hobby. Good luck for the future.

Roger Basford, G3VKM,
Haddiscoe, Norwich.

Consumers' rights

I must congratulate Angus McKenzie on a very good consumer article in the March issue. Some points I would like to make are the following:

1. When buying a secondhand rig from a dealer, insist on a three months guarantee on parts and labour, and preferably buy one without modifications.

2. Keep the receipt - it's your main proof of purchase.

3. When comparing prices, check that it includes VAT.

4. Dealers will always accept a building society cheque in lieu of cash.

Two good books on consumer affairs are: *Fair Deal*, by the Office of Fair Trading, 95p from most newsagents or available on order. And *A Handbook of Consumer Law*, published by the Consumers' Association, £3.95 from bookshops.

Finally, if you want to keep the XYL permanently occupied in consumer affairs (thus giving you more time on the air!) write to Ann Foord, of the Confederation of Consumer Groups, Top Farm, Main Street, Burnaston, Derby DE6 6LG. If this fails, get her to take the RAE!

Howard Holmden, G4KCC,
Farnborough, Hants.

Novice licence?

You are a pest! I am so wound up I feel compelled to write. In the March issue (page 9) you state: "Not a soul contacted us about the novice licence issue, so no one is interested. What a load of rubbish!"

On page four you state you received 261 letters, but how many copies of your mag did you sell? A lot more than 261 I bet. You cannot expect everyone to air their views. Just for the record, allow me to state that I doubt if anyone is more interested than I am. I will explain, at the risk of boring you.

I became interested in radio at 10 years of age (1940). My father was a radio operator as part of his war effort, and in our bathroom in Redhill (Surrey) was an Eddystone 358, supplied by who I do not know. But, I remember he had to listen to two frequencies in the 38MHz band crystal controlled and take blocks of five in CW. The German Enigma code.

When Dad wasn't using it, I was. I learnt the Morse code (I can manage about 10wpm now) and played around with radio parts, not that I ever got anything to work. To cut a long story short, I have been interested on and off ever since. That is, until last September, when a local G8 encouraged me to buy some equipment. Ever since, I have been entrenched in radio theory (RAE) and it isn't easy, trying to learn from books. If I know enough theory by next September (one year's studying) I will tackle the 30-week course at Worthing. I joined the RSGB and am now ex-BRS46840, as they claim to represent those who have an interest in radio. Don't you believe it! I wrote to the RSGB and complained bitterly about their attitude to CB. Waste of

time.

I am disenchanted with CB due to its limitations, and I want now to transmit CW and join the QRP Club, and that means a Class A licence - or a NOVICE LICENCE.

Going back to this licence then, I bet there are thousands of Class B operators and SWLers who are interested. It is just a question of apathy. To me a novice is someone who doesn't know a lot about radio, has very little or no contact with like-minded people, and hasn't the foggiest idea of achieving what they would like to do.

I rest my case. I enjoyed the Icom R70 write up, as I am seriously considering buying one. Until last Xmas I owned a Trio R1000 but as I was able to sell it for the price that I gave for it, I sold it. 73.

Peter.

Buyer's rights

Just got our copy of *Amateur Radio* magazine, and must congratulate you on the way your "Buyer's Rights" article turned out. It's a great pleasure to see a balanced, sensible article in a radio magazine, and I must also say that if the standard of the magazine is kept at the current level, it's going to be a great success. We were literally squabbling over who could read it first. 73.

John Wilson,
Lowe Electronics Ltd.,
Chesterfield Road, Matlock,
Derbys DE4 5IE.

We can always sell you two copies. We should point out that this, and many other letters commenting on Angus McKenzie's article on buyers' rights, arrived on the Editor's desk before the April issue went to press, but lack of space meant they had to be held over until this issue. - Ed.

Icom user

Having recently bought an Icom 740 in place of my 18-months-old Icom 720A, I purchased your December 82 issue from the shelves of the newspaper shop in this small Fenland village of Wimblington (AM 31E) near

March in Cambridgeshire, the home of FIVE licensed amateurs, primarily to read G3OSS's excellent test report on the FT102 vs IC740, and having read it, wrote Angus direct to congratulate him thereon and to agree with his 740 findings. Then I found the "Full description of the RCA AR88" of great interest to any prospective buyer who has not handled one.

The arrival of the new monthly issue for March 83 has been eagerly awaited and I have not been disappointed. Your method of reviewing the Icom IC-R70 is to my mind just what is needed to hand to a SWL who comes to you for advice as to what to get to improve his/her listening facilities.

Recent listening-in to a multi-way 80m QSO revealed that one Old Timer was buying this very receiver to use as a "separate" because of its excellent performance. I find that sensitivity-wise my "old faithful" solid state Heathkit SB303 amateur bands receiver brings in all I can hear with the 740, maybe because the receiver portion of the transceiver is considered to be at best a compromise. On the other hand an amateur with professional facilities states that he can hear 28.5mcs signals using the same aerial!

I was naturally most interested in Pat Hawker G3VA's "Secrets of Wartime Radio" being also one of Lord Sandhurst's RSS Group Supervisors, particularly to now learn in detail (from the photo on page 15) how and where many (now also venerable) G2s and G6s and G8s spent WW2 whole or part time!

Newcomers to amateur radio should value "New or Used?". Of the 18 dealers (excluding components suppliers) I have used since November 1938 as G3WW I have been extremely lucky to have encountered only ONE with whom I would not do business again; he is no longer in business. CU on SSTV with B/W, colour or 3D.

Richard Thurlow, G3WW,
March, Cambs.

More reader's letters on page 68.

STRAIGHT AND LEVEL

We had a letter last week asking us why this column was called Straight and Level; the guy concerned is an airline pilot and he asked us why we were using flying-type jargon in a radio magazine?

That's an interesting question – basically, we were thinking that this is a sort of newsy feature where we're "straight" with the news and we don't tell any fibs or otherwise cop out of what a news page ought to be. We were also thinking that we're "on the level" with our news! Actually, the title is a hangover from our early days when it was suggested that we ought to have a column like the one in *Flight* magazine which contained all sorts of amusing odds and ends and that column is called Straight and Level – somewhere along the line the idea stuck and we ended up with the same title. The writs haven't poured in from IPC Business Press or whoever publishes *Flight* yet, but we really ought to change the title before some Smart Alec points out that we've nicked their idea.

Witty title

So we've decided to award a year's subscription (of *Amateur Radio*, Brian, not *Flight*) to the person who comes up with the wittiest title for this column. You'll remember that this is the place where the staff of this noble rag put together all the odds and ends of news and views that get heard and where we try and set the record straight about what's what in amateur wireless, so let's hear some good suggestions, folks. Someone in the office suggested Readability Three Strength Two but we didn't care for that, and anyone who comes up with Deep QSB or Scatter or Low Noise will have their feeders ceremonially chopped at dawn! (*What about Random Noise?* – Managing Editor)

We heard that, sir. Anyhow, a free year's worth to the man who comes up with the best title, so let's hear from you. We're always pleased to publish anything interesting, intriguing, scandalous or just slightly odd in these columns, so if you have any incriminating evidence, naughty photographs of strange rituals with antennas on the top of Welsh mountains at dawn,

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

etc, etc, do let's have 'em so that everyone else can share the fun. Any black-and-white pic with a reasonable amount of contrast will do nicely, and we know from our questionnaire that lots of you enjoy the odd spot of photography, so don't keep them to yourself. We'll even pay you some money, dash it all.

One thing we'd love to publish is a list of frequencies used by the MoD's new system in the 432MHz band – not because we want to show how clever we are but because it occurs to us that if we're sharing a band with something it helps to know what frequencies to avoid in any particular area and we certainly are sharing a band with MOLD in some areas of GB. But no-one seems inclined to let us have such a list, although we're convinced that given enough listening around even us lot out in the sticks could put together some sort of list. However, the response we got from various interested parties was a flat no, so regrettably we can't publish anything and indeed we're not sure whether or not we'd be breaking the law if we did. Rumour has it that there are likely to be well over 100 MOLD sites when the system is all complete, or so a Pye press release we saw recently seemed to indicate, but we'll just have to wait and see what happens. We were driving through Maidstone the other week and there was one hell of a big fat carrier on about RB5½ which just had to be MOLD unless someone was messing about – any offers, anyone?

Rally season

Turning to happier things, the rally season is now well under way and indeed we went to the NARSA exhibition a few Sundays ago – gosh, what a change from that awful place at Belle Vue! Lots and lots of traders, and also the RSGB, doing what looked to us like good business at Pontins Holiday Village, and even the weather wasn't too unkind. Most unfortunately we didn't manage to make the RSGB's VHF Convention at Sandown Park this year due to a prior business

arrangement many moons ago, but we gather that it was a good event and that the social evening was rather splendid. The VHF Convention is something we always enjoy and were very sorry to miss this year, especially a couple of the lectures which we were looking forward to – it's a happy and relaxed atmosphere where the dedicated VHF chaps can catch up with all the gossip and buy some good bits.

Repeater jamming

Talking of good bits, we're beginning to hear of more Phase 5 and 6 repeaters coming on the air and indeed we had our first contact through one in the shape of GB3FN down at Farnham in Surrey. Nice, simple logic and reasonable coverage seemed to be available to all comers as we drove through its area, although as we said last time the 432MHz repeater network doesn't seem to be exactly heavily used! Isn't it a pity that GB3SL is still the target for various sorts of boring behaviour, though? Perhaps the new Telecommunications Bill will go part of the way towards solving the problems of repeater jamming, since after all it isn't the repeater group or the RSGB's fault – it's down to the responsible parties to enforce the law as far as we can see.

By the way, many thanks for all your letters – we haven't counted them this month but many thought that Pat Hawker's article in the last-issue-but-one was extremely good, and indeed we gather that many people wrote to Pat direct – you'll be glad to know that he's currently thinking about a follow-up. Angus McKenzie's piece about what you can and can't expect from your dealer also brought in quite a hefty mailbag and all of you approved of what he'd written.

We're also getting a goodly number of technical queries in, so we're going to adopt some ground rules for this. If you write in with a technical query, we'll publish it in the magazine as and when: we can't guarantee when it'll be, because we're getting a good pile, and we'll undertake to answer the question

in print at some time. If you'd like our technical department to solve a specific problem for you we'll need a stamped addressed envelope and we'll undertake to do our best to produce a good solution – we reserve the right to publish the answer unless it's something like a case of breakthrough on your neighbour's VCR and you don't want them to risk seeing your name in print! Whatever you do, please *don't* ask us to deal with technical queries on the phone – now we've gone monthly doing the technical stuff really is a full-time job and we can't ask the folks to come away from some deep project or other to spend half-an-hour on the phone 'cos it isn't fair. So we'll gladly help with technical odds and ends, but by letter only please. Oh, and *don't* ask us to design one-off complicated thingies which would take us the best part of a week, not without enclosing a £50 note anyhow!

Impersonator

What's worse is that we heard of a case a while back where someone tried to impersonate someone else at the RAE, of all things – we don't know all the details but apparently he was rumbled and left in a hurry, as the saying goes (the way we heard it, which was a QSO on 3.5MHz, the man said in a strong Yorkshire accent "Aye, the blighter left in his socks"). If you're reading this, Man In Charge Of City And Guilds, please do something before the amateur licence gets devalued beyond rescue. Passport? Fine, but what if you're under whatever age is for having one of your own? Hmm – let's hope they think up something pretty damn quick. Somebody in the office said they'd rather have an ordinary pirate than someone who got up to the level of getting A.N. Other to impersonate him and I know what he means . . .

Oh well – musn't preach. You'll lose all your readers and get the sack and then thy wife would have no use for thee! Those commandments last time were a laugh, weren't they, and I have them on the wall over my wireless now to quote at the incautious!

Any other little gems? By the time you read this the new RSGB *VHF-UHF Manual* should

be out and indeed we're waiting impatiently for a review copy (heavy hint) so that we can report on how good, or bad, it is. Hopefully it'll be very good, especially now that there is so much activity on the VHF and UHF bands. Someone told Technical Bod on the radio the other day that there were now more Class B licences than Class A, would you believe – we weren't able to get chapter and verse on the figures, but the Home Office confirmed that this was indeed so, although they cautioned us that many Class B chaps take the Morse test and get a Class A so the figures aren't that way for good and all time. But it's jolly interesting all the same, and it means that we'll have to watch our mix of reviews carefully to make sure that there's something for everyone in there somewhere.

Hot off the press

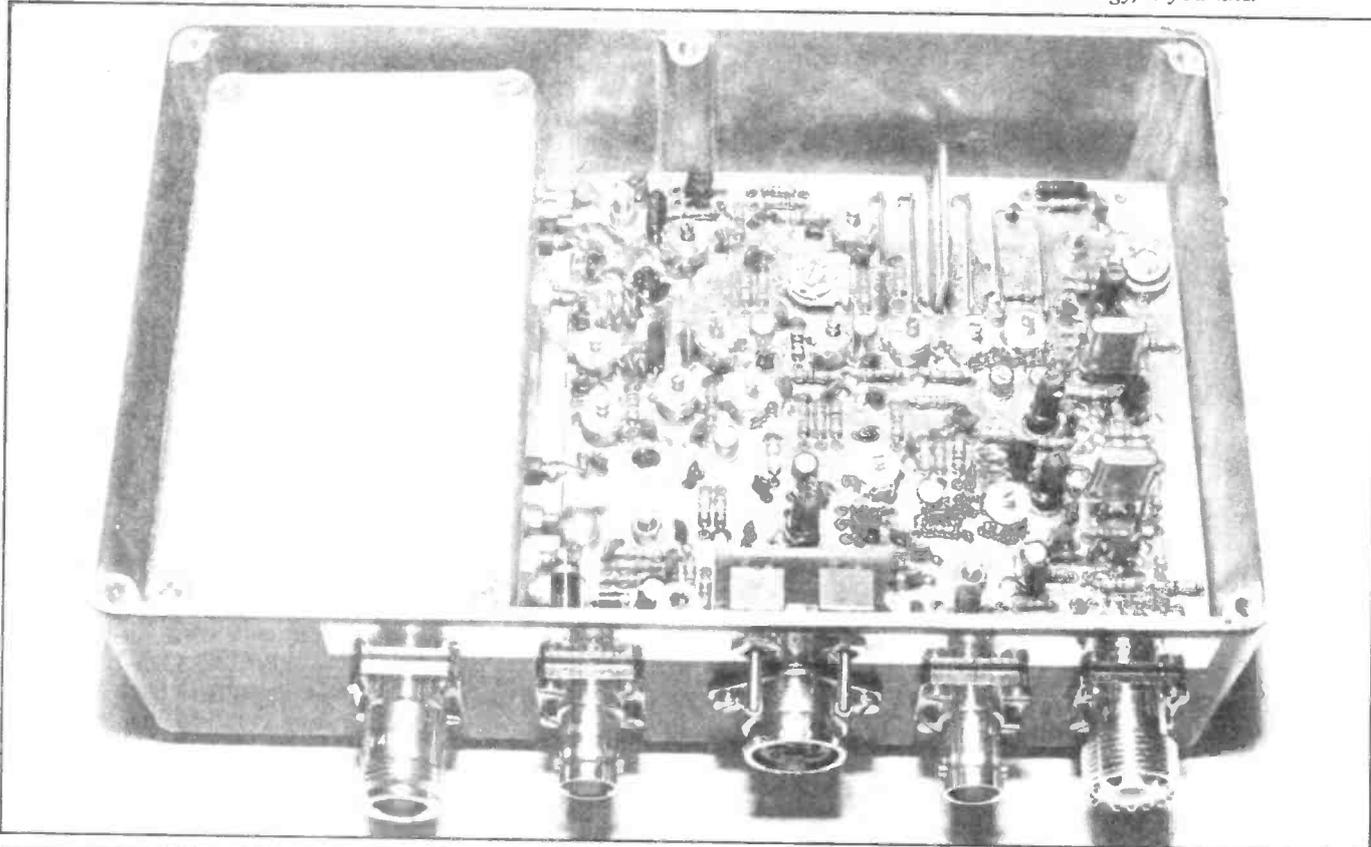
Don't forget, by the way, that you can get *Amateur Radio* on a subscription basis now, so if you want it to come crashing through your letter box more or less hot off the press (that way you get first look at all the juicy morsels in the classifieds!) just fill in the form that's knocking around somewhere in this issue and we'll do the necessary.

We heard a bit of an odd thing on GB2RS a while back, which said that the Home Office had introduced new vetting procedures forthwith (lovely word, that – reminds us of "get out of my house forthwith and don't darken my door again, you scoundrel!") for all candidates who were sitting the amateur Morse test. In future, apparently, all candidates will be required to show a valid passport or produce some other positive means of identification to the examiner's satisfaction. Reading between the lines, we'd deduce that some people have impersonated some other people to take the Morse test for them – and indeed one of the traders we spoke to at the NEC over a pint of rather nice ale said that he'd heard that the going rate for getting someone to do the Morse test for you was a hundred nicker.

If this is true, we're delighted that the Morse test is being tightened up. Given that we're all human and that we're all prone to take the odd inside track when we can, getting someone to impersonate you for a Morse test sounds about as low as you can sink and I shouldn't think I'd enjoy having the callsign if I'd got it that way. Poor people, and well done HO for doing something about it.



Above: Next in our series on classic receivers is an excellent detailed feature on the Collins 75A-4, written by an amateur, for the next issue. Below: We also strip down, peek at, and test the Microwave Modules 432MHz SSB transverter. The alternative to black box technology, if you like.



Well, our comments about Magdeburg Annie and her sundry sisters brought a few interesting letters and telephone calls, including a few from newspaper science correspondents and what not. We also had some cassette tapes sent to the office for us to play with – thank you very much, gentlemen, we'll have a communal listen just as soon as we can and report back.

We have had a few letters asking us where to obtain a guide to all the stations which transmit on the short waves apart from amateurs; well, it's a bit outside our brief but we feel far and away the best guide is something called the *World Radio and TV Handbook*, which covers broadcast stations on long, medium, short and what used to be called ultra-short waves, nowadays referred to as VHF.

You can get this annual publication from all sorts of shops, and the RSGB will sell you one if you happen to be in the vicinity of Potters Bar – the 1983 issue is just out and if you're an avid broadcast band listener as well as an amateur band fan, you're well advised to part with £10.95 and get one.

Now then, propagation predictions for this month. We finally got ourselves sorted out and herewith a little summary of what's going to happen. All sorts of weird and wonderful things start to occur in March because there's a change under way from what are usually called "winter" conditions to "summer" conditions. In practice, this means that if you happen to live in the northern hemisphere there's a marked decline in what a professional user would refer to as the Maximum Usable Frequency, or, in other words, the highest frequency which will get reflected off the F layer one way or another.

Obviously the first band to be affected by this is 28MHz, and it's worst on east-west paths because it's a good rule of thumb that the maximum usable frequency is always lower on an east-west path than on a north-south one. What this means in practice is that you're a lot less likely to hear Stateside stations on 28MHz than you were this time last year or even a month or two ago – a month or two

ago the MUFs were higher than they are now because of the fact that "winter" conditions were in force, and a year or so ago the solar flux levels were a hell of a lot higher than they are now.

Bearing in mind that the maximum usable frequency is more or less a function of how much solar flux there is, the cards are pretty well stacked up against hearing much out of the States or anywhere on an easterly path from the UK for some time to come.

So – to sum up, you can more or less forget hearing, say, Japan or the good ol' US of A on 28MHz because of the fact that (a) the solar flux levels are way down as we start down the wrong side of the sunspot cycle and (b) we're getting into summer conditions anyway, in which the MUFs are lower. However, 28MHz won't be quite dead; remember that north-south paths have higher MUFs than east-west ones and our man reckons there'll still be enough of it about to make points south, such as Africa and maybe South America, audible during daylight on 28MHz.

Come to think of it, we had a contact with a 5N3 station a few days ago round about seven our time, with S9 both ways, so that suggests we're on the right track.

Less spotty

To some extent the same goes for 21MHz; this band has been nothing short of brilliant for the last couple of years but as the old sunspots get less spotty, 21MHz is going to be a lot more patchy and erratic than it has been. The early-morning VKs and ZLs just aren't going to feature in a week or two, unless there's the odd burst of high solar activity, and any Stateside stations you hear aren't going to stay there all day as they were inclined to last year. However, you will find that it tends to stay open longer than 28MHz does – you can forget all about 28MHz after about 8pm at present as far as we can tell, but 21MHz tends to last a bit longer than that especially on a southerly path. It's still a good band to be on

For the short wave listener

because propagation wants to move around a lot and open up to odd places when you're not expecting it to.

However, 14MHz really will be coming into its own in a few weeks. As always, 14MHz carries the bulk of the world's DX traffic and it's open to somewhere or other practically 24 hours of the day. Be prepared for a lot of activity and a lot of pile-ups on 14MHz because as we get down the other side of the sunspot cycle half the amateur world who were having a ball on 28 and 21MHz in the good times come back to their old stamping-ground of 14MHz and the amateur populations swells again.

Absolute chaos

Funnily enough, we were talking to a professional wireless operator the other week and we showed him what a typical amateur DX band, which happened to be 14MHz, sounded like in the middle of the afternoon. He sat listening to it all for ten or fifteen minutes and then just switched off and shook his head in wonder! He was used to nice, orderly channel spacings, reasonably strong signals for his teleprinters and voice channels and a fairly quiet life. Listening to 14MHz, which is the very opposite of practically any of those things, brought forth the remark: "Well, I dunno why you call yourselves amateurs – a lot of my colleagues would be hard put to have any sort of contact under conditions like that, much less have a ten-minute chat like you just did!" So we felt quite pleased with that!

It's true of course, an amateur DX-type HF band is enough to give your average pro sparker an instant cardiac arrest, and he simply wouldn't tolerate such an overcrowded part of the spectrum. Mind you, we don't exactly relish it, and we're looking forward to the day when the wheel comes round full circle and amateurs are given everything below 30MHz because the professionals don't want them any more!!

Before we go on to the lower-frequency bands, we know that we have some CB or ex-CB

readers and it's worth mentioning that the decline in solar flux and the change from summer to winter conditions is the reason why your 27MHz FM isn't likely to find its way to as many exotic places this summer as it did last year. And for anyone out there who still thinks that a monster amplifier is the answer, forget it, friend, all the power in the world won't do anything for you if the ionosphere ain't on your side.

So on we go, and next on our list comes 7MHz. This is a good band right now if you can stand the pace and the rubbish from broadcast stations who have no right whatsoever to be there, and the next few months ought to see all sorts of luscious morsels cropping up on 7MHz at any time between midnight and about 7am. As always, you need a receiver that can handle it because there's no way you'll hear the weak ones if your front-end is suffering from flattening from Radio Bleeding Tirana 40kHz away! But it's a good band and ought to get better this year, so go build a bomb-proof front-end and some good IF filtering and surprise yourself – there really is some superb DX for the asking on 7MHz if you're prepared to work for it and stay up late.

It's even worth having a listen around 5 or 6 in the evening because that's when you'll start hearing the southerly stuff such as Africa, and if it's your lucky day that'll be when you hear the Australians coming through. Yes, it's a great band and much maligned; we'd love to build a really super antenna for 7MHz but the Managing Director wouldn't like it much on account of the occasion we dropped a balun on to the roof of his brand new Granada.

Turning to 3.5MHz, early morning and late at night are good DX times on this band right now and we think it'll get better as the year goes on and things like absorption get less. Here again, you'll need a good antenna and a reasonably good receiver, but the rewards are that you'll hear practically anywhere in the world between about 8pm and 5am. During the day, of course, like MHz, it's mostly inter-G natters with the odd station from the near Continent at no extra charge.

DATONG

New



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Why suffer when you don't have to? Model ANF provides the high-technology answer to tune-up whistles and other heterodyne interference to SSB communications. It also features an excellent 4-pole tunable bandpass filter to make life easier on CW. Connected in series with the receiver's loudspeaker Model ANF continuously searches the audio spectrum for continuous tones. When it finds one it stops the search, locks on, and removes it with a really deep, narrow notch. The filter's centre frequency is shown on a 10 LED bargraph-type display at all times. You can see at a glance the position of the sweep during the search or the approximate frequency of the interference during "lock". The display is also useful when using the auto-assisted manual tuning mode or the CW mode.

A built-in compandor system eliminates the need for careful input level setting. The receiver volume control works exactly as normal yet the auto-notch performance and signal-to-noise ratio remain just as good at any volume setting. Built to truly professional quality standards, Model ANF is available now either direct or via Datong Dealers, price £59 plus VAT (£67.85 total). Send for a free copy of the full data sheet.

COMING SOON

The amazing Datong Automatic Woodpecker Blanker - the star of the recent RSGB show at the NEC.

AUDIO FILTERS MODELS FL2, FL3, FL2/A

Model FL3 represents the ultimate in audio filters for SSB and CW. Connected in series with the loudspeaker, it gives variable extra selectivity better than a whole bank of expensive crystal filters. In addition it contains an automatic notch filter which can remove a "tuner-upper" all by itself.

Model FL2 is exactly the same but without the auto-notch.

Any existing or new FL2 can be up-graded to an FL3 by adding Model FL2/A conversion kit, which is a fully tested auto-notch module in P.C.B. Form. Datong filters frequently allow continued copy when otherwise a QSO would have to be abandoned.

Prices: FL2 £78.00 with VAT £89.70, FL3 £112.50 with VAT £129.37, FL2/A £34.00 with VAT £39.67



GENERAL COVERAGE RECEIVER CONVERTER MODEL PC1

Once upon a time it was the norm to use a ten metre receiver to receive the two metre band. Now, large numbers of special purpose two metre SSB rigs are in use and conversion the other way becomes a very attractive possibility.

With the addition of Model PC1 each of these two metre SSB rigs becomes a really good general coverage receiver (from 50 kHz to 30MHz!). Two metre SSB rigs are not cheap and it makes good sense to get the most out of them. They also tend to have very good performance in terms of sensitivity, selectivity, and big signal handling. Each of these features is just as vital for short wave reception and Model PC1 is designed not to degrade them at all. The result, your two metre SSB rig receives below 30 MHz as well as it receives on two metres. And compared to many medium cost general coverage sets, that is saying a lot!

Try this test. Listen on twenty metres after the band goes dead in the evening. With many general coverage receivers the band never dies. It remains populated with phantoms generated by the receiver from the many very strong signals on forty metres. This is the kind of effect that the higher quality receivers minimise, and that goes for PC1 plus a good two metre rig. Reviews: Rad. Com., April 1982.

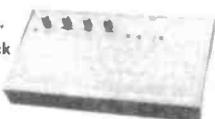
PC-1 £119.50 with VAT £137.42



MODEL PC1

KEYBOARD MORSE SENDER THE ULTIMATE "MORSE KEY"

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- **COMPREHENSIVE CHARACTER SET:** includes punctuation, procedure signals, accented letters. Plus a "merge" key for making any non-standard character. **BEAUTY AND STYLE:** only one inch thin and with four-colour panel Model MK
- looks every bit the thoroughbred it is. Model MK is supplied with output leads and spare connectors but without batteries (four HP7 pen cells).



COMPACT RECEIVING ANTENNAS MODELS AD270/370

Datong Active Antennas solve the age-old problem of finding space for a 'good' receiving aerial. Model AD370 mounted on a roof top or Model AD270 in a loft will give similar sensitivity to much larger conventional aerials yet are only 2 1/2 and 3 metres long respectively. Moreover they do not suffer from interference picked up by the feeder cable: such pick-up can be a problem with conventional dipoles because it is hard to maintain an good balance over a band of frequencies.

Although active antennas were introduced to the amateur market by Datong only a few years ago they have long been used by military and commercial receiving stations. The performance specifications achieved by the Datong AD270/370 are very close to those of "professional" active antennas selling for ten times the price - a point which is not lost on our many professional customers. The advanced design ensures two things: that you don't miss signals through inadequate sensitivity and that the antenna does not invent signals which are not there. Datong Active Antennas represent an advanced solution to a common problem and so far as we know have no serious competition in terms of performance at the price. (Reviewed in Rad. Com., June 1982).

AD270 £41.00 with VAT £47.15 AD370 £56.00 with VAT £64.40



MODEL AD370



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All prices include delivery in U.K. basic prices in £ are shown with VAT inclusive prices in brackets

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FL2/A	34.00	(39.67)	AD270+MPU	45.00	(51.75)	(Linked)	28.00 (32.20)
FL1	69.00	(79.35)	AD370+MPU	60.00	(69.00)	Codecall	
FL2	78.00	(89.70)	MPU	6.00	(6.90)	(Switched)	29.50 (33.92)
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ASP	72.00	(82.80)	DC144/28	28.00	(32.20)	Basic Mobile	
VLF	26.00	(29.90)	Module			DF System	159.00 (182.85)
D70	49.00	(56.35)	Keyboard Morse	119.50	(137.42)	Complete Mobile DF	
D75	49.00	(56.35)	Sender			System	214.00 (246.10)
RFC/M	26.00	(29.90)	RFA	29.50	(33.92)	PTS1	39.99 (45.99)
AD270	41.00	(47.15)				Model ANF	59.00 (67.85)

Data sheets on any products available free on request -

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NEC EXHIBITIONISM

Billed as the successor to the annual Alexandra Palace event, this year's National Amateur Radio Exhibition and Convention took place at the very adventurous venue of the NEC in Birmingham.

When the RSGB announced to the trade that the old brigade had been in too long and that the Ally Pally Rally was about to be dragged kicking and screaming into the twentieth century, there was a good deal of tooth-sucking amongst the trade – would it cost a bomb? Would anyone bother to turn up? Would it be the most disastrous flop since Napoleon went to Waterloo?

Well, it really wasn't so bad at all, as *Amateur Radio* found out when we made the trek into the hinterland of Darkest Birmingham from swinging Bicester: it took us about an hour, which considering it was some unearthly hour of the day and we'd been up till two the morning before trying to get a 432MHz linear to behave itself, wasn't bad going. It does help if you remember to sort out the neutralising BEFORE you switch on, doesn't it?

Anyhow, we managed to park the car not a million miles away from Hall 6 – well, it *felt* like a million miles, but it was actually only a few hundred yards and there was even a free bus service. This has got to be better than the Ally Pally affair ever was: we can remember thinking as we plodded up that enormous hill after parking our car in Wood Green that the RSGB must lose three or four senior members each year from coronaries.

The entrance to Hall 6 had a large illuminated poster over the door saying Radio Society of Great Britain in large letters, which was a nice

**Chris Drake visited the NEC for
this year's National Amateur
Radio Exhibition and Convention.
This is a round-up of what he saw,
photographed, and discovered was new.**

change. When we got there, the queue was only about forty bodies long, but by 9.30 it had swelled out of sight round the back of the road and by about 10 to 10 someone said that it was practically back to the motorway! There were some moans about that, but what do you expect if you got there that early?

First impression was of a large hall, a bit on the gloomy side but not in the same league as the Gothic mausoleum of the old Ally Pally. All the stands had been built in some sort of modular manner, which at least looked nice and neat – apparently it was the same stand contractor who did last year's event at that Big Tent On The Hill, so no wonder we had a feeling of *deja vu!* Hall 6A was a sort of little rally-within-a-rally, consisting of traders with a number of tables, and when we first looked in it seemed fairly empty. We thought that a few more traders could have been got in without too much trouble, but in fact later on in the morning this impression was speedily reversed. That little hall was absolutely packed with people, and it took about half an hour to squeeze a way round – any attempt at assessing what was on show was doomed to failure, because it wasn't possible to see anything remotely resembling a stand, let alone anything that looked at all



The exhibition was a treasure corner for thousands of visitors. You could spend hours lurking over the trays of goodies, and things you didn't have a clue about! There were several stands with arrays of trays like this, specialising in TV, computer, general radio, antennae, test equipment and the like. Well worth a visit next year.



Photographer Drake waited patiently in the queue to take a good picture, but even after five minutes all he got was a view over peoples' shoulders!

like electronic components! That had to wait until a bit later on.

So, having had a quick look at Hall 6A we kicked off with a wander round the main hall. First stop was the RSGB stand, which was just opposite the door – they were doing a roaring trade, with people about six deep at the stand and books and money changing hands at a great rate of knots. At one point, there were so many people there that we thought the counter of the stand was about to cave in, and there was a bit of speedy rebuilding and reinforcing to be seen later in the day. Many chaps wanted ID cards, and there was a fair old queue for those.

Next stop, next door, was **Lowe Electronics**. As usual they were showing Trio products and it was interesting to look at the new TS-430 in the flesh – it looks a nice radio and we'll try and do a review on one shortly. Lowe do some other goodies, however, and they have a

nice line in scanning radios and small monitors for 144MHz and aviation-type

bands. They're always happy to talk over your needs and flog you things and they've been in the game for years.

Next in line was the Birmingham firm of **Amateur Electronics UK**, who had a huge stand that looked as though it was all counter. They were delighted with the NEC, although of course it wasn't far to come from Alum Rock – they even said that they'd asked for exactly the same pitch next year! AE-UK are principally Yaesu dealers, and we spent some time looking at the new FT-726R, you know, the one we mentioned in Shoptalk and hadn't seen a picture of. Basically it's a mainframe 144MHz all-mode machine with optional plug-ins for 50

and 432MHz – we were impressed with all the facilities, which struck us as being much more on a par with what you get on an HF band transceiver instead of something for the other

Amateur Electronics UK had a huge stand that looked as though it was all counter

bands. It's certainly a big, capable radio but it ain't exactly cheap – however, if you absolutely insist on having every known facility on the VHF and UHF bands in one box instead of doing it via transverters and lots of cables, the FT-726R looks like a viable way to go. We overheard one visitor say to another: "Well, if that isn't the ultimate black box I dunno what is".

M & B Radio was the next port of call; they had a mouthwatering display of test gear and receivers and what-have-you, mostly Government surplus and all rather nice. We could have got rid of a good part of the office petty cash at this stand but we did restrain ourselves and we

won't have to put up the cover price next month... If you want solid ex-Government things of the kind that every self-respecting amateur had twenty years ago, **M & B** and **John's Radio** are stands you mustn't miss at any rally.

The other stand most definitely not to be missed was that of **R. J. Finch**. This outfit have all sorts of beautiful things, mostly from the Racal stable, most in lovely condition and all highly tempting – there are RA17s and later bretheren cheek-by-jowl with transmitter synthesisers, panadaptors and the Lord knows what, as well as all sorts of components and bits which are just the thing for antennas or big linears. They're a great place to go if you need things like ceramic standoffs and coaxial relays, and they do a nice line in high-grade RF connectors as well. All in all, R. J. Finch was the stand we spent most time at, and it's fatal to go anywhere near it with money in your pocket – have the XYL or someone else with a strong mind and not the slightest interest in amateur radio on hand to drag you away because otherwise you're likely to have some explaining to do to your bank manager...

Practical Wireless and **Radio and Electronics World** were at the show and selling various items; it's always nice to meet the opposition and have a friendly chat, although **Ham Radio Today** weren't there for some reason. They were booked to come but they didn't show up, which was a pity. Oh, and if any Clever Dick asks why we weren't there on a stand, dispensing goodwill and back numbers, the short answer is staff and cash.

We paid a call on **Mutek**, who were selling their high-grade

NEC EXHIBITIONISM

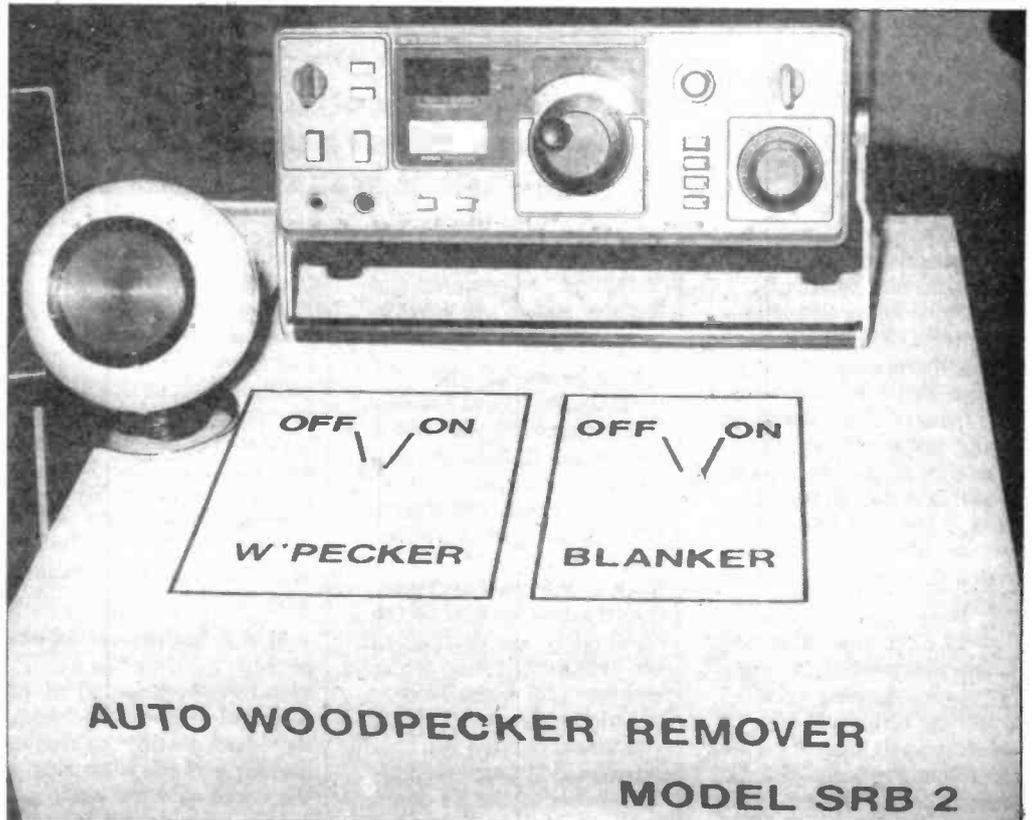
add-ons, and spoke to Chris Bartram – business is booming, he said, and they have a lot of even nicer things in the pipeline. Mutek have a reputation for good RF design, and their replacement boards for the IC211/251 and the FT225 series must have helped win a contest or two in their time.

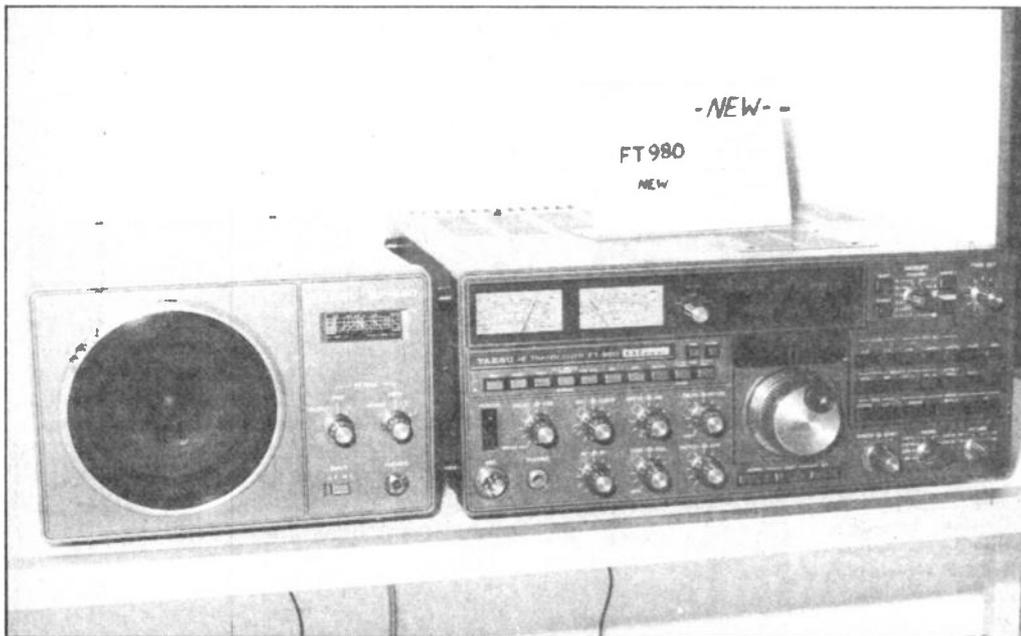
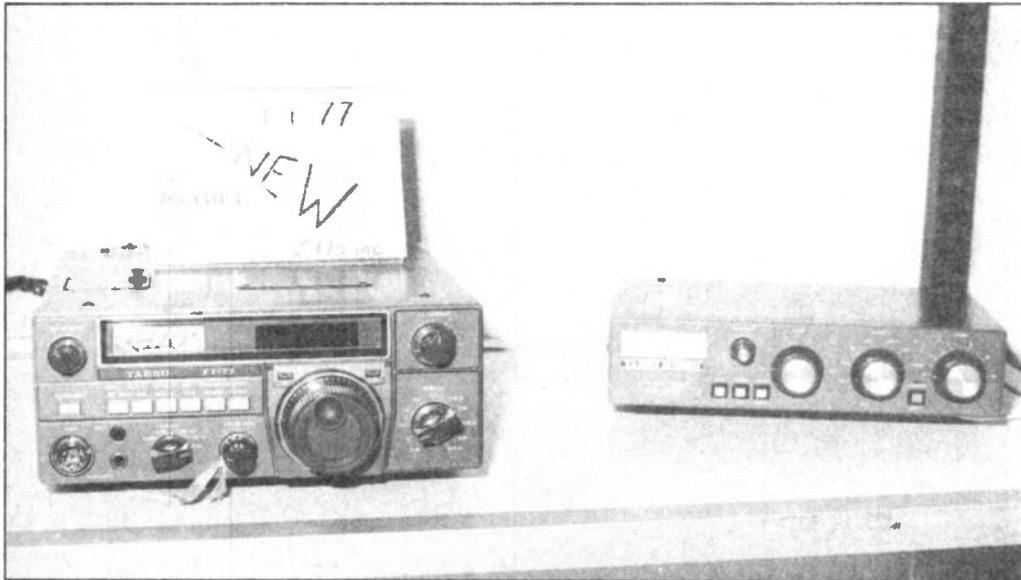
Transformers selling for a fraction of what someone must have once paid for them

It was good to see some of the RSGB's committees out in force, and they had stands of their own where you could pop in and see the state of play. We also spent a fascinating half-hour or so on the BARTG stand and hearing about what was new in the teleprinting world. Apparently the chap who used to compile the GB2ATG teleprinter news bulletin has had to quit, which is sad – it must be a chore producing those teleprinter tapes. Some modern teleprinters now are really in the jet-age though, and if your vision of RTTY is that of old Creed 7Bs clanking away and upsetting the XYL, the neighbours and the family hound, times have changed – keyboards and VDUs have changed all that.

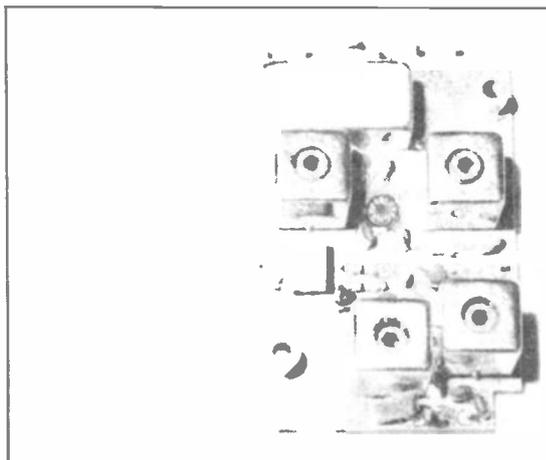
The world of amateur television is alive and well, and the **British Amateur Television Club** is alive and well and publishing all sorts of things aimed at getting the newcomer on the air with the minimum of fuss. We're to do an article on this soon.

Just over the road was the **Datong** stand, with a very clever device in the shape of a Woodpecker-killer on show.





Left above: An all-singing, all-dancing decoder for Morse, RTTY and ASCII, and it will send ditto for you at the push of a button or two. Seen at the H. Lexton stand among the goodies. Left: Clever device for zapping the woodpecker. The ammunition comes from Datong – and it works well. This page, top: The new FT77 HF mobile from Yaesu, which replaces the FT7B. Above: Also brand new, the FT980 which falls between the FT1 and FT902, near the top of the range. Seen here with matching speakers plus interesting filters. Right: From Mutek, the low noise, high dynamic range pre-amp for 2m.



This was being demonstrated with the aid of a gated signal generator, and it certainly seemed to work well. There was such a crush at this stand that we weren't able to get some better details, like how it worked and how much it cost, and we never did get back to them – so we'll have to do some research for the next issue.

Mutek boards have helped win a contest or two in their time

Later on it was possible to get into Hall 6A without being choked to death, and we started a good look round. The idea of Hall 6A was rather like the American "flea market" where you can have the big guys on their elaborate stands selling megabuck radios, and the little guys selling bits and pieces off trestle tables. Hall 6A was a real treasure trove for those who still like building instead of just buying, and there were some components there that were of superb quality. **Samsons** had a range of transformers that looked as though they had come from Admiralty or Ministry sources; they were beautiful, and they were selling for a fraction of what someone must once have paid for them. They also had a nice range of electrolytics, a as well as odds and ends like monitors. **Birketts** were there, with all sorts of goodies, and indeed two or three traders were selling some prime components for a song. High-grade semiconductors seemed to be very common, and indeed we laid in quite a lot of them for some future projects; one

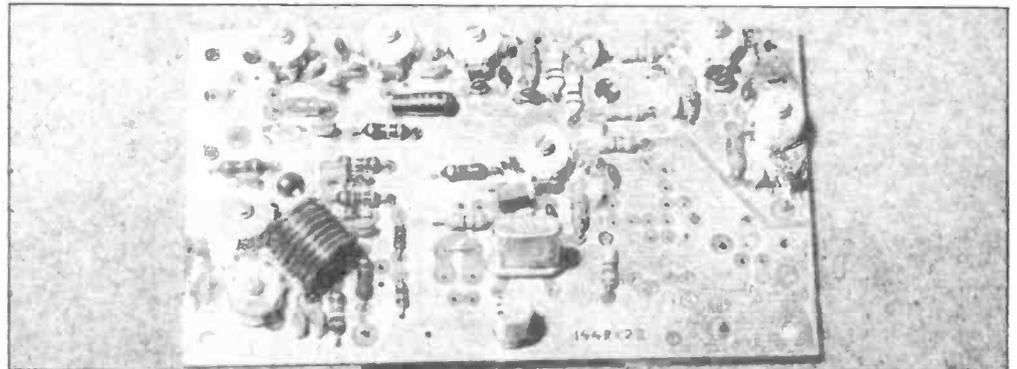
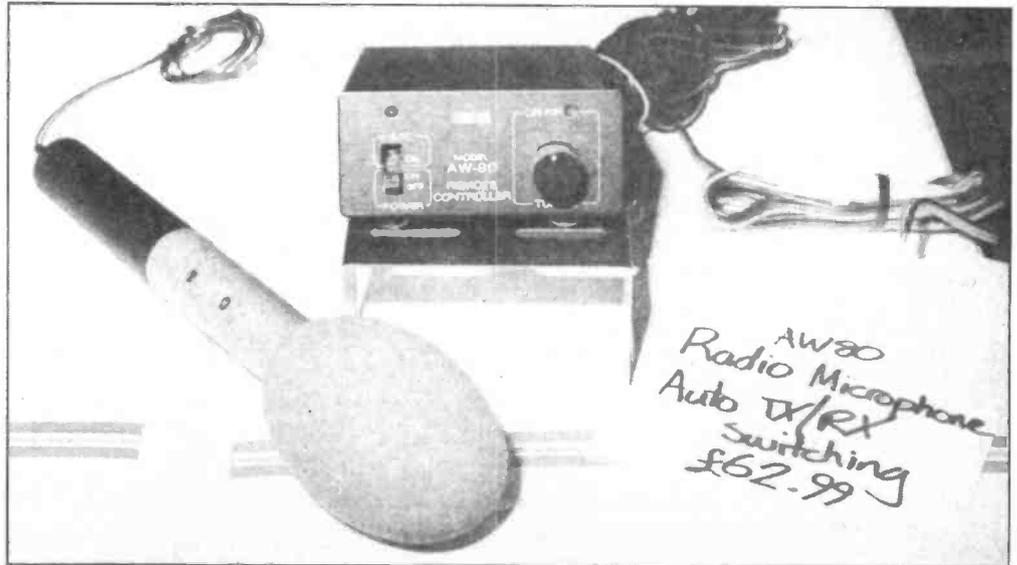
NEC EXHIBITIONISM

stand was doing a good trade in valves, too!

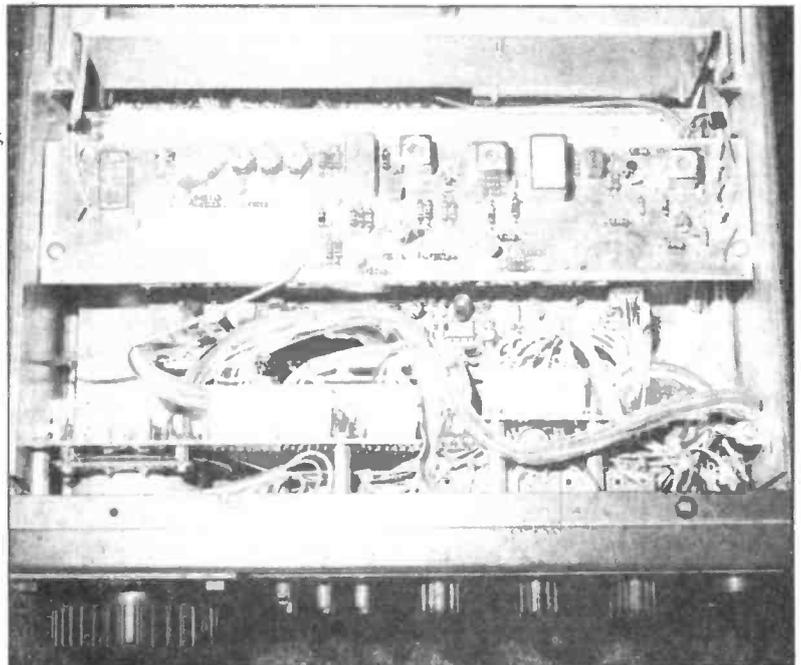
All in all, then, it looks as though the RSGB did a good thing in moving. We didn't get to any of the lectures which were on, and we only caught a brief glimpse of the Lord Mayor doing his official opening, so we didn't see it all by any means, but it looked good to us. The trade seemed to think so as well, and most told us they'd be keen to come next year. Whether this casts a shadow over the future of the Leicester show is now a big question; we heard a lot of people say that Leicester was long past its best and that the time had come for two big shows a year, possibly at the NEC or maybe elsewhere. But the general feeling was that the NEC was pretty good.

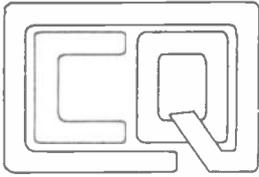
The only moans we heard was that the catering was awful (which it was – it wasn't that it was terrible but it was bloody expensive and we had to queue for hours and hours to get it), it was a bit hot and there should have been some facilities for exhibitors to have their own refreshments. Some moaned about having to walk a fair way from their cars, but at least the car parking was free and the NEC officials we spoke to were very friendly and helpful unlike the sourpusses at Ally Pally!

So, we feel that the NEC is the place now, and apparently something over 5,000 people on the Saturday thought so too. And it's so nice to see a bit of a balance between the black-box seller and the grass-roots components man instead of an exhibition full of gleaming commercial gear; good to see a rally for the home-brew addict as well as the commercial-equipment user. Roll on next year.



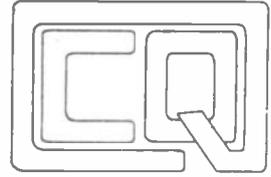
Top: Interesting microphone for base and mobile use. Just the thing for a noisy car? Above: Convolver from 50MHz to 144MHz, receive only. Right: Very impressive front end board for the Icom 251E, from Mutek. See our review next month!





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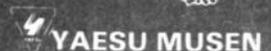


Derek G3 TGE
Roy G3 TLF
Kerry G6 IZF

Photo Acoustics Ltd



OF NEWPORT PAGNELL



SHOP TALK

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.

First off the pile this month is a new gadget from Mr Datong, or actually Doctor D.A. Tong as he really is, from Leeds. You'll remember we had a look at his clever Morse keyboard a while ago. Actually, it was only last month – funny how working on a magazine causes you to lose all sense of time, isn't it? (Or did you just mean all sense? – *Managing Ed.*)

Anyway, the latest offering from Spence Mills goes by the name of the PTS-1 Tone Squelch System and it's basically a variant of a commercial device known for years as Selcal – Technical Bod remembers it well and shudders every time he hears the word since he used to service gear like it years and years ago and it used to give him no end of aggravation. Selcal is in essence a way of sharing a fixed frequency between several users without them being able to overhear each other; basically you have a gadget in the receiver that's hooked into its squelch or muting in such a way that a tone or a combination of tones have to be sent before the receiver unmutes and you can hear anything.

Even if you're sharing a channel with half-a-dozen other users, you'll still only be able to hear the transmitter that's associated with your receiver. Obviously only one transmitter can use the frequency at once, but it does

mean that you can sit in blissful silence and get on with something else until a message aimed specifically at you pops up.

The Datong system does much the same. Essentially it adds one of sixty-four different audio tones between 1747 and 2330Hz to the output of your wireless on "transmit" and listens for same on "receive" and you can select whichever tone you fancy with some natty little dual in-line switches in the base of the unit. So if there's a group of you, it's pretty unlikely that another group on the same frequency will be using the same tone.

So the PTS-1 on "receive" sits there and mutes the receiver – actually, since it has its own audio output stage, it does it all without having to break into the rig and get at the squelch or the muting or what-have-you. If the correct tone isn't there the receiver just slumbers on the table and you can get on with whatever it is you're doing but if a transmission

Front and rear views of Datong's other new product – an auto-notch filter which we'll test soon.



comes up with the right access tone the receiver unmutes and up comes the man you want to hear. As soon as he's finished the squelch closes again, so you'll never hear a thing unless it's someone you want to talk to.

Apparently the Datong device sends the tone at a level which is just audible on a normal rig, and indeed it'll detect it in the presence of large amounts of noise. Then at the receiving end the tone gets filtered out, so all you hear is normal speech.

Dead clever, we thought, but we're not sure whether it'll become a feature of every amateur station in the country! It seems to us that the system is only usable on FM and AM transmissions since the smallest amount of mistuning on SSB and bang goes the correct tone frequency – let's face it, you can't tune in an SSB receiver exactly to an SSB transmitter and hold it there unless there's some sort of pilot-carrier system in use, so the PTS-1 can't be used with an SSB rig. However, we can see that it might be handy for Raynet groups and so on, or a group of friends who want to stay in touch on a commonly used channel. Mind you, we tend to find that if one particular gang want to stay in touch, they

Your Sinclair Spectrum can produce all sorts of natty sound effects with this box – maybe you could even have whole QSOs with it while you're out with the YL...

tend to pick some fairly outlandish frequency which Joe Average Amateur wouldn't use in a million years and sit with squelched receivers parked on it.

We'd imagine that the PTS-1 would find a lot of use for FM CB, and reading between the lines of the press release this would seem to be the market that the lads and lassies at Spence Mills are aiming for. But there are, no doubt, some applications for it on the amateur wireless waves. Contact Datong Electronics Ltd at Spence Mills, Bramley, Leeds LS13 3HE or call them on Leeds 552461.

There are more new wireesses in our report on the NEC exhibition, so turn to there if you want some details. There's another new Datong product which is designed to deal with the Russian Woodpecker thing, and we hope to have a closer look at that in an issue or three.

If you're an avid computer user who owns a ZX81 or a Spectrum (as far as we can see, every household in the

country has 2.4 of the things) you might be interested in a new goodie from Bi-Pak Semiconductors. It's a sound-effects device from which you can derive three channels of sound plus some noise and you can control pitch, volume and the overall attack and decay envelope, and it goes by the name of the ZON-X; apparently you can use it with an adaptor and then it plus a Sinclair Spectrum can produce unlimited sound effects. Well, whatever turns you on . . . have a word with Bi-Pak Semiconductors at PO Box 6, Ware, Herts or telephone Ware 3442 or 3182 for more details. The thing costs £25.95 and the Spectrum adaptor is £6.80.

Here's a good gadget for mobile operators; it's called the Monolock and it's basically a way of allowing you to keep both hands on the wheel whilst operating mobile. It consists of a unit holding a send and receive gear lever. A lead taken from this box via a quick-release plug and socket goes to an electret condenser mike sitting on your lapel or whatever your sartorial fancy is. There's an inbuilt timer which takes you off transmit if you talk for longer than four minutes, which you have to reset manually with a switch, and there's an internal preamp with an adjustable gain control so that you can use whatever microphone takes your fancy.

Quite a natty idea, we thought, although we haven't seen one in the flesh, so to speak, so we can't comment on how it pans out in practice and you could, after all, build one yourself and save £31 plus postage and packing. However, if you're interested speak to Messrs Automatic Safety Lighting Ltd at 311 Lidgett Lane, Leeds 17.

The same outfit also sent us a press release all about some long-life electric lamp bulbs which looked quite interesting - they claim a

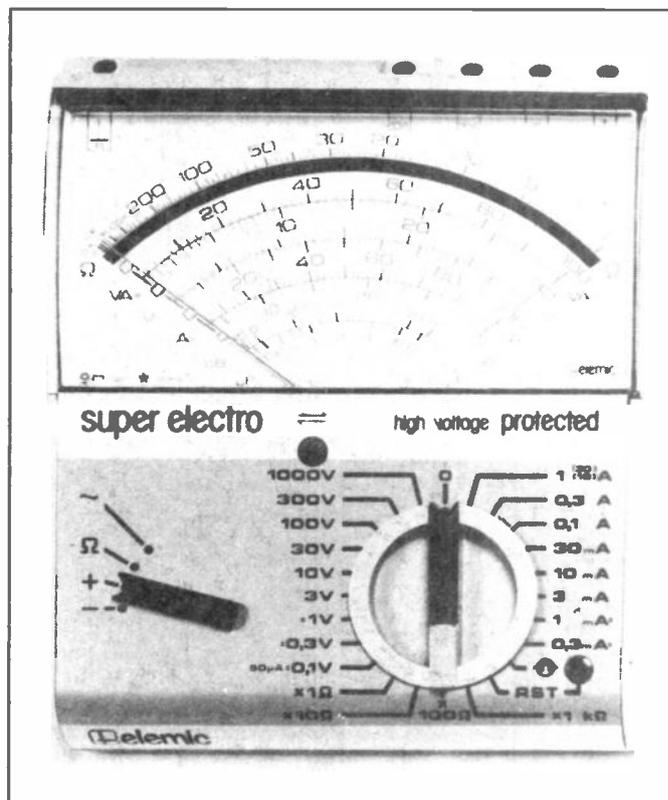
guaranteed average life of 2,500 hours under normal working conditions. They're called the Pluslife range, so if you need this sort of thing contact Moortown Electrics at the same address as above.

Can we at this point make an appeal to all those in the radio, electronics or what-have-you business? We'd love to see as many press releases as possible so that we can show radio amateurs what you've got on offer, but it's very rare that we actually get much information on actual rig-type hardware; we get reams and stacks of stuff about intelligent CRT controllers and single-chip DTMF receivers and the Lord only knows what which we hesitate to publish because we don't know whether Joe Average Amateur is interested in them, whereas the day we get anything about the latest Trio or Yaesu or Standard or Icom or some equivalent I think I'll die of shock. We honestly don't have time to spend a day solemnly ringing round all our advertisers to find out what's new, but we'd love to hear from you if you've got it.

A press release all about a rather natty-looking multimeter plopped onto the Editorial desk last week. It's from Black Star Ltd, who import things from well-known names like Sabtronics and Elemic, and the multimeter is from the latter stable. It's called the "Super Electro" and it's said to have 57 ranges and to offer protection against 50kV (!) on all ranges.

It'll measure AC and DC up to 1kV and AC and DC current up to 30 amps, as well as resistance and capacitance. The blurb also says that it has phase sequence detection for three phase systems and a mains and insulation tester. It has a sensitivity of 20K per volt and an accuracy of 1.5% of FSD.

It looks a good buy for £39.95 plus VAT, although



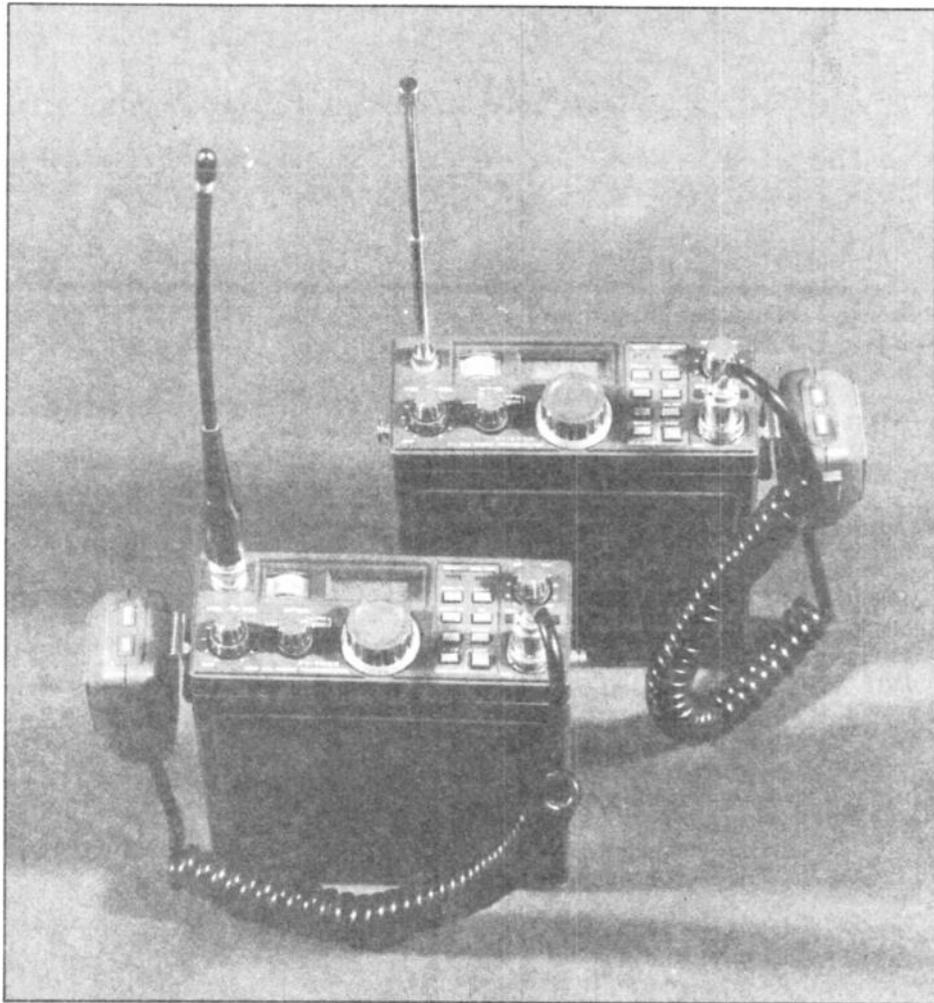
The Super Electro multimeter. DVMs and whatnot are all very well but yer actual analogue multimeter still rules OK for many things around the shack.

we'd love to know how they give it high voltage protection up to 50,000 volts (that really is one hell of a lot of volts). Anyway, you can obtain further details form Black Star Ltd, 9a Crown Street, St Ives, Huntingdon PE17 4EB, or you can ring them on 0480 62440.

Might be worth mentioning at this point that there's still plenty room for ye olde analogue multimeter despite all the hi-tech digital things you can get these days for next to nothing. We've used the old AVO for years and years and for some purposes - like watching how a voltage is changing - you can't beat them. It's true, however, that you couldn't measure, say, 800 volts to an accuracy of plus or minus 0.001 of a volt with an AVO, or any other analogue-type moving-coil meter, but is isn't often you

need to do that sort of thing!

And lastly, we gather that there's a new edition of the *Guide to Amateur Radio* (the 19th edition, yet) now available from the RSGB. They tell us that it's an expanded edition of the last one and has 160 pages; we like the last one and usually end up recommending it, together with the *RAE Manual*, to those who enquire of us how and why to get started in amateur radio. It'll rush you £3.44 if you're not a member of the RSGB, and £3.09 if you are, and although we haven't seen one yet (hint) we'd have no hesitation in recommending it to the new comer to the hobby. The RSGB live at Alma House, Cranborne Road, Potters Bar, Herts. EN6 3JW, or they're available on Potters Bar 59015. Their opening hours for selling things over the counter are from 10 to 4 and be warned - there are two very dishy ladies behind the counter these days so mind you don't end up buying all their stock by mistake.



TWO TOP MULTIMODES TESTED

Angus McKenzie, G3OSS, compares two popular and efficient portable multimodes from the Yaesu stable.



Comparison prices

<i>FT290R</i>	£265.00
<i>FT790R</i>	£325.00

Accessories:

<i>Mobile mount</i>	£22.25
<i>Soft case</i>	£3.45
<i>Linear amp (2m 10w)</i>	£51.00
<i>Linear amp (70cm)</i>	£91.00
<i>Slow charger</i>	£8.80
<i>Ni-Cad 2.0 a/hr C</i>	£2.35

(All prices include VAT at 15%)

Both these multimode rigs have achieved important distinction, mainly because they are the first available portable multimodes for their respective bands. The FT290 originally appeared in 1981, and soon established itself as a useful rig covering the upper and lower SSB, CW and FM. The FT790, being near-identical in many ways, also covers the complete 70cm band, from 430 to 440MHz.

The two rigs have almost identical facilities, and both can be fitted with nicads. Various alternative chargers can be purchased for use with the rigs, either working from mains or in the car. So let's concentrate on the FT290 first of all; it has a pull out ¼ wave whip on the top fascia.

Lots of knobs

Whilst underneath the rig there is an SO239 UHF socket for connecting an external linear or 50 Ohm antenna. All major controls are on the main fascia and include receive audio gain/ on/off switch, concentrically mounted with a squelch control (FM only), together with a six-position mode switch for CW, USB, LSB, FM simplex and both up and down repeater shifts. A 12-position switch selects any of 10 built-in memories, two additional positions switching on the memory scan mode. The tuning knob has

50 click steps per revolution, and operates very smoothly indeed with no trace of sponginess, the steps being switchable between 100Hz and 1kHz for CW and SSB, and 12.5kHz and 25kHz for FM, which is just how I like it.

There are two VFOs available, selection being on another button, whilst yet more buttons give memory set and recall, priority auto switching, 1750Hz/TX call, and VFO split. A clarify button provides up to 10kHz shift on receive only, with fixed TX using the main VFO, this operating in 100Hz steps only, for all modes.

“... many of us cannot stand using VOX-controlled sensing on SSB”

On the back of the rig are three switches, one selecting high or low power, another a noise blanker on/off whilst the third has three positions for selecting battery check, lamps on (most useful) or normal. Two small sockets provide inputs for trickle charging or external DC input, up to 13.8 volts being permissible. On one side of the rig are two further sockets, one for eight Ohm external loud speaker whilst the other is in parallel with the PTT

FIVE HAND-HELDS TESTED

Due to a mysterious error, we missed out a section of Angus McKenzie's report on the Yaesu FT208R. Now, if you connect this copy up to the beginning of Page 20 in the April issue, you should have it all...

This rig can have frequency selected by using the numerical pad (25 or 12½kHz up or down steps), by using various scan functions and stopping when required, or by accessing any one of the ten memories. Scanning either the whole band up to 148MHz or any required section is possible, it also being possible to programme in a band chunk which one does not want to scan! A lithium battery is built in for switchable memory retention when the rig is switched off, the battery having a claimed life of around five years, which allows the rig to switch on, always on the

frequency last used before turning off. In addition to the basic pad provisions, switched select key lock on/off (this locks the key board, which is most useful), scanning manual/clear or busy channels, and 12½/25kHz steps. Tone burst is built into the PTT lever on the side, and this was liked, although I prefer switchable auto tone burst. On the 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.

line. Why on earth the latter could not have been a small relay controlled short on TX and open on RX socket to drive external linears/transverters is a mystery, and I wish Japanese manufacturers would realise that many of us cannot stand using vox controlled RF sensing circuits on SSB. Personally, I can't stand hearing overs such as the following "EQ - EQ 00 etres, E3 OSS alling", ie with all the beginnings of words chopped off. A 3.5mm jack socket is provided for interconnecting a Morse key.

Scanning, stopping and starting

Inside the rig are yet more switches selecting memory backup on/off (enables all memories including last dial position to be retained when rig is switched off), and scanning for busy or clear channels or manual scanning. When the scanning switch is on busy/clear positions the synthesizer remains on a "found" channel for five seconds before resuming scan, a touch of the scan up or down or PTT buttons on the microphone stopping the scan, which is started again by holding down the scan buttons for at least half a second. A third switch selects a tone squelch facility which is an optional accessory, not suitable for the UK market. The rig weighs 2.1kg and measures 160x60x215mm.

Ergonomics and things

Although many points in ergonomics are a matter of opinion, I have to judge ease of use of hi-fi and all other types of electronic equipment for many years and I am fairly used to questioning people about ergonomics in an attempt to find important common factors. The FT290 is obviously popular because it offers remarkably good facilities for all modes except AM, but of course there have to be some compromises. My own FT290 was about as deaf as a door post, but we improved its sensitivity by nearly 6dB by careful tweaking in the lab, to about the same sensitivity as the review sample. As supplied, the rig does not have auto tone burst for repeater use, nor does it have reverse repeater, but SMC can supply auto tone burst and also a listen on input facility when the "call" button is depressed for no extra charge if this is specified before purchase.



There did not seem to be quite enough volume available from the internal loudspeaker either on SSB or FM for other than fairly private use of the rig, and under mobile conditions it was most definitely not loud enough without distortion, especially for passengers in the back. SSB transmitted quality seemed generally good, provided that the rig was not being amplified by an inappropriate linear. The reproduced audio from the speaker tends to be slightly muffled but not too badly so; the quality on FM is not as good as on the FT208 or any of the Trio rigs. I found that the 100Hz steps on SSB were just about adequate for normal use, but on long overs I have always felt a little jumpy if someone's transmission is perhaps 50Hz off frequency which cannot be corrected. It is a great pity that the receiver incremental tuning (clarifier) does not have much smaller steps than 100Hz, and a separate pot would have been welcome if it could have had continuous variation. The S meter is only graduated at one, five and nine, and seemed fairly poor, the same meter being used to give power out and battery indication.

"All the special functions worked well, and scanning was particularly good . . ."

The rig seems fairly lively on receive, but on FM all the 2m hand-helds reviewed last month seemed slightly more sensitive. Selectivity was easily good enough for normal use, but radio frequency IM performance on receive was only fair when the rig was used on an outside aerial. The large battery capacity enables the rig to be used for quite a long time without recharging, although the current drawn with the receiver squelched was rather high. On SSB, the noise blanker worked just moderately well, and there seemed to be a lack of front end and IF gain so that weak signals required the volume control to be fairly well advanced, whilst a strong one interrupting would nearly blow my head off, with distortion! All the special functions worked well, and scanning was particularly good on FM, but nowhere near fast enough on SSB unless the 1kHz steps were chosen, in which case a signal could be missed.

Results analysis

The review sample did not measure at all well for front end sensitivity; it was distinctly worse than the IC202S SSB portable, and most FM portables. My own one had been worse still as originally delivered, but ended up to be better than the review sample after tweaking, and improving by a further 4dB when the Mutek front end modification had been fitted. This small pre-amp board, complete with relay and gain preset, takes approximately one hour to install if you know what you are doing, including adjustment time, although of course it would be faster once you have done your first one! This modification is available from Mutek direct in Devon and is very worthwhile if you are using the FT290 for portable or mobile use, but RFIM is of course worse and so fixed station use in heavily populated areas will not be so appropriate.

The radio frequency intermodulation measurements on the receiver were not bad in comparison to most FM walkie talkies, but the IC202S is clearly much

Boring S-meter

better for SSB. The selectivity on SSB was quite good, the normal band width being 2.3kHz which is about right. Many other rigs though have sharper skirts these days. The S meter indicated only 5dB difference between S1 and S5, and in any case the S1 signal I would have personally called around an S7, judging by ear. S9 however was set reasonably. On FM, the S meter was equally stupid, although sensitivity was different.

FM selectivity was easily good enough for the rig to be used at 12½kHz spacing, the 25kHz selectivity being excellent. Although the audio output into an external eight Ohm load was 1.6 watts (10% distortion) the internal speaker seemed inefficient and frankly, not too good. FM distortion at 125mW was just adequate and could have been better. The receive frequency for maximum sensitivity was approximately 2.5kHz off channel on FM which is a pity, for the audio signal to noise ratio actually improved by as much as 6dB on a very weak signal when the signal generator was tuned for optimum.

This sensitivity fall off is equivalent to a 3dB degradation approximately of RF sensitivity.

We checked the squelched receive current and this really was rather high at 70mA, 3½ times higher than that of the average FM 2m walkie talkies, but note here that the battery pack has perhaps four times the capacity.

" . . . quite clearly Yaesu need to think about power conservation circuits a little more"

The transmitter section had an average frequency error of 600Hz on all modes, although on SSB the rig did transceive reasonably closely. FM output power was generally just short of 3w, there being surprisingly little difference between 13.8v external, or internal battery supply. SSB peaks in excess of 4w were noted – fascinating. The low power position cuts the power very appreciably and usefully on both FM and SSB. Current drawn on TX seems rather high, particularly on low power, so quite clearly Yaesu need to think about power conservation circuits a little more. Peak tone burst deviation was just right, but audio peak deviation was, as usual, set very much on the high side, and the odd repeater might possibly object.

The harmonic spectrum showed 3rd, 4th and 6th harmonics to be just a little high, and the 4th could cause a slight problem to TV. The rig did not seem to spread on SSB with normal use of the microphone, but some spreading developed on some other FT290s when their owners started eating the microphone when excited! The rig's capability of delivering, typically, well in excess of 3w pep is quite clearly the reason why many transmissions with linear amplifiers after an FT290 have sounded rather nasty, since usually these amplifiers are equipped to give around 10dB gain (10 times power), but no more than 30w maximum without bad flat topping.

FT290 conclusions

Yaesu have clearly designed this rig with portable use in mind, and for this application it performs extremely well for its price. Since most stations that you would work with it would be likely to be running higher power, the lack of sensitivity on receive will not be too serious. If we assume that the Mutek board would work equally well in the review sample as it did in my own one, then the on-channel sensitivity improvement could be around 6dB. Comparing the Mutek modded 290 with the review sample showed the extra sensitivity to be worthwhile, allowing the user to orientate himself and the rig more easily, so that there could be a better chance of being heard when transmitting. The rig is a little heavy, but not impossibly so if carried, but might be a little heavy on the shoulder. Yaesu can supply a car mounting harness with power supply working from the car electrics, but this was not supplied for review. I found that in the car there was only just enough volume for me, either with the rig resting on my lap or placed in the glove compartment, whilst my wife or colleague was driving, both of them finding volume inadequate as they were farther away from the rig.

“Many external linears have no external pre-amps, in which case the installation will be decidedly deafer than average”

For fixed station use the rig should work moderately well without a linear, but the trouble starts if an average linear is used without due care to ensure power compatibility without flat topping. Many external linears either have no receive pre-amps, in which case the installation will be decidedly deafer than average, or they may contain an RF pre-amp which has too much gain, thus seriously degrading the RFIM performance.

In my opinion when you order the linear you should specify that the transmit

section is less sensitive, giving a power gain of perhaps six times only if you are primarily interested in SSB. Furthermore, you should buy a linear with the RF receive pre-amp switchable on/off. Under these circumstances, the rig can make a convenient small home station set up. Many have used the FT290 with a Microwave Modules 2m/70cm transverter with an appropriate attenuator, and this combination works quite well. A few stations have successfully used the 290 with the MM 1296MHz transverter.

Not for DX-chasing

A recommended rig, then, but you should note the reservations before purchase, and not a rig for DX chasers. I have had tremendous fun with my own FT290 on portable locations just to keep in contact with the outside world from the most unlikely places!

The FT790 is almost identical to the 290, it covering the complete 70cm band from 430 to 440 MHz. On CW and SSB, 100Hz and 1kHz steps are provided, whilst on FM the steps are 25kHz and 100kHz. As with the FT290 it is possible to tune FM to 100Hz if you tune onto SSB first and then switch over to FM. However, one touch of the tuning knob after this reverts you to the normal steps. Non-standard frequencies can also be entered into memory from SSB and used on FM thus permitting the use of “private” strange frequencies, such as 433.612.5 for example.

The antenna socket is BNC 50 Ohms on the fascia, a half wave flexible whip with built-in transformer being supplied, the same socket being used for feeding external antennas. I much prefer this arrangement to that on the 290 as I feel the matching is better, and I never did like the idea of a collapsed whip in parallel with an aerial socket.

Repeater facilities

The mode switch incorporates normal and complete reverse repeater facilities, but tone burst is not automatic, the call button being depressed to give 1750Hz/

PTT. 70cm repeaters do not normally require a tone burst once the repeater has been turned on at the commencement of a QSO, and so auto tone burst could actually become annoying, and thus its absence is welcome on the 790.

Unlike the 290, the 790 includes a built-in speech processor which can be switched on/off internally, other switches being the same as on the 290. Outside connections are also precisely the same, except for the absence of the SO239 socket on the base. If memory back up is switched off, the rig selects 433.400MHz on turn on, whereas it will of course reselect the frequency last used before turn off, if memory back up is on.

“... selectivity was excellent on SSB, the bandwidth being just right”

Strange as it may seem, the front end was more sensitive on the 790 than on the 290, and one of the best I have yet encountered on a portable 70cm rig. Unfortunately, though the RFIM performance is poor close in, (although decidedly better with two strong carriers farther away from the wanted channel) it was worse than I have ever measured in the last year or so. To put this in context though, signal strengths are normally lower on this band, and there are far fewer stations, so RFIM is likely to be of importance only on occasions when the rig is being used on a large aerial system as a fixed station, and perhaps during a contest or tropo opening. The selectivity was excellent on SSB, the bandwidth being just right, and the skirts much steeper than on the 290, the -60dB bandwidth being as narrow as 3.5kHz. On FM the selectivity measured well considering the channelling and no troubles are likely to be experienced.

The S meter is the same type as on the 290, and again S9 is set at a reasonable level, but S1 is only 15dB lower, thus 2dB per S point (rather stupid again)! The maximum audio output available from a

1kHz tone modulation at 4kHz deviation is typically around 1.1 watt, with distortion moderately high. Even at 125mW distortion was high at 3.7%, although in practise the distortion doesn't sound too bad. There was less gain in hand on the 790 before distortion set in, but the speaker seemed slightly more efficient, low deviation signals being much too quiet even with volume flat out.

“... one credit point for the 790 is that the receiver was precisely on frequency”

We were rather surprised that the receive squelched current was very high and this is certainly going to reduce battery life before recharging is necessary

(1½ times more drain than on the 290). One credit point for the 790 is that the receiver was precisely on frequency thus giving optimum performance right on the nominal FM channels. AGC characteristics seemed quite reasonable as a compromise for CW and SSB, although I personally like a slower recovery time, the same comment applying to the FT290.

It is worth noting that the 50/100kHz RFIM measurement averaged 25dB better than the closer in one, thus showing that the mixer itself is not the main contributor to the RFIM problem. The first IF filter seems to be too wide. The maximum power output for FM on TX was just under half of that of a 290, SSB again being somewhat higher. The SSB pep output seemed better controlled than on the 290, peaks being more consistent (compressor on). The transmitted frequency accuracy was remarkably good, repeater shift also being precise. Tone burst deviation was accurately set and FM speech deviation averaged slightly

high but could peak rather too high for some repeaters. On the low power position the output was around 1/6th power, but the rig took a high current which is most unfortunate – one expects a 70cm rig to be less economic than a 2m, but ½ a on low power does seem a little ridiculous.

“... no drift problems were noted once the rig had warmed up”

The harmonic output of the 790 is clearly better controlled than on the 290 and I do not suppose that any harmonics will cause a problem, no spuri being detected down to the noise floor of the analyser at -70dB. No drift problems were noted once the rig had warmed up, and on SSB transmit and receive frequencies corresponded well.



FT790 conclusions

We were all more impressed with the 790 than we had been with the 290, the only major concerns being the generally high current drain and the poor RFIM performance (from immediately adjacent channels). In general use the 790 was a pleasure to use and the transmitted quality was liked by almost all listeners, although on receive the built-in loudspeaker rattled a bit on bassy signals if turned up a bit. The very wide band coverage is most useful and it will clearly encourage the use of a wider range of frequencies, and I can recommend the rig highly. Superb as a hand-held, excellent for mobile, and reasonable for a home station.

Accessories

SMC sent us a speaker microphone (YM49) and it was useful, allowing less receiver gain to be used, the reproduction being very clear although topky. LF was lacking, but in a communication context this does not matter.

On transmit, the TM49 was slightly more topky than the YM47 normally supplied, and it was thought the mike gave better intelligibility, but it was possibly slightly more tiring to listen to, although I preferred it for general use. An accessory 2m linear (FL2010) is available, which is stated as giving 10 watts output, but at the very high price of £64 for well under an S point.

A mobile cradle (MMB11) is available at £22.25 which incorporates interconnections to run the equipment off the car electrics. A shoulder strap is supplied with each rig, but a soft carrying case is optional (CSC1). The standard mains charging unit (NC11C) costs around £8 and takes between 10 and 15 hours to recharge the nicad pack at 150mA charging current. Note that some retailers include the cost of eight nicads (C-type) whilst others do not.

In the case of the FC290R, SMC state they will modify the rig to include auto tone burst and reverse repeater check without additional charge, provided the modification is specified before purchase.

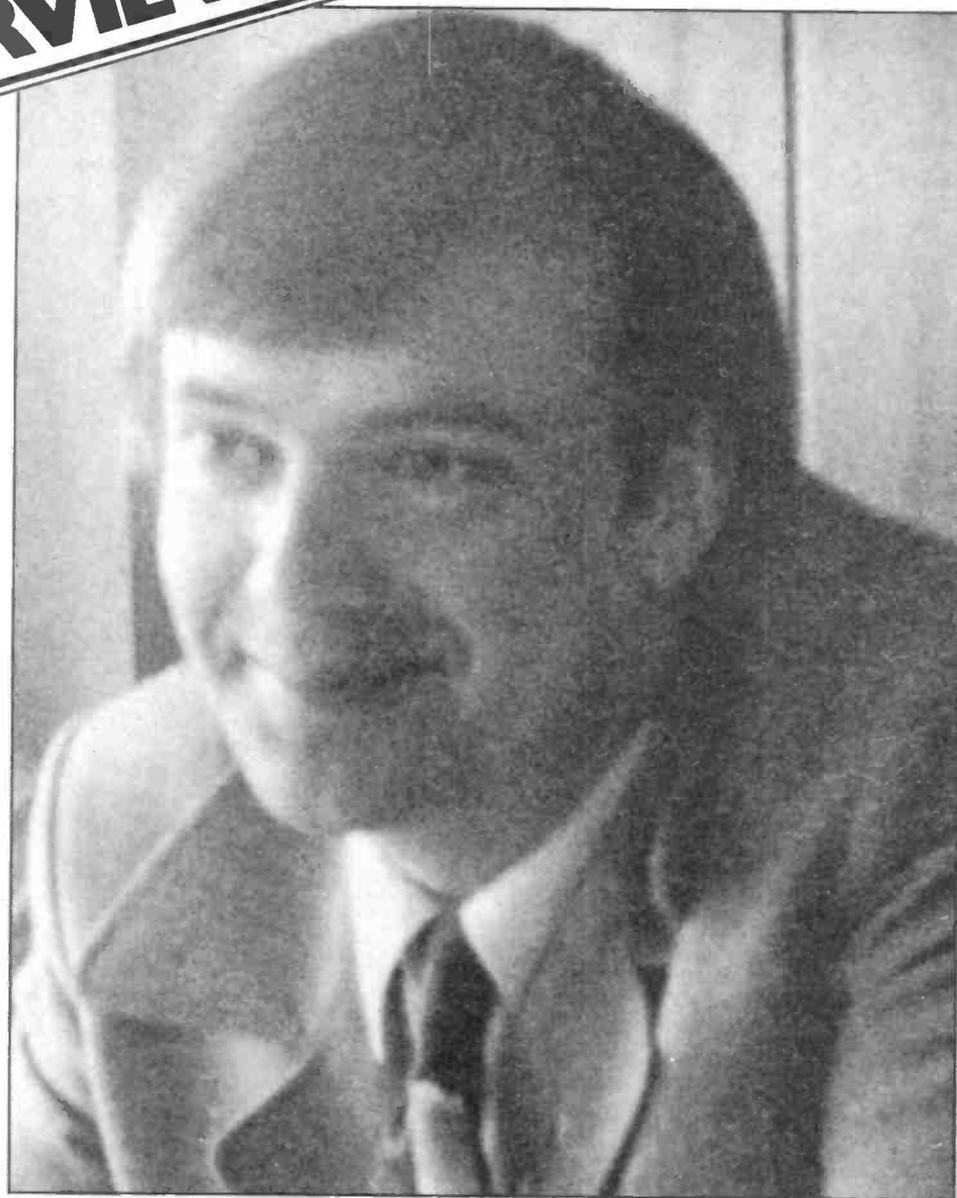
MULTIMODE PORTABLES: MEASUREMENTS

Equipment: Yaesu FT290R and Yaesu FT790R

General information: FT290R carrier frequency 145.000MHz (unless otherwise stated). FT790R 433.000MHz (unless otherwise stated). Deviation FT290R 3kHz; FT790R 4kHz. Modulation 1kHz. SSB, receiver tuned for 1kHz beat

Receiver	FT290R	FT790R	Notes
Sensitivity on FM for 12dB sinad (uV pd)	0.21	0.16	
Sensitivity on SSB for 12dB sinad (uV pd)	0.16	0.13	
Generator shift for best sinad on FM (kHz)	+2.6	0	
Improved sinad when above carried out (dB)	18	12	Initially at 12dB sinad point
RFIM at 25 and 50kHz offsets (mV pd)	0.2	0.027	Level at each frequency for 12dB sinad product
RFIM at 50 and 100kHz offsets	-	0.47	" "
Selectivity FM adjacent channel (dB)	46/57	45/66	12.5kHz (290) 25kHz (790)
Selectivity FM alternate channel (dB)	68/71	73/74	25kHz (290) 50kHz (790)
Selectivity SSB 6dB/60dB bandwidth (kHz)	2.3/4.4	2.4/3.5	
Audio output power for 10% THD (W)	1.6	1.6 at 5%	Into 8 Ohm load
Audio distortion for 125mW audio output (%)	2.3	3.7	
DC current drawn on FM when squelched (mA)	69	106	
S meter: FM levels for S1/S5/S9 (uV pd)	2.0/3.5/6.3	0.9/1.4/4.0	
S meter: SSB levels for S1/S5/S9 (uV pd)	0.9/1.6/3.2	0.4/0.6/2.0	
Transmitter			
Output power FM high/low - batteries fully charged	2.6	1.3	
Output power FM high -13.8vdc supply (W)	2.8/0.15	1.2/0.22	
Output power SSB high -13.8vdc supply (W)	4.5	1.8	
FM deviation max/close speech (kHz)	6.9/6.9	8.0/6.5	peak-peak/2
Tone burst deviation (kHz)	3.3	3.6	
Tone burst accuracy rel. to 1750Hz	within 4kHz	within 2kHz	
Harmonic output 2nd/3rd (dBc)	-60/-55	-62/-70	
DC current drawn high/low power (mA)	810/320	690/480	
Weight	210g	218g	
Recommended retail price	£265	£325	

INTERVIEW



DAVID EVANS G3OUF

The General Manager of the RSGB talks about the future of amateur radio to Chris Drake

RADIO SOCIETY
OF GREAT BRITAIN

CFD: *There is a view that the RSGB is out of touch with its members. How do you feel about this?*

G3OUF: *Emphatically not the case. The organisation has a very clear knowledge of members' views, via the representative system of elected council members, regional representatives and area representatives, via its committee members and national organisations such as Raynet, and via the thousand or so letters and telephone calls received each working day. And one can add to those the direct input from meeting members at exhibitions, conventions and the lectures we give.*

Many of the demands are from members for services we already provide, but they are not aware of. Many suggest services that we would dearly like to provide, but cannot at this time for financial or other reasons – until recently, one of these other reasons has been the lack of space at our headquarters. Some members would like the services which probably we would never be able to supply without prejudicing services to other members.

“We are very aware that we do little for the newcomer to the hobby”

So, the main problem is not that of realising what members would like, but what service the society can supply within its budget. The latter is, of course, directly related to the subscriptions level; the higher the subscription rate the greater the number of services that can be provided.

CFD: *A common criticism we hear is that there are too many 'old boys', and not enough gets done for the new amateur. Any comments?*

G3OUF: *If you mean by 'old boys' experienced amateurs, it is difficult to imagine that one can have too many of them. We are very aware that we do too little for the newcomer to the hobby. One way we have reacted is by significantly expanding our membership services staffing especially to provide assistance to this area.*

CFD: *Radcom is often felt to be way above the heads of society members. Are there any plans to make it less of a learned journal and more down to earth?*

G3OUF: *We must remember that, unlike many magazines, Radio Communication is essentially an RSGB magazine which is written by members, for other members. The high technical level of some of the articles is simply a reflection of the high technical level of much of present amateur radio. One should not be the least surprised that articles will be above the heads of many amateurs – amateur radio covers such a wide range that everybody, however well experienced, must inevitably regard himself as a beginner in most aspects of amateur radio.*

Nevertheless, the question conceals a real problem: that the situation is not so much that the articles are too technical, but rather that there are too few simple articles. Here we have a basic problem; that those who are best qualified to write have, like the rest of us, only limited time to spend on amateur radio. If they can be persuaded to write at all, then naturally they will tend to write about things they are interested in and not necessarily what others would like to see.

However, we must always remember that much of our beginners' material is contained in our books. It would not be very cost-effective using up valuable space in Radio Communication repeating material as each new group of newcomers appear. On a more positive note, one of the consequences of the move of headquarters is that we can now implement the decision made by council two years ago, namely, the employment of a full-time technical officer whose main function would be to ensure the generation of 'beginners' technical material.

CFD: *Does the RSGB feel that 50MHz will eventually be available for all, including Class B licensees?*

G3OUF: *As many will realise, the society has been negotiating for many years regarding obtaining an allocation of this part of the spectrum. More recently, the Merriman committee gave strong support to the idea. The current experimental 50MHz licence represents a further step in this direction. Putting these factors together, if the latter experiment*

proves successful, and unless other factors intrude, then the chances of obtaining a permanent 50MHz allocation would appear good. If allocated in the future on a permanent basis, we know of no reason why Class B licensees should not have full use of the band.

CFD: *We hear a lot of moans about slow deliveries of books, cheques cashed and no goods sent etc. Why does this happen?*

G3OUF: *Things do go wrong at the best of times. One problem has been our success. RSGB typically despatches one book every 40 seconds each and every working day throughout the year. Even a very low failure rate affects the individual, and in amateur radio everyone then hears about it and often assumes the worst. However, there is little doubt that during the last months at Doughty Street and during the move to the new headquarters, the most difficult working conditions increased the likelihood of things going adrift. A major problem which has affected this has previously been lack of space at headquarters. It is an interesting statistic that the area that now can be devoted to book storage and despatch is larger than the total area at the old Doughty Street headquarters. Often delays are caused by customers who do not sign their cheques or send the wrong amount of money. Even a sudden demand on a book cause it to become out of stock unexpectedly. We now have more staff to deal with these sorts of problems more quickly, and additional staff in the new packing department – clearly we continue to strive for perfection.*

“Amateur Radio needs a strong capable society...”

CFD: *Finally, do you feel that the RSGB is fully in touch with what members need, and with the state of amateur radio in GB today?*

G3OUF: *I think we have already answered that in your first question; yes I do. We fully recognise that amateur radio needs a strong capable national society and our aim is to achieve this in as professional and committed a way as possible.*

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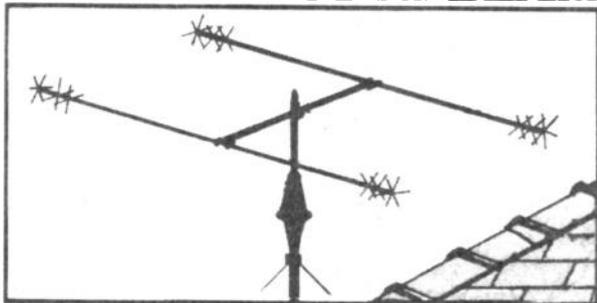


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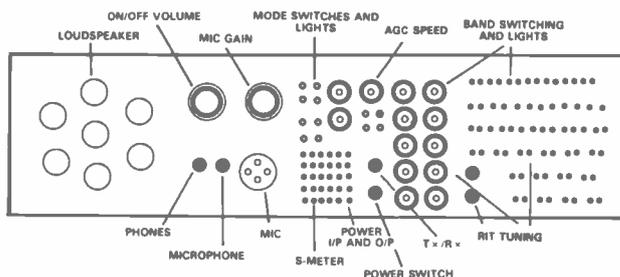
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INTERVIEW

CFD: Why are there so many committees?

G3OUF: RSGB is without doubt one of the strongest amateur radio societies in the world. Much of this is due to the existence of its 15 committees which cover education, exhibitions, finance, IARU, interference, membership, Raynet, HF, VHF and microwave and propagation studies. Their main function is to do specific jobs as defined by their terms of reference. A good committee is a means by which members from a wide range of backgrounds and experience can pool their expertise to produce benefits often very much greater than the sum of the individual efforts.

"...not why so many committees, but rather do we need any more of them?"

However, committees have other virtues; committee members are equally good at transmitting information from the centre outward and therefore provide additional links with the membership. What we should not forget is that we get these benefits effectively for nothing; we could not afford even a tiny fraction of the committee effort if we had to pay professional rates.

As regards the number of committees, the RSGB Forward Planning Group is currently looking at the working of committees. Although there may be some rationalisation, it is already obvious that there are many areas of amateur radio presently not covered by any committee. So the question we should perhaps be asking is, not why so many committees, but rather do we need more?

CFD: There is a lot of criticism of the society's relationship with the HQ - someone recently referred to it as a 'conspiracy of secret societies to work together to reveal nothing'.

G3OUF: The relationship between any government regulatory department and any outside body cannot be assumed automatically to be straightforward because they serve different interests often of great complexity. Many factors make for further difficulties, examples are the government cut-backs which have reduced the staff effort devoted to the amateur services (as well as other services), and the problems caused by irresponsible operating and spectrum abuse, (in some cases by amateurs themselves), which further reduce the time for positive action on amateur radio matters. Despite this, there is little doubt that the present relationship with the Home Office is very constructive and we are already beginning to see the value of this in a number of areas. It is equally true that every effort is being made to give members as much information as possible as reference to the news section in our own magazine will show.

CFD: What plans do the society have for the future?

G3OUF: This is an impossible question to answer in a few words. The short answer is to continue efforts to generate conditions under which amateur radio can thrive. As noted above, the RSGB has a Forward Planning Group whose responsibility is simply to look ahead to see what is needed and to make the appropriate recommendations.

"432MHz band is allocated to amateurs on a secondary basis only"

CFD: Can the RSGB do anything about things like Mold and Syledis?

G3OUF: The short answer is: not a great deal at this time. It is necessary to understand that, while within ITU Region 1, amateur and radiolocation are shared primary services, in the UK the 432MHz band is allocated to amateurs on a secondary basis only. It is a primary allocation for radiolocation, of which Syledis is an example, and to the Ministry of Defence who have recently introduced their Mold system.

In this, they are obviously completely within their rights. The problem arises, of course, simply because both amateurs and professionals recognise 432MHz as a very useful part of the spectrum.

In practice, Mold may not be too much of a problem as it is in a part of the band that is channelised, but spaced 12.5kHz away. In the case of Syledis, RSGB has been able to see that its effect has been reduced by various means but has not yet been able to encourage a change of frequency which has been under discussion for some time.

"The council is considering all the implications of a novice licence"

CFD: What are the RSGB's views on a novice licence? Was there any truth in the Ham Radio Today story in the March issue?

G3OUF: At present plans for novice licences, although agreed in principle with the Home Office, are in abeyance for a number of reasons. One reason is that active consideration is being given by both RSGB and the Home Office to the possibility of Class B licensees being permitted to use Morse at frequencies above 144MHz provided that they identify themselves using telephony. One argument being put forward is that, once Class B licensees are able to experience the advantages of this mode, then they will be encouraged to obtain their Class A licence and take advantage of the associated privileges and in particular, operation on HF. An experimental period of operation is being proposed. If there are no unforeseen problems and the experiment is a success (which will largely depend on the response by amateurs) we may find the modified Class B licence will fulfill many other requirements or what others call the novice licence. At the time of writing, the society's council is considering all the implications of this proposal. Additionally, the Home Office has stated that they would simply not be able to cope with any additional grades of licence at present.

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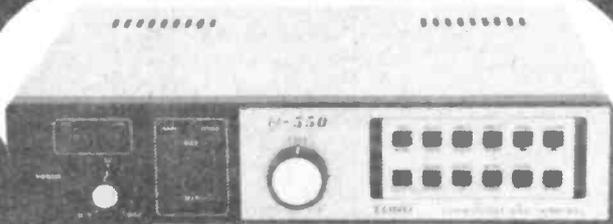
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• PROCEDURES •

As they say on the television, there's a change to our advertised programme here. Since we've started our series on passing the RAE (and we'll be going into the technical side of the hobby in some depth in the next few months under that particular heading), we're going to convert the "Starting from Scratch" feature into things that you don't tend to learn from the RAE course but which you'll need to know when you get the ticket (preferably before then) so that you can go on the air and know what you're doing.

This month we will look at some basic operating procedures. These are covered anyway during the RAE course but there they tend to be basic and simple. Thus, there's room to take a look at some of the points that don't crop up in the RAE syllabus, and which fox people sometimes if they've come into the hobby from cold, or maybe don't know how to get the best out of a repeater or a satellite or what-have-you.

Specifically, the RAE doesn't ask you how to go about working DX or how not to make enemies out of your locals when there's an opening on 144MHz or a contest – so let's go into some of these things.

Just for fun, here's a sample of what you might hear on 144MHz SSB if you were tuning around. Let's imagine you're listening on a frequency of 144.300MHz, which in the VHF bandplan is universally acknowledge as the calling frequency for SSB and you hear something like:

"... CQ, CQ, CQ from G6ZZZ, Golf Six Zulu Zulu Zulu in Alfa Lima square calling CQ, G6ZZZ beaming west from Sevenoaks and standing by"

G6ZZZ is calling CQ, which means that he's putting out a call announcing to all and sundry that he's available to engage in conversation. CQ is probably an abbreviation from the very early days of radio when all you had was Morse, and we like to think it's a Morse version of Seek You. It means simply, a general call to all stations, or any station who might happen to be listening and feel like coming back to the call. If you like, it's the proper radio version of "one four for a copy"!

Basic operating procedures that are covered in the RAE course, plus some others that aren't. Needless to say it's a good idea to learn all of them. Nigel Gresley advises.

G6ZZZ is also using the phonetic alphabet when he spells out his callsign as Golf Six Zulu Zulu Zulu. The reason for this is that letters and figures all by themselves tend to get a bit lost on the radio and instead of saying "Z" it's better to use the word Zulu which is the internationally recognised phonetic equivalent. "Golf" is G, of course, and indeed some amateurs tend to say "Figure 6" instead of just 6 to make life easier, if the man they're talking to on 432MHz is 500 miles away and fading in and out of the noise. When G6ZZZ is really trying for DX, he'll probably say "Golf Figure Six Zulu Zulu Zulu" and that stands a better chance of being understood under weak-signal conditions than just "G6ZZZ".

"So it's a great help to announce which way you're beaming if you have a directional antenna..."

Now then, about this "Alfa Lima square" bit. Basically, there is a code for specifying your location down to a 2km by 1km square anywhere within the UK or Europe – it's easy to calculate from an Ordnance Survey map and if you buy the RSGB's "QTH Locator" map you also get a piece of paper telling you how to go about it. G6ZZZ's full QTH locator code might be of the form AL51g, where the AL defines a large area, the 51 cuts that down a bit and the small g sets his position within the 51 area.

Now it just so happens that many VHF and UHF addicts have fun working as many QTH squares as possible, and by a "QTH square" they generally mean just the major one – which is AL in the case of G6ZZZ. So he's announcing his QTH square in his CQ call so that anyone who particularly wants to work AL square knows that they can do so simply by calling him and having a contact. By the way, you'll sometimes hear them called "QRA locators" or "QRA squares" but it's usually felt that "QTH" is more correct.

He's beaming West

What else has our pal done? He's announced that he's "beaming west", and this shows that he's a good chap who will surely go to heaven. The reason it's so important to announce which way you're beaming on VHF and UHF ("beaming" simply means that "my antenna is pointing", by the way, in case you hadn't guessed) is that any VHF or UHF antenna worth its salt is likely to have a narrow and sharp main lobe into which all the power goes; if you hear a weak and fluttery signal from the north of you and the chap doesn't tell you which way he's beaming, you've no way of knowing whether he really is a rare one 500 miles away or whether he's only 30 miles up the road and you're hearing a weak signal off the back or the side of his antenna.

If he says he's beaming south, you've probably got a reasonable chance of having a contact if you want to, but if he's beaming north-east or something he's probably going to get called from someone in that area who's getting much more signal from him than you are. So it's a great help to announce which way you're beaming if you have a directional antenna of any sort. In fact G6ZZZ has been extra-good because he's also announced that he's located in Sevenoaks as well as beaming west. Now let's imagine you're in Swansea and you hear this incredibly weak signal in and out of the noise just after you've had a contact with your mate in Llanwhatsit to the north of you. Let's imagine that you hear that it's G6ZZZ and practically nothing else. Now, as often happens, ten gets you one that G6ZZZ is too new to be in the callbook so

STARTING FROM SCRATCH

you haven't the foggiest whether he's just over the border or whether he's a good distance away – you also haven't a clue which way to turn your antenna so as to get a good signal from him and maybe work him. But then you hear "... Sevenoaks" in the noise, and you think "gosh, that's quite a way and it's somewhere to the east of here, I'll swing the beam". In other words, if you announce where you are you give the guy at the other end a sporting chance of getting the best signal he can from you and maybe having a brilliant contact which gives you your RSGB Senior award and a nice QSL for the wall.

To sum up, if you're at all serious about VHF and UHF, it's important to say (a) whereabouts you are so that people can get their antennas pointing vaguely in your direction and (b) which way you're beaming. The QTH square isn't so important but it's nice to include it if it's a rare square and conditions are reasonable because that's the way to get the father and mother of pile-ups. If you live in ZL or AL, however, I'm not sure I'd bother! However, it is another help to the distant station because if he's a square collector it'll probably influence his decision as to whether or not to call you and it's nice to give him the chance to decide. However, your whereabouts and your beam heading are *vital* and woe to those who don't announce them and give the likes of us heart attacks trying to decide whether to stoke up the linear or wind the beam round or what the hell!

Universally used

You see there's quite a lot to think about, even in a CQ call isn't there? Since we mentioned Swansea and since G6ZZZ happens to be beaming west, let's assume that the next thing we hear after he's said he's standing by is:

"G6ZZZ, Golf Six Zulu Zulu Zulu, this is GW4ABC, Golf Whisky Four Alfa Bravo Charlie, GW4ABC in Swansea, West Wales calling and standing by"

So our friend in Swansea has heard G6ZZZ calling CQ and decided to go back to him. Obviously the fact that he probably heard G6ZZZ beaming west influenced him, and he's probably getting as good a signal at this stage as he's going to get; let's see how it pans out:

"The Golf Whisky station calling G6ZZZ, QRZ? QRZ the Golf Whisky station, Golf Six Zulu Zulu Zulu listening"

It seems that G6ZZZ has heard something, but he hasn't been able to make out the full callsign; he knows it's a station in Wales because he's heard that the prefix of whoever is calling him is GW, which is that used for Wales, but he hasn't got any further than that at this stage. "QRZ" means "who is calling me?" in this context; strictly speaking G6ZZZ is using a Morse-type code on SSB, which isn't thought to be quite the thing in some

circles but it's almost universally used on phone even though it's really for CW use. As you may know, there is something called the Q-code, and things like QTH and QRZ are parts of it. You can use them on Morse either as a statement or as a question, so if you sent QRZ in Morse it would mean "You are being called by..." whereas QRZ? means "Who is calling me?"

Voice modes

When you're using voice modes of one sort or another you can say things like "the QTH here is Sevenoaks" or "QRZ the GW station?" if you want, and in fact you often do on the HF bands because not everyone's English is as good as yours and someone in Lower Slobbovia is quite likely to say "QTH here Slobville" instead of "well, old chap, I happen to be domiciled in the rather quaint seventeenth-century hamlet of Slobville on the lower foothills of the Transylvanian mountains" or whatever it might be. In the case we're examining, many people use QRZ to mean "who is the weak signal down there in the noise calling me?" although, as we've seen, this is a different usage from what the Q-code was originally meant for.

On the right is the phonetic alphabet, and below, the RST code, otherwise known as the Readability, Signal, and Tone code. Learn them!

Phonetic Alphabet

Letter	Phonetic	Pronunciation
A	Alpha	AL FAH
B	Bravo	BRAH VOH
C	Charlie	CHAR LEE
D	Delta	DEL TAH
E	Echo	ECK OH
F	Foxtrot	FOKS TROT
G	Golf	GOLF
H	Hotel	HOH TEL
I	India	IN DEE AH
J	Juliet	JEW LEE ET
K	Kilo	KEY LOH
L	Lima	LEE MAH
M	Mike	MIKE
N	November	NO VEM BER
O	Oscar	OSS CAH
P	Papa	PAH PAH
Q	Quebec	KEH BECK
R	Romeo	ROW ME OH
S	Sierra	SEE AIR RA
T	Tango	TANG GO
U	Uniform	YOU NEE FORM
V	Victor	VIK TAH
W	Whisky	WISS KEY
X	X-Ray	ECKS RAY
Y	Yankee	YANG KEY
Z	Zulu	ZOO LOO

RST code

Readability

- R1 Unreadable.
- R2 Barely readable, occasional words distinguishable.
- R3 Readable with considerable difficulty.
- R4 Readable with practically no difficulty.
- R5 Perfectly readable.

Signal strength

- S1 Faint, signals barely perceptible.
- S2 Very weak signals.
- S3 Weak signals.
- S4 Fair signals.
- S5 Fairly good signals.
- S6 Good signals.
- S7 Moderately strong signals.
- S8 Strong signals.
- S9 Extremely strong signals.

Tone

- T1 Extremely rough hissing note.
- T2 Very rough ac note, no trace of musicality.
- T3 Rough, low-pitched ac note, slightly musical.
- T4 Rather rough ac note, moderately musical.
- T5 Musically modulated note.
- T6 Modulated note, slight trace of whistle.
- T7 Near dc note, smooth ripple.
- T8 Good dc note, just a trace of ripple.
- T9 Purest dc note.

Back to the contact: Let's assume that the Welsh station repeats what he said before, and that G6ZZZ turns the beam or switches on his preamp and gets a reasonable signal from him this time:

"Golf Whisky Four Alfa Bravo Charlie, this is Golf Six Zulu Zulu Zulu, roger roger – many thanks for the call. Your report is 4 by 2, 4 by 2 with QSB, 4 by 2. How do you copy me? GW4ABC from G6ZZZ, go ahead"

"Roger, roger, from GW4ABC, I copy 4 by 2. Your report 5 and 5, 5 by 5 with a little QSB but you're Q5 with no problem at all. The name here is Mike and my location is the town of Swansea in the county of West Glamorgan. The rig here is an Icom IC-211 and the antenna is a 6-element quad at 45 feet above the ground. Wonder how you copy? G6ZZZ, this is GW4ABC, over"

There are a few things to look at here. G6ZZZ has given the Welshman a report of "4 by 2" and this means 4 on a



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STARTING FROM SCRATCH

readability scale of 1 to 5 and 2 on a signal strength scale of 1 to 9. In other words, our man in Swansea isn't exactly storming into Sevenoaks, although we need to be a bit careful here and analyse what's meant by readability and strength. As you'll see from the table, readability 4 means "readable with practically no difficulty", which may well be true but it doesn't mean what many amateurs use it for which is "well, I can copy about half of what you're saying when the fading doesn't take you down into the noise or when that clown next door starts up his motorbike and wipes out any reception at all".

What's real readability?

It's extremely rare to hear anything other than readability 4 or 5 being sent and we'd all do well to stick to the real meaning of the readability scale and stick to it. The same goes for signal strength. The scale from 1 to 9 has perfectly defined meanings, and indeed there's no real point in saying to someone that they're "20 over 9" just because your S-meter happens to indicate 20dB over S9 on its silly scale. The vast majority of S-meters are without a doubt, USELESS for S reports and they're meant to be sent according to what those floppy things either side of your skull tell you, not what some stupid meter needle does or doesn't say. An extremely strong signal is S9, and "20 over 9" doesn't mean a damned thing to a living soul so forget all about it!

You often hear reports like "well, you're perfectly readable and you sound quite strong but you're not moving the S-meter needle so I suppose you're S-nothing, or do I mean S1?" Urrgh, knock it off chaps and use the S-scale for what it was designed for. No two S-meters are calibrated alike anyway, and certainly the vast majority of them are (a) highly non-linear anyway, (b) don't correspond to any particular signal level for a given reading and (c) usually give up the ghost over S9 and read anything they feel like reading. Please, ignore the wretched S-meter on your rig. It's worse than useless and certainly isn't related to what goes in your lugholes. Can we please start a campaign to use the RST code (as it's called) properly and not have so many silly reports flying about on the wireless?

Anyway, let's assume that G6ZZZ is a sensible chap and actually means what he says - ie that our signals from Wales are very weak. That's what S2 means. He might well be being honest about readability 4 as well, if the Welsh signal was pretty consistent and the band was quiet,

but he also said that there was some fading (the QSB bit - it's another example of a CW Q-code being used on voice) so the readability 4 might be a bit generous. Have a look at the RST table we've given and practice listening to signals on the radio and deciding what reports you'd give them - the old RST code is much misused, alas, and it's time for a revival! Don't worry about the T bit of it, by the way; that's to do with Morse and we'll come to that in a subsequent article.

As a final question to leave you with until next time, what's all this "roger roger" stuff? Well, "roger" simply means that everything has been received and understood - if you've seen any war movies recently, you'll know all about it. You'll often hear it repeated a few times on the amateur bands, and in fact if you ever come across a meteor scatter contact in progress and hear someone

chanting "roger, roger, roger" for ages, he isn't taking part in some bizarre ritual, it's just that he's telling the other station that he's copied all the relevant info and that his side of the contact is complete.

Oh yes, just to finish with, "Q5" is a sort of unofficial way of saying that all the information has been copied and that the signal was readable all the way. Some amateurs use it to reassure the chap on the other end that they've received all the details despite factors like fading interference and that their signals are more or less getting through.

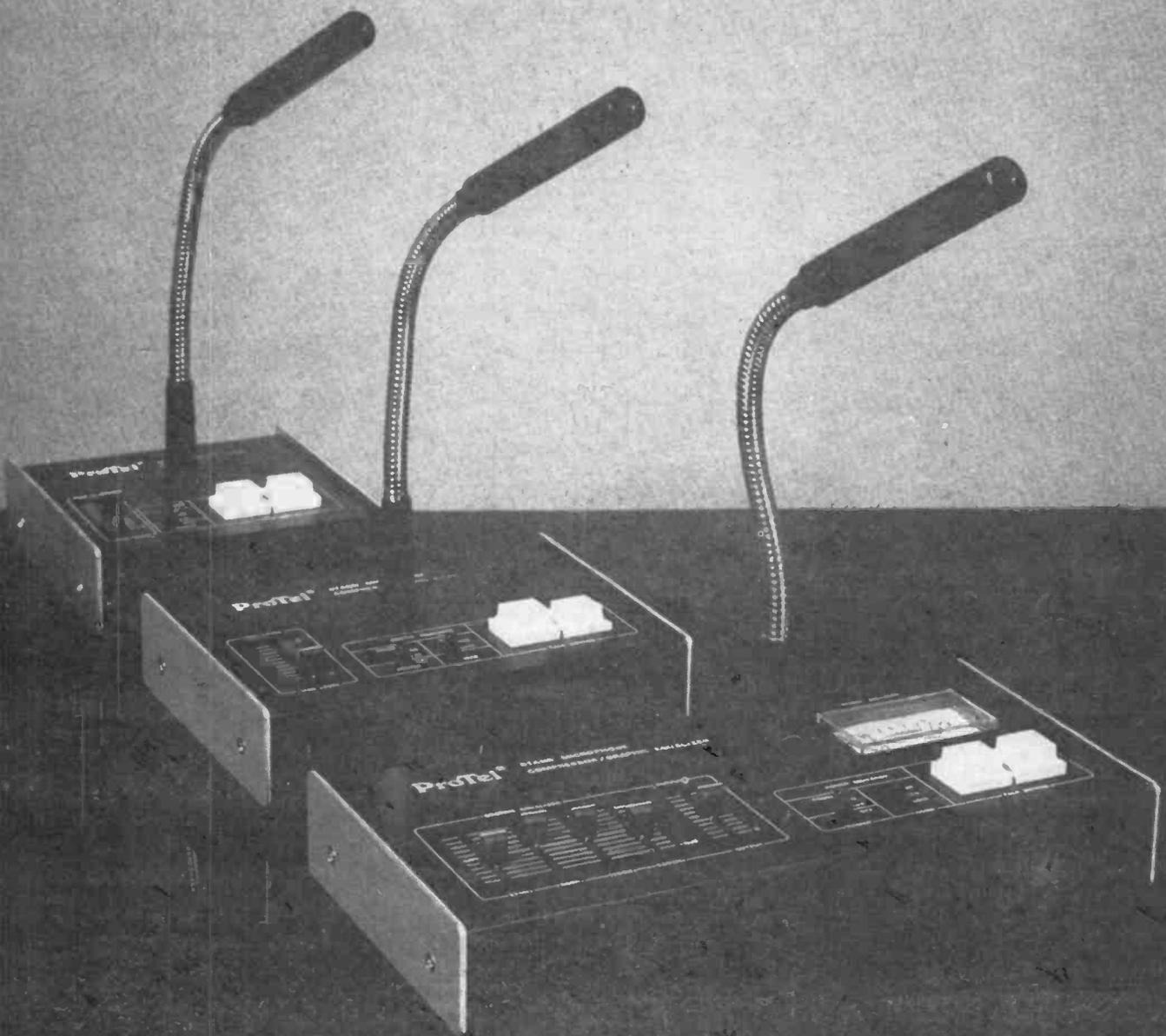
We'll leave it there for now and continue analysing this contact next month. For now, I'd suggest learning the R and S portions of the RST code, committing them to memory and making a firm vow to use them meaningfully from here on in!

International Q-code (most commonly used codes)

QRA What is the name of your station? The name of my station is ...	QSN Did you hear me (or (callsign)) on kHz (or MHz)? I did hear you (or (callsign)) on ... KHz (or MHz).
QRB How far are you from my station? The distance between our station is ...	QSO Can you communicate with ... direct (or by relay)? I can communicate with ... direct (or by relay through ...).
QRG Will you tell me my exact frequency (or that of ...)? Your exact frequency (or that of ...) is ... kHz (or MHz).	QSP Will you relay to ... I will relay to ...
QRH Does my frequency vary? Your frequency varies.	QSR Shall I repeat the call on the calling frequency; did not hear you (or have interference).
QRI How is the tone of my transmission? The tone of your transmission is ...	QSS What working frequency will you use? I will use the working frequency ... kHz.
QRK What is the intelligibility of my signals (or those of ...)? The intelligibility of your signals (or those of ...) is ...	QSU Shall I send or reply on this frequency (or on ... KHz (or MHz)) (with emissions of class ...)? Send or reply on this frequency (or on ... kHz (or MHz)) (with emissions of class ...).
QRL Are you busy? I am busy (or I am busy with ...).	QSV Shall I send a series of Vs on this frequency (or ... kHz (or MHz))? Send a series of Vs on this frequency (or ... KHz (or MHz)).
QRN Are you troubled by static? I am troubled by static.	QSW Will you send on this frequency (or on ... KHz (or MHz)) (with emissions of class ...)? I am going to send on his frequency (or on ... kHz (or MHz)) (with emissions of class ...).
QRO Shall I increase transmitter power? Increase transmitter power.	QSX Will you listen to ... on ... KHz (or MHz)? I am listening to ... on ... kHz (or MHz).
QRP Shall I decrease transmitter power? Decrease transmitter power.	QSY Shall I change to transmission on another frequency? Change to transmission on another frequency (or on ... KHz (or MHz)).
QRQ Shall I send faster? Send faster (... words per minute).	QSZ Shall I send each word or group more than once? Send each word or group twice (or ... times).
QRR Are you ready for automatic operation. Send at ... words per minute.	QTH What is your position in latitude and longitude? My position is ... latitude ... longitude.
QRS Shall I send more slowly? Send more slowly (... words per minute).	QTQ Can you communicate with my station by means of the International Code of Signals? I am going to communicate with your station by means of the International Code of Signals.
QRT Shall I stop sending? Stop sending.	QTR What is the correct time? The correct time is ... hours.
QRU Have you anything for me? I have nothing for you.	QTS Will you send your callsign for tuning purposes or so that your frequency can be measured now (or at ... hours) on ... KHz (or MHz)? I will send my callsign for tuning purposes or so that my frequency may be measured now (or at ... hours) on ... kHz (or MHz).
QRV Are you ready? I am ready.	QTV Shall I stand guard for you on the frequency of ... kHz (or MHz) (from ... to ... hours)? Stand guard for me on the frequency of ... kHz (or MHz) (from ... to ... hours).
QRW Shall I inform ... that I am calling him on ... kHz (or MHz).	
QRX When will you call me again? I will call you again at ... hours (on ... kHz (or MHz)).	
QRY What is my turn? Your turn is Number ... (Relates to communication).	
QRZ Who is calling me? You are being called by ... (on ... KHz (or MHz)).	
QSA What is the strength of my signals (or those of ...)? The strength of your signals (or those of ...) is ...	
QSB Are my signals fading? Your signals are fading.	
QSD Is my keying defective? Your keying is defective.	
QSI I have been unable to break in on your transmission or Will you inform ... that I have been unable to break in on his transmission (on ... kHz (or MHz)).	
QSK Can you hear me between your signals and if so can I break in on your transmission? I can hear you between my signals; break in on my transmission.	
QSL Can you acknowledge receipt? I am acknowledging receipt.	

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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	£720	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	£736	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	£559	Good 144MHz multimode, even better with Mutek front-end board
Icom IC451E	£689	Ditto for 432MHz
Yaesu FT726	£649	Brand new

VHF and UHF portables

Icom IC2E	£169	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	£209	SSB 144MHz "portable", still going strong
Icom IC402	£245	ditto for 432MHz
Yaesu FT208R	£209	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 introductions.

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

Yaesu FT730R	£285	144MHz mobile/base station (FM) Ditto on 432MHz - 10watts. Rx a bit deaf
Yaesu 480R	£369	Multimode 144MHz rig; some have had problems
Yaesu FT780R	£399	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	£375	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	£399	Lots of facilities,
Icom IC-R70	£499	See our review
Yaesu FRG7	£199	The old "Frog"
Yaesu FRG7700	£330	Reputedly rather good.
NRD515	£985	Very nice, although not without its faults

SHORTWAVE AND THE FOURTH DIMENSION

The American, Hugo Gernsback, was the one who first linked shortwave communication with science fiction. Many predictions by this man, and people like H.G. Wells, and Arthur C. Clarke (among others) have surprised us all. But, we ask, have the science fiction writers let on all they know about shortwave? David Lazell asks the question, and attempts to answer it.

Radio signals from outer space are run-of-the-mill events, if you have a big enough dish in your back garden. H.G. Wells concluded his epochal tome, *First men in the Moon*, with indistinct radio signals from the moon mariner marooned up there. In retrospect, one suspects a flat battery at the base station.

H.G. Wells – like Edison – was not much interested in radio communication. The pioneer who truly linked science fiction (SF) with shortwave was that sturdy New Yorker, Hugo Gernsback.

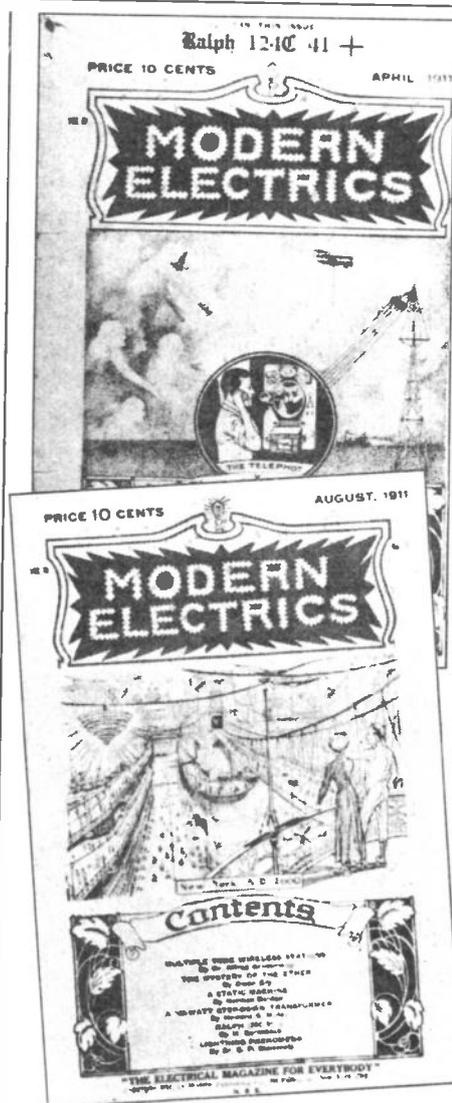
Although he did not get to the moon, Gernsback has a lunar crater named after him. As this lies on the visual border between the dark and light sides of the moon, it is in Cavour Country right enough. "Cavour" was H.G. Wells's hero who went moon-wards.

First complete radio kit

Hugo Gernsback is aptly called 'the father of modern wireless'. Indeed, almost eighty years have passed since he published a catalogue of amateur radio parts on behalf of the youthful Electro Importing Company – the firm which distributed the first complete radio kit in the USA. In 1912, when he was in his late twenties, Hugo Gernsback published a journal devoted to electrical and hobby radio interests. *The Electrical Experimenter* – re-titled *Science and Invention* in 1920 – is recognised as the great uncle of all radio interest magazines.

Totally without DC supply

But, in 1919, with an interest accelerated by military use of radio during the war, Gernsback launched *Radio News*. It found so eager a market that he launched another title in 1921, *Practical Electrics*. As this well-illustrated periodical described, practical application of electricity to home, industry, invention and business, it acted as timely consumer education.



'The Electrical Magazine For Everyone' – Hugo Gernsback's 'Modern Electrics' offered advice on 'wireless stations' as long ago as 1911. 'Modern Electrics' was 'the grand dad' of all popular radio magazines. Gernsback's best-seller 'Ralph 124CSI+' was serialized in the magazine.

It's important to remember that large areas of the US were dependent on local DC systems, or totally without mains electricity supply. Rural electrification programmes of any size had to wait for the New Deal initiatives under Franklin Delano Roosevelt – the Rural Electrification Administration (REA), Tennessee Valley Authority (TVA) etc. Gernsback, although a magazine entrepreneur of some importance by the time Roosevelt came to power, must have been keenly interested in wider use of electricity. He had foreseen so many inventions of the 1930s – and beyond – in his famous science fiction epic *Ralph 124C, 41 Plus: A Romance of the Year 2060*, written well before the first world war. In fact, the author's time-scale was not sufficiently ambitious, since some of the wonders of the Year 2060 have already come to pass – radar and two-way television, for example.

Detailing the future

Unlike some visionaries – who merely dream and describe – Hugo Gernsback detailed the future technology in detail. His description of radar in *Ralph 124C, 41 Plus* includes the principles upon which the innovation would work. Published in 1911, the book represented the fruit of Gernsback's reflections over many years. Among inventions described are two-way television, rays that destroy germs, tape recorders using the ¼ tape which was accepted as standard in the 1950s, football matches under floodlighting, artificial silk and wood, stainless steel products and advanced building materials. Gernsback, who edited shortwave radio journals, invented the word 'television'.

His flair for radio excited the admiration of the great American radio pioneer, Dr. Lee De Forest. When Gernsback's book was re-printed in the USA during 1950, it included two forewords – one by the author, the other by Dr. De Forest. Two world wars had occurred since the book was first published. Gernsback had been properly realistic about human nature.



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 JANUARY, 1932

The masthead of Wonder Stories, one of Hugo Gernsback's world famous journals from the early 1930s. Known as "the magazine of prophetic fiction," it correctly foretold many of today's innovations in world wide communication.

The book's blurb makes the point:

Romance – Mystery – Martian Intrigue

Against an amazing background of mechanical, electrical and chemically altered life of mankind there is set a brilliant and colorful romance in the life of the greatest living scientist of that age.

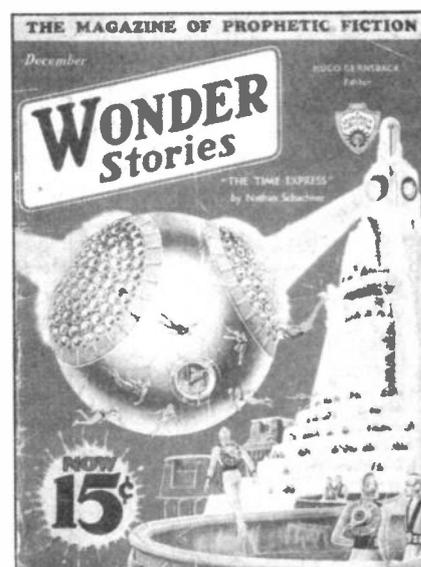
Ralph's love for the beautiful stranger, his conquest of his rival and the worsening of the great saturnine Martian, culminating in a running fight in space with tragedy and terror conquered by almost unbelievable and incredible weapons, make one of the most interesting and gripping stories ever told.

Anti-gravity devices

Hugo Gernsback believed that anti-gravity devices would be operative before the end of this century – shades of the H.G. Wells anti-gravity component Cavourite, described in *The First Men in the Moon*. It's not likely that Gernsback was thinking merely of rocketry; he referred to flying saucers. Could it be that someone, somewhere in the world, has already discovered the secret?

Solar energy, pollution-free cars ('electrobiles') and vast motorways that never wore out, were all part of his vision for the late century. He suggested that petrol-driven cars would have to be abandoned, because of their damage to the natural environment. Helicopter ports on top of buildings, recorded music in public buildings, remote-controlled street lighting (itself sensitive to natural light conditions) and other recent inventions were foreseen by this remarkable man.

In 1930, at the beginning of a golden decade for shortwave journals, Hugo Gernsback launched what was to become the world's most famous shortwave journal, *Short Wave Craft*. Avidly read by the



Compared with today's science fiction magazines and novels, the front covers of Gernsback's books were innovative, and pictured many fabulous animals and machinery. Here then, fiction is stranger than fact.

growing army of shortwavers, the magazine was always stimulating and well-informed. Significantly, it carried features about radio pioneers many of these personally known to Gernsback in his twenties and thirties. He celebrated his fiftieth birthday in 1934, by then involved in new publishing adventures. His Stellar Publishing Corporation (96-98 Park Place, New York) published the highly popular and entertaining *Wonder Stories* which combined science fiction with the likely inventions of the future, allied to the social sciences. Back issues reveal a preoccupation with interstellar communication and the red planet, Mars. *Wonder Stories* – though always exciting – combined an element of vision, with literary quality. It was no mere 'SF pulp'. Man's journeys to other planets will be possible through new electro-static grids, anti-gravity networks which will be associated with new concepts in radio communication.

Amateurs in 1990

In that sense, amateur radio in the 1990s may listen in to astronauts on terrain far removed from our own. As we have seen in the space programmes of the USA and USSR, space travel is possible, courtesy of the radiowaves. For Gernsback, the possibilities for space/time travel would be amazing enough, yet rely on the competence of radio frequency communication.

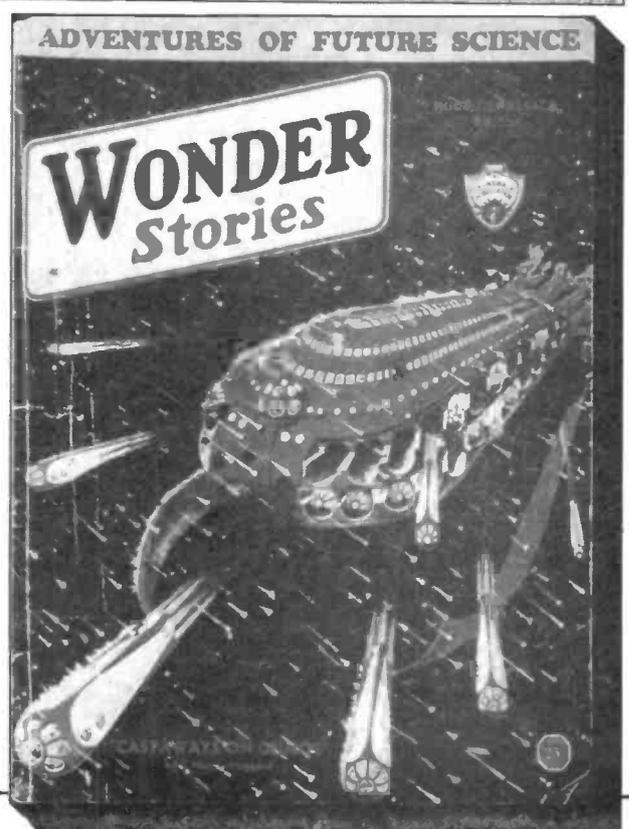
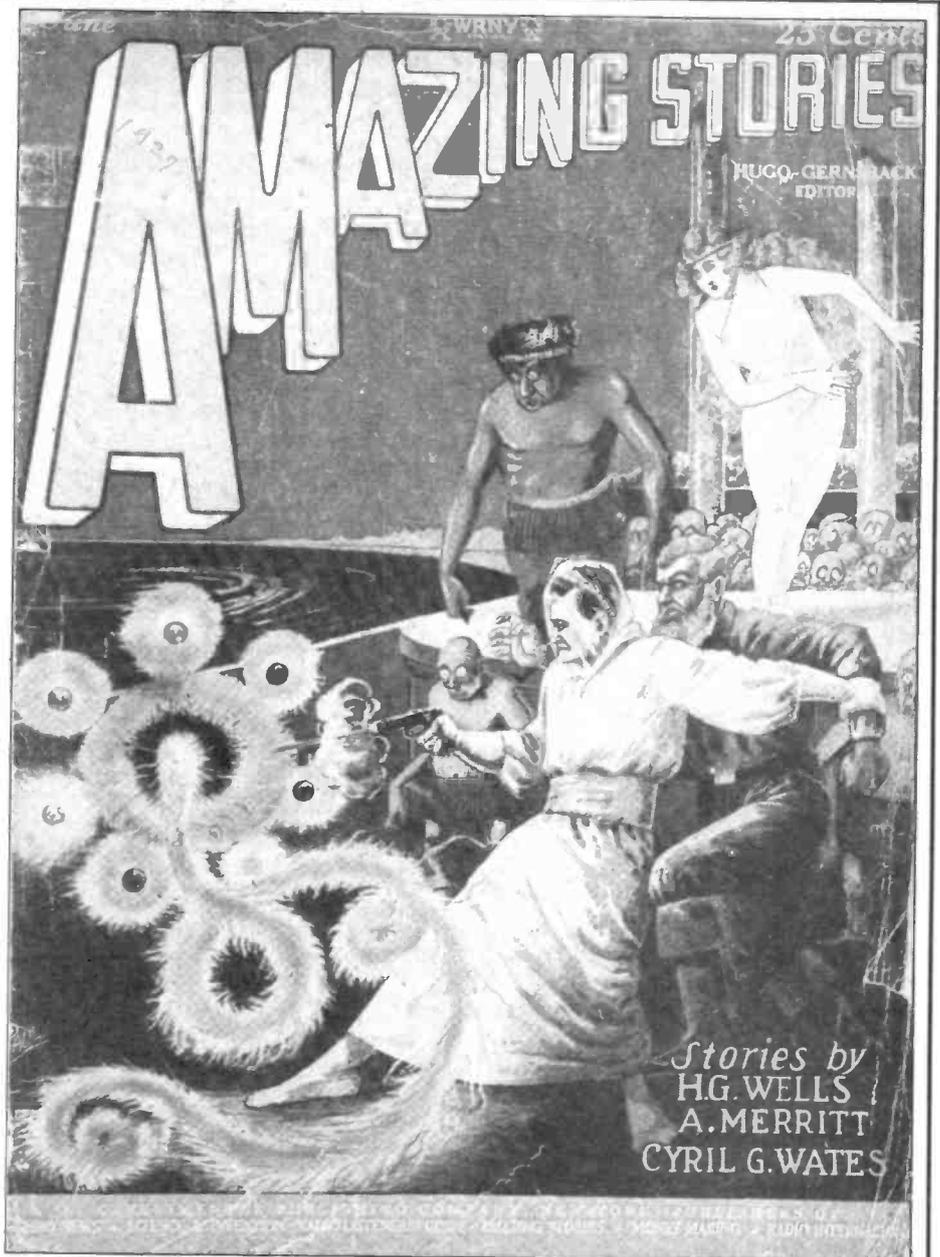
Shortly before the beginning of the second world war, he launched yet another title *Radio Electronics*. Alas, few British enthusiasts were able to see it. Today, copies of this journal (as of *Short Wave Craft*) are eagerly sought. Holding around sixty patents for inventions, Gernsback remained keenly interested in shortwave to the end of his long, busy life. He died in August 1967, well into his eighties. For most Americans, as for shortwavers worldwide, his name was synonymous with that of amateur radio.

SHORTWAVE AND THE FOURTH DIMENSION

Today, he is recalled with affection and admiration, not merely as the writer who developed the amateur radio hobby, but as a visionary who saw that worldwide communication was the key to everything else. As we wonder if the universe is itself limited in relation to other universes now beyond our technological reach (but perhaps not for ever so) we grasp Gernsback's essential point.

If international amateur radio communication could develop largely free from political considerations, ie apart from appropriate frequency arrangements, mankind might free itself of warfare. Gernsback demonstrated that the ability to invent wonders came readily enough to technological man in the late 20th and early 21st century. But it was in his amateur radio magazines that he showed the possibilities of friendship. The most important vehicle in our times might well be the "Short Wave Craft".

Right: A Merritt's classic story, "The Moon Pool", has been reprinted many times, this one 50 years ago! Below: More amazing and wonderful stories from the Gernsback file. In the year 2050, we'll probably look back at 1980s sci-fi book covers and say: "Didn't they have odd imaginations!"



Buy

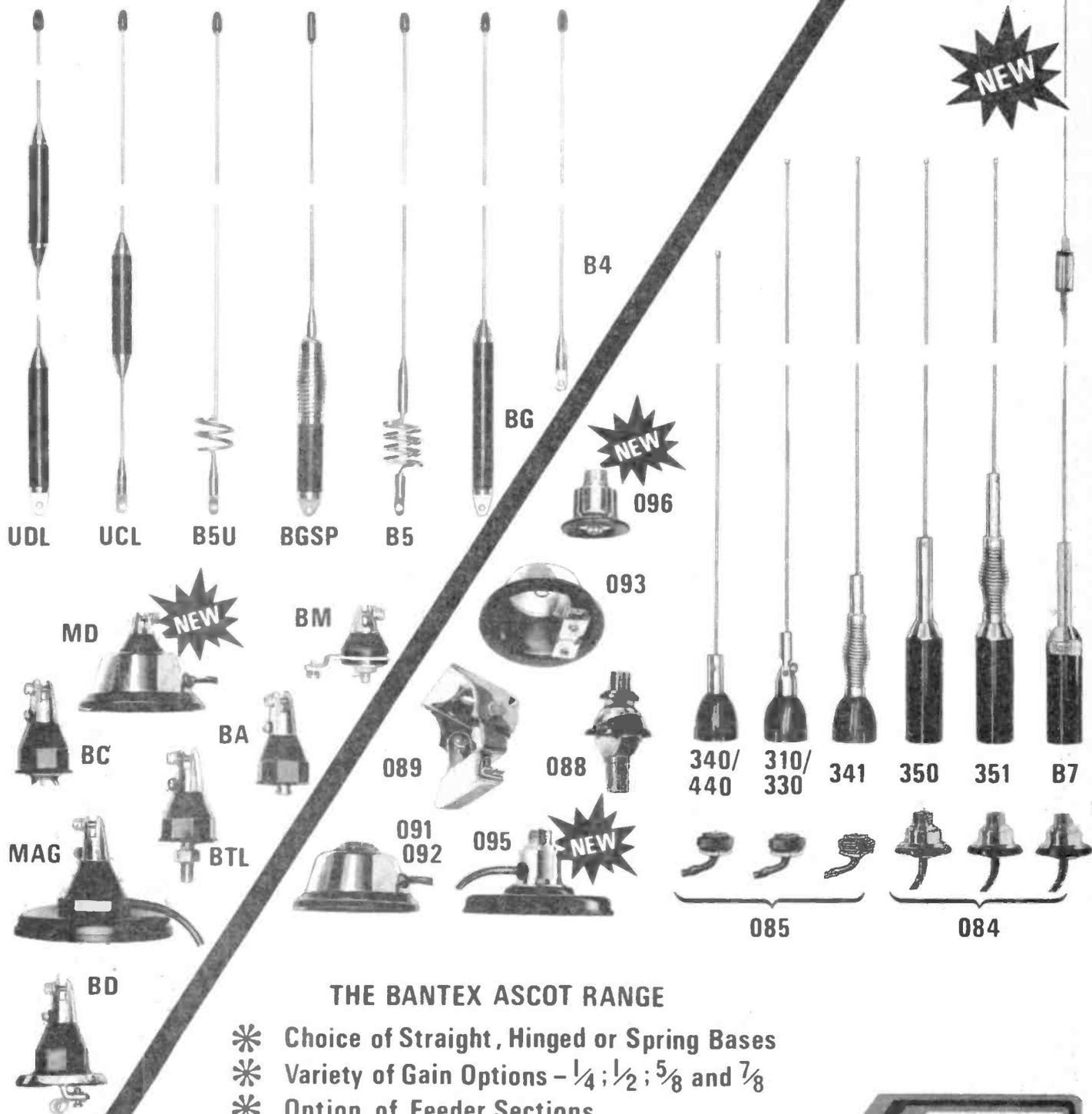


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TRIO TR3500

Angus McKenzie, G3OSS, continues his comparison report on hand-held rigs. See last month's issue of Amateur Radio for data on the Icom IC-2E and IC-4E, Trio TR2500, and Yaesu FT-708R and FT-208R.

Last month I reviewed three 2m hand portables and two 70cm ones, but unfortunately the TR3500 did not arrive in time to be included, although its 2m equivalent did, and was.

The TR3500 is identical in all its facilities to the 2500, but with two minor exceptions: the squelch control has a click position at fully anti-clockwise to give a nominal average squelch setting, whilst the repeater/simplex switch has plus as well as minus TX shift, the switch having four

positions including a position for receiving on the dial frequency but transmitting on the memory frequency – MO.

The April issue of *Amateur Radio* carries full details of facilities on the hand-helds which include reverse repeater shift, switchable auto tone burst, touch pad operation for frequency, memory and up/down functions. On the TR3500, programmable band scan is useful, but unfortunately up/down steps are only 5kHz which makes it annoying when you want it to shift just two or three normal channels, this being the same problem as with the TR2500.

The RF input sensitivity measured reasonably well, but it is noteworthy that the FT790 was better. The TR3500 was accurately tuned up to give optimum performance exactly at centre channel frequency. RFIM, whilst being better than that noted on the FT790 was none too good, the IC4E being a few dB better while the FT708R was excellent – RFIM though is of less importance on a 70cm RM rig.

While the selectivity could be said to be adequate, most other rigs were better; the alignment was well carried out, measurements on either side of the IF being virtually identical. No S meter is fitted. The maximum available audio output power was, as usual for a hand held, limited, but unfortunately the loudspeaker was also rather inefficient, although having a better-than-usual response.

Audio distortion at lower levels was adequate. We very much liked the quality of the optional accessory loudspeaker/microphone supplied by Lowe Electronics, and we preferred it to the normal one. The receiver squelched current drain is much lower than on the 790, but alas 50% higher than the two other 70cm hand-helds reviewed last month. We noticed more ignition interference than usual on the receiver when out portable, but could not pin this down.

Results analysis and personal comments on use

The transmitted output power was slightly higher on absolutely fully charged nicads than given by the home based stand/charger. Note that the power in any case is higher than that of the FT790, whilst the current drain was actually lower – a credit to Trio. Low power was usefully set at just over 1/7th of high power; the current consumption was thought reasonable. The 1750 tone burst was so short that we could not accurately measure deviation, but it seemed to be reasonable, its frequency being accurate. Typical peak deviation on speech was around 6.8kHz, absolute maximum being only marginally higher, which shows excellent limiting.

Transmitted speech quality was thought by most listeners to be above average. The transmitted output frequency was

unfortunately quite noticeably off channel, but not sufficiently off to cause much of a problem. Repeater shift accuracy was within 100Hz, but of course was affected by the inaccurate main output frequency. The purity of the output spectrum was thought good; second and third harmonics being below 60dB.

Conclusions

Whilst greatly comparing the tuning ergonomics of the TR3500 with those of the IC4E, we all found the 5kHz steps a considerable nuisance, and Trio should have provided a key pad means of selecting five or 25kHz up/down steps. In previous years, when most 70cm operating was via repeaters, and one only regularly used two or three of them which could be stored easily in memory, up/down steps were not so important, but now that there are far more simplex QSOs, tuning ergonomics really do matter. The listen on input reverse repeater facility is extremely useful, and the size of the rig, with its acceptable weight obviously helps it to be recommended as a useful little portable with far more comprehensive facilities than those on the IC4E.

However, I personally still prefer the FT708, and the FT790 which is (however) not really a handheld. If the importers could attend to the 5kHz steps problem with a minor mod, I would recommend it more strongly. Similar accessories are available for the TR3500 as were detailed for the 2500.

FM HAND-HELD TRANSCEIVER MEASUREMENT: Trio 3500

70cm. **General:** Carrier frequency 433,000MHz. Deviation 4kHz. Modulation 1kHz.

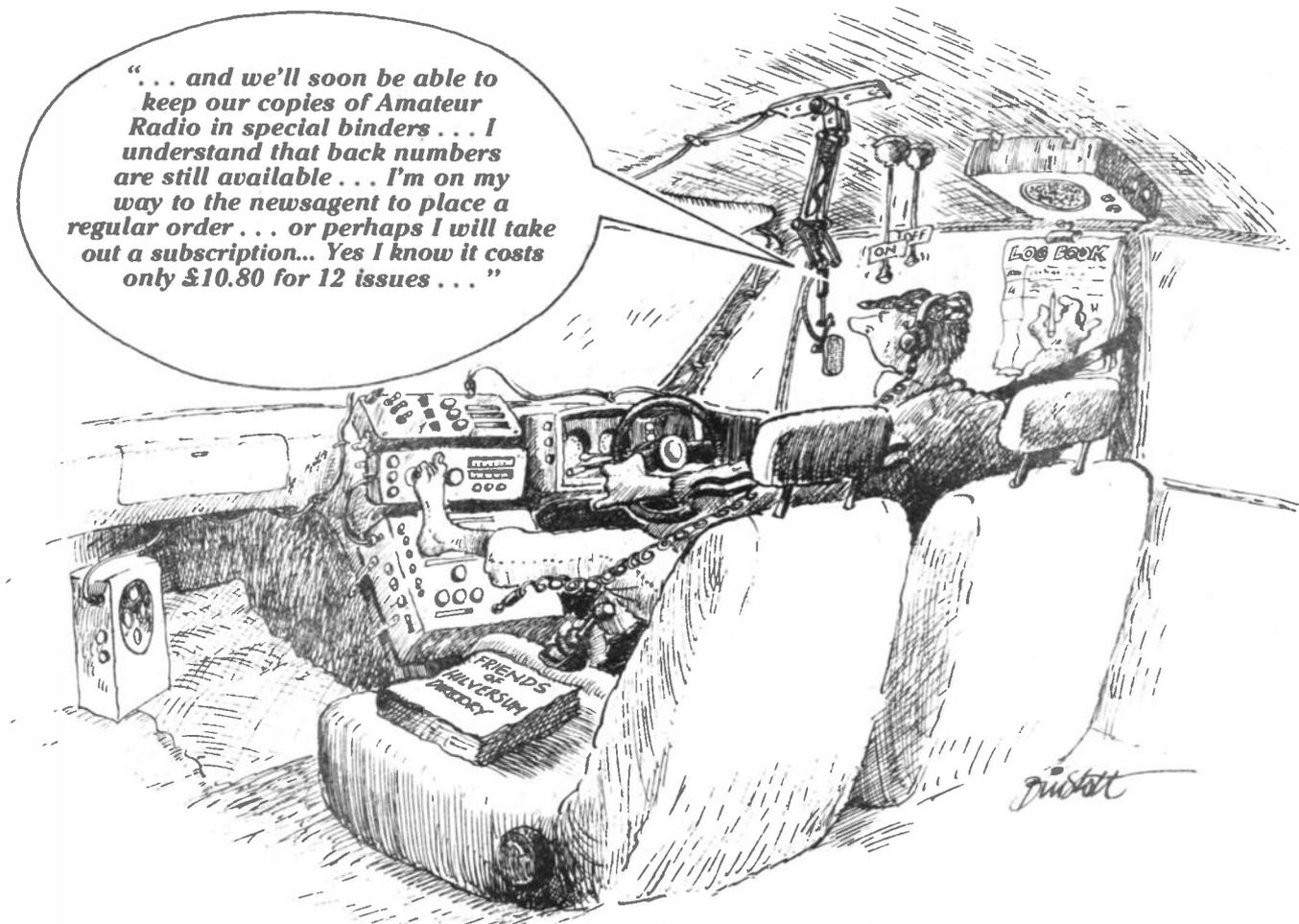
Receiver measurements

Sensitivity: RF level for 12dB sinad (uV pd)	0.18
Generator shift for best sinad (kHz)	0
Best sinad when above carried out (dB)	12
RFIM at 25 and 50kHz offset for 12dB sinad product (mV pd)	0.06
Selectivity high/low alternative channel spacing ratio off channel to on channel (dB)	56/55
Selectivity high/low adjacent channel spacing ratio off channel to on channel (dB)	48/48
Audio output power for 10% THD (W) (into 8 Ohms)	0.6
THD for 125mW audio output into 8 Ohms (%)	2.6
DC current drawn when squelched (mA) (rated battery voltage)	38

Transmitter measurements

Power output high/low: (W) batteries fully charged	2.2/0.36
Power output high/low: (W) using base stand supply	1.9/0.31
Deviation from dialled frequency (Hz)	+1.1kHz
Deviation of repeater shift from 1.6MHz	-100Hz
Toneburst accuracy	Within 2Hz
Toneburst deviation (kHz)	7.2/6.8
DC current drawn high/low: TX (mA)	620/270
Harmonics high power 2nd/3rd (dBc)	-61/-66
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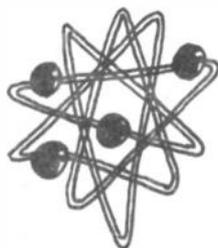
Elementary science, electrical theory about
current, conductors and atoms. Explained by
Nigel Gresley.

If you took the trouble to read the article in last month's issue, you'll no doubt be eager to get stuck in and set about learning how to pass the exam; you'll have bought your RAE Manual and reams of paper and you'll be all set to go.

So let's kick off and set about learning some basic electrical theory. This forms part of the syllabus for Part 2 of the exam and it's a pretty good place from which to begin our investigation, since practically all else follows from the basics. And if you can get these sussed out you'll be well placed to understand what follows in the months ahead.

Basic electrical theory, then. Actually, we can start with a bit of elementary science, which says that every little thing in the universe is made up of things called **molecules**. The point about a molecule is that it's the smallest quantity of a substance that can exist while still displaying whatever properties that substance happens to have.

One molecule of common salt, for example, is about as small an amount of common salt that you could have without the molecules itself being split into the things that themselves make up molecules – don't worry, we'll come to those shortly. One molecule, however, is an incredibly small amount of something; your average grain of common salt, for instance, is made up of millions of molecules and indeed the highest-power microscope ever made (the electron microscope),



can see only very large molecules. So don't run away with the idea that molecules are rather like grains of sand, because they're much, much smaller than that!

Part 2

Now, if you take your local friendly molecule of salt (or sand, or whatever) and take a closer look at it (not literally, of course – you need some fairly monumental equipment to suss out what a molecule is made of) you get down to some even smaller things called **atoms**. These are the basic ingredients of any substance you care to name. There are just over a hundred different sorts of atoms, from very simple ones to quite complicated ones and if you hang in there you'll see in a minute how one atom can be more complicated than another. If we go back to our example of bog-standard common salt, such as you sprinkle on your cod and chips, you find that one molecule of it is made up of one atom of a substance called **sodium**, which in its ordinary state is a weird soft

**“Electrically speaking
the whole atom is
neutral – it doesn't
have any net charge,
positive or negative”**

metal that's apt to burst into flames all of a sudden, and one atom of something called **chlorine** – this is basically a nasty smelling gas that's green and thoroughly unpleasant. The compound of sodium and chlorine in this case is called **sodium chloride**, which is the fancy name for salt, and it's important to note that the substance called sodium chloride is quite different from either sodium or chlorine in its properties.

Since this is supposed to be all about passing the RAE and not passing O-level chemistry, we won't go any further with that bit of it; just remember for now that two types of atom have combined to make one molecule in this case. Everything in the known universe is made up of some combination of one or more atoms

to form molecules – even you and me! We're getting down to some pretty basic stuff here! It so happens that sodium chloride is a pretty simple compound, and indeed it's as simple as you can get insofar as two different atoms combine to make up one compound; if you take something like your dining-room carpet, for instance, you'd find that it is made up of much more complex molecules which were formed from atoms of carbon, hydrogen, nitrogen, sulphur and the Lord knows what else. So molecules can either be quite simple or devilishly complicated.

Anyway, let's get back to the RAE before we get off our track and start turning the lounge into the National Chemistry Research Establishment. Let's have a closer look at these atoms because that's where we start with electricity and we'll need to know a bit about how they're put together.

It's only fair to say at this point that modern scientists tend to have all sorts of violent disagreements about exactly what goes on inside the atom and if you start delving into it too deeply you're likely to end up with pages of things like probability theory, de Broglie waves and a very sore head. Serves you right. So we'll stick to more or less the classical model of the atom and what makes it tick, and we'll just bear in mind that you're likely to come across all sorts of arguments and ifs and buts in the clever magazines like *Wireless World*. Don't worry about them for now, you can always write the definitive story in twenty years' time when you're well out of the RAE stage and writing learned papers in the Proceedings of the Institute of Physics or whatever. Basically, an atom is supposed to be made up of a sort of central core of two other particles, which are called **protons** and **neutrons**, and some even smaller particles that whizz round the central core like a satellite in orbit. These are called **electrons** and these little beasts are where we start the science of **electronics**.

Needless to say there's more to it than that, and there are supposed to be about fifty other sorts of other particles inside

an atom which belt about doing their thing but we'll promptly forget all about those and concentrate on the atomic Big Three of the proton, the neutron and the electron.



You'll have realised by now that these really are the fundamental things of which every single solitary thing in the world is ultimately composed of. Nobody quite knows whether they're particles or what but at least if you think of them that way you don't sprain your brain too much so we'll stick with the idea that the electrons orbit the little bunch of protons and neutrons (the little bunch is called the **nucleus** of the atom, by the way) and the whole affair constitutes one atom. What makes one atom different from another – that's to say the difference between an atom of sodium and an atom of chlorine – are the numbers of protons and neutrons in the nucleus and how many electrons there happen to be. As you can imagine, it isn't exactly the easiest thing in the world to find out, so we'll have to take the physicists and such on trust and believe what they tell us.

A couple of other small points also need thinking about before we have a closer look at the electrons and things. Electrically speaking, the whole atom is neutral – that's to say it doesn't have any net charge, positive or negative. We don't want to get into the more arcane points of what's meant by "charge" here, by the way (or at least not yet awhile) so think of it at this stage as being positive or negative in the sense that the poles of a battery are, and if you're a Great Brain don't start tut-tutting and writing to the Editor because if you're that clever you shouldn't be reading this article anyway – you should be writing for us and making a

small fortune... ahem, where was I?

Oh yes, charge. Actually, the nucleus (ie, the protons and neutrons) has a positive charge associated with it but the electrons are negatively charged and the two cancel themselves. So remember that the electrons are negatively charged, although we won't be returning to exactly *why* it matters for a while yet so don't hold your breath!

The other thing to bear in mind at this stage is that the inside of an atom looks a bit like a map of our solar system – in other words, it isn't that all the electrons orbit the nucleus at one fixed distance away from it (unless it's a simple atom with only a few electrons, that is) but some are at different distances from the nucleus rather like Mars orbits the

“So we can see that there are two basic ways in which atoms and electrons interact . . .”

Sun closer in than Jupiter or Uranus. If we take some ordinary copper wire, for example, and in some magic way examine what's going on inside one atom of it, we'll see that there are four "orbits" where you'll find electrons. The orbit nearest the nucleus has two electrons in it, the next orbit out has eight, the next one out from there has 18 and the most outer orbit of all has only one.

This outer orbit, however, is jolly important and we musn't think that it isn't just because it only contains one measly electron. The thing is that this electron isn't in a tight and fixed orbit round the nucleus, so to speak; it's quite easy to dislodge it, and in many atoms what happens is that there's a sort of random exchange of electrons between different nuclei. The outer shell electron, if you like, does a couple of orbits of one nucleus and then dives off towards another one and whizzes round that one

a few times – that's a rather picturesque way of looking at it, but in more or less all the metals, like iron or copper or silver or aluminium, this is what's happening.

Conductors and insulators

However, if we take a substance such as glass or wood, we find that things are a bit different. Glass is actually a compound of a few things as opposed to being a single element on its own like copper, but the principle is the same. What happens here is that the outer ring of electrons is shared by several atoms, or to put it another way one atom shares its outer electrons with other atoms and the whole thing forms a sort of lattice structure. In other words, the outer electrons aren't in the least bit mobile because it's extremely difficult to dislodge them from this stable structure.

So we can see that there are two basic ways in which atoms and electrons interact, and if you've stuck with things so far you may have guessed our next trick. This is that the two types of substances, to wit those whose electrons are mobile and dislodge-able and those whose aren't, are called **conductors** and **insulators** respectively and practically every material in the universe falls into one or other category. However, before we go any further we should say that there is another type of material known as a **semiconductor** – don't worry about semiconductors at this stage but we'll be paying them a good deal of attention later on when we get to things like transistors and what-have-you.

Righty-ho, what about conductors and insulators? Let's take a piece of ordinary copper wire and apply a battery to it, or in other words, apply an electric field to it. You remember that the electron is negatively charged (and we'll be looking at what we mean by charge by and by, so hang on a sec) and that copper is one of those substances in which the electrons are mobile and drift around between atoms. When we apply the battery, what

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happens is that the negative electrons tend to feel rather attracted to the positive pole of the battery because as we've seen, opposite signs attract each other and it's the fact that the nucleus of the atom is positively charged that keeps the electrons more or less in order around it. So in between orbits, the electrons in our copper wire tend to move towards the positive pole of the battery, and (wait for it) this movement is known as an **electric current**.

If you have a conductor, such as our copper wire, this will happen as long as there is some sort of difference of potential or voltage or whatever you want to call it between the two ends of said conductor. This is due to the tendency of the electrons to move from the point of most negative potential or charge to the most positive ditto.

So that's a very basic explanation of what an electric current actually is – there are a few twiddly bits, but in essence it describes what happens when you connect a bulb to a battery, for instance. The electrons seek to equalise the difference in potential between the positive and negative poles of the battery and in order to do that, there's a sort of net "drift" of electrons through the wire

and the bulb and back to the battery. As the battery runs down and the potential between the two poles gets less, the electrons don't drift quite so purposefully and the bulb glows a little less brightly – and when there's no more potential between the two poles (ie, the battery's flat, Brian) the electrons just go back to randomly drifting between atoms without any net movement either way.

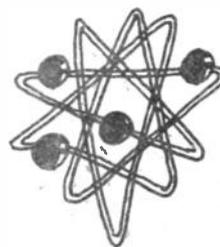
However, if you apply your battery to each end of a glass rod, for instance, what happens then? You've probably guessed that the answer is not a lot, because as we saw earlier the outer electrons are quite happy to stay where they are – they're in a stable ongoing relationship with each other and their parent atoms, so to speak (makes the inside of an insulator sound like an Islington family, doesn't it?) and they don't feel any need

“This is why we tend to coat our copper wire with an insulator in the form of plastic or rubber . . . ”

to move. Well, actually they do, but because these electrons are much more restrained than the corresponding electrons in copper or aluminium (for example), probably not a lot is going to happen as far as any flow of electric current is concerned. Sure, there'll be a fair amount of strain since the electrons are still attracted to the positive pole of the battery or whatever, but you don't get the steady drift that we saw with our copper wire.

So this is what an insulator does, or rather doesn't – it doesn't allow an electric current to flow, and indeed this is why we tend to coat our copper wire with an insulator in the form of plastic or rubber, so that we can handle the wire without having an electric current flowing

through our fingers and so on. Yes, Brian, the human body isn't a perfect insulator and electric current in the fingers can be nasty, so watch it!



Just to finish with for now, don't run away with the idea that as soon as you connect the wire to the battery there's an instantaneous of an electron from one pole of the battery to the other. Remember we called it a drift, and so it is; it starts pretty well as soon as you connect the battery, but the actual speed of drift

An inch a minute

of one electron itself is extremely slow, even in a cable carrying a very heavy current it isn't usually faster than about an inch a minute.

We're getting a bit short of space so we'll leave it at that. Next time we'll be taking a close look at what we mean by "positive" and "negative" and having a look at things like potential difference, electromotive force and charge. We shall also sort out what we mean by voltage and current – so there's plenty to whet your appetite there. See you next time . . .

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Transverters VS black boxes

TWENTY YEARS ago, almost all communications on the 2m and higher frequency bands were either with amplitude modulation or CW. There were no black boxes available with an output directly on VHF, other than the ancient Gonsette communicator and a Heathkit rig.

I can remember only two makes of transmitter for VHF - Withers, and Tiger. Invariably, the DX hounds made their own equipment, including receive converters, and some even made the receiver too, although most amateurs used receivers such as the AR88, HRO, BRT400, or even the dreaded R1155 as IF strips. None of these receivers had product detectors unless they had been modified.

SSB started gaining popularity about 20 years ago, after early experimenters including G3MED and G3CCH (for example) had built their own transverters. It is perhaps of interest then that SSB on 2m started with transverters, Collins for example, making an excellent one, with a 4 x 150PA, in the early 60s, and the first SSB complete black box did not arrive on the scene until the next decade, including the dreaded Liner 2.

Its performance was dreadful, having bad transmit quality, and an extremely poor receiver. Part of the problem was the

Which system for you? Both have their advantages, says Angus McKenzie, G3OSS. On these pages, he explains the pros and cons of using HF rigs with transverters for VHF and UHF.

use of badly designed mixer circuits, with local oscillators deriving their frequency from mixtures of various crystal chains, the circuits generating many spurs in and out of the 2m band. Not for some while did fairly respectable rigs such as the Trio TS700 multimode appear.

FM activity commenced in the late sixties, with an early group of keen enthusiasts around the London area originally forming the UK FM group having a net frequency then of 144.48MHz. I hasten to add that this frequency is now part of the SSB section.

Almost all the earlier FM black boxes were crystal controlled, VFOs and synthesizers not generally coming for many years after the time that FM had already got a hold of the 2m band. It will thus be seen that there are two entirely separate philo-

sophies in originating and receiving signals on the VHF and UHF bands; one way is to generate a CW, SSB or FM signal, usually between 28 and 30MHz and transvert this band up to the appropriate higher frequency, the alternative, of course, being the use of a "black box". The transverter should be essentially a linear device, provided it is not over driven, so whatever goes in at 28MHz comes out at 144MHz.

Similarly, a perfect transverter on receive gives an output on 28MHz from an input frequency of 144MHz. Matters however are not so simple as this, for no transverters or HF rigs are anywhere near perfect. The alternative black box generates inside the box an IF signal on TX which works its way up to the final output frequency either by multiplication or by beating with local oscillators. On receive, the VHF band for example, usually beats down to an IF such as 10.7MHz for SSB, or perhaps an additional 455kHz IF for FM. Most black boxes for 2m which incorporate an SSB facility are single conversion for this mode and this is actually of extreme importance in making the final choice, for a transverter coupled to an HF rig essentially has at least two and possibly up to four local oscillators before the main filtering. For example, a typical 2m transverter has its local oscillator derived from a crystal,

with injection at 116MHz, thus $144 - 116 = 28$. Although this is obvious, how about the following equation? $144 - (2 \times 58) = 28$, but $(3 \times 58) - 146 = 28$.

This immediately shows that the choice of a 58MHz crystal is deadly for a 2m receive converter since a very small proportion of 3rd harmonic in the double-circuit from 58MHz to 116MHz will give you the 2m band upside down, as well as image bands at 202MHz and 88MHz. This is not the only bug that you can get with 2m receive converters, so let's look at a few more problem areas.

$116 - 88\text{MHz} = 28\text{MHz}$. Thus an FM transmitter at the very bottom end of band two can cause chaos with a 116MHz local oscillator, for even if it is coming out at well below 28MHz, it may be strong enough to cross modulate with strong in band signals. Any multiple combination of transverter and HF receiver front end local oscillators can beat with unwanted input frequencies to give an audible output, and local minicab or other PMR services always seem to get through if they possibly can! A good transverter will not only have a clean local oscillator, but a very high Q RF pre-amplifier circuit, thus rejecting out of band signals before they can mix with local oscillator spuri etc.

Sensitive front ends

Some transverters have far too much gain, and thus overload the main receiver causing more spuri and so on. Unfortunately, the design of a transverter has to be a compromise between performance and cost, although I feel that some designs I have encountered could have been much better at no additional cost. Transverters usually have very sensitive front ends, and should have clean transmitted outputs if driven with a clean signal. I have even come across the odd valve transverters which are not too clean, although this is sometimes because of dirty 28MHz signals fed into them.

What else can be wrong with transverters? Imagine a 1mV strong local signal coming out of the transverter at perhaps 30mV (at least) and then into an average HF receiver. This high input level would just about be satisfactory on its own, but when other signals are on the band, which are also strong, RF intermodulation products can be detected all over the place which can cover up weak signals. Noisy local oscillators having bad phase jitter or noisy sidebands either in the transverter or HF receiver, can reduce the effective dynamic range of the entire receive system, this effect being called "reciprocal mixing". Putting in the ubiquitous 20dB attenuator on the rig doesn't help, and in any case 20dB attenuation will usually ruin the effective noise figure of the RF chain since most HF receivers are moderately deaf. The optimisation of transverter receive gain to give no overall sensitivity loss, but good dynamic range together with any given HF receiver is not simple, and the sources of problems are sometimes very difficult to locate.



So how about black boxes? I have measured a good few in my time and have yet to measure one with a front end noise figure better than 5dB unless it has been either very carefully tweaked, or modified. A Microwave Modules transverter though can typically have a front end noise figure of 2.5dB. Linear 2s that I have measured varied from 8dB to a deaf 12dB! Unmodified Yaesu FT221s are 7dB typically, but so much better with a Mutek board front end, whilst Trio 700s etc. usually made 6.5dB. Most of these black boxes though, have quiet local oscillators and only one IF for SSB, usually at 10.7MHz, so their dynamic range (potentially) is very good. But it is their sensitivity and sometimes RFIM performances, which are poor. Furthermore, few black boxes have other than fairly poor SSB receive filter pass bands, and I have not yet come across one with even a half decent CW position. The only way of getting round the sensitivity problem is to use a masthead pre-amp for optimum results, or an external pre-amp, perhaps built into the linear as a compromise. Many pre-amps though, have grossly excessive gain, one actually achieving 18dB.

Using such a pre-amp would therefore be giving 8mV to the black box from a 1mV aerial signal, and so we go round and round in circles again with RFIM etc. You need in practice at least 8dB, and preferably 10dB more gain in the pre-amp so that

Left: The Icom IC-251E 144MHz all mode transceiver – an excellent piece of equipment in the black box category. Top this page: Another top flight black box, the Yaesu FT-221R 2M transceiver. Above: Microwave Modules's 70MHz SSB transverter, showing connections on this otherwise uninteresting looking black container. The goodies are all inside!

the dB figure representing the coax cable loss and the noise figure of the black box, and thus a satisfactory masthead pre-amp should have 14dB gain at least, to overcome 2dB cable loss with 4dB RX noise figure. We can get dangerously close to overloading an unmodified receiver if there are strong signals present, and so most of the experts modify their black boxes to reduce the RF gain before the mixer, without losing out on noise figure, and possibly even improving it. Lower cable loss with an improved black box front end allows less masthead gain for a given overall sensitivity, and therefore greatly improved receive intermod performance and fewer signal overload problems.

On the transmit side there are just as many problems to consider. When you add linears to transverted HF signals, you are likely to get bad frequency modulation on CW or SSB transmissions. RF feedback can easily get into the mike leads or transmitter audio circuits, and we all know

Transverters VS black boxes

what the result can be. The problem can be exaggerated if there is a poor SWR on the VHF aerial signal, for the returned RF from the aerial seems to find its way almost everywhere in the set-up. RF signals have a habit of getting back into power supplies causing the 13v rail to wiggle up and down and thus vary the frequency slightly as the voice amplitude varies. The most recent HF transceivers are usually designed to work properly in too many types of external transverter, but many an old dreadnought is not. I have not heard too many FM problems on SSB black boxes when they are used with linears, with the exception that some FT221s seem rather poor for this.

RF feedback though is another matter, and if you have shuddered at the sound of a Liner 2 tweaked up to flat out power into a 4 CX250B running CFFT BTF (crammed full, fit to bust, back teeth floating), which I have, you will wonder how it is that some people don't seem to care. Sometimes, the dynamic range of the transmitted output may not be too good, so that noise sidebands of a transmission may be puffing away even 500kHz off channel. Most of us would, at first glance, think that 60dB rejection of off channel noise would be reasonable, but this amounts to as much as 1uV noise on a 1mV received signal. Thus giving a noise floor into some poor chap's

receiver which would be around an S7! Even 80dB is not really good enough, and 90dB is perhaps what should be aimed at. But very few rigs indeed are as good as this, although usually black boxes are slightly better than HF rigs with transverters. Unless the HF rigs are very carefully set up. The basic problem can be inadequate dynamic range of the transmitter IF stages after the SSB filters, for any noise floor will be amplified up by later stages to a level that is all too often significant.

"A very thorny subject which is well worth investigation - HF transceivers driving transverters"

Another major difference on TX, is that black boxes invariably have ALC applied around the PA, but most transverters very unfortunately omit this. But how about the situation with HF transceivers driving transverters? This brings up a very thorny subject which is well worth investigation. Most rigs have a low level transverter output from a maximum level of 250uW up to 500mW, dependant on the rig. Some incorporate the facilities of switching off the valve or transistor PA when feeding transverters. Almost always the HF transceiver's ALC goes with the wind when the PA is turned off, thus requiring extreme care in setting microphone gain, not only to avoid flat-topping the transceiver feed,

but also to avoid over-driving the transverter.

Things are particularly awful when, at a portable contest site, such equipment is set up carefully by the main operator who might not have a loud voice, to be followed subsequently by a loud fog horn operator who consistently flat-tops the equipment. There is only one way round this problem; this is to arrange for the transceiver feed either to be ALC'd from within the transceiver, or from the transverter, or even linear. Several Trio HF transceivers (including the TS820 and 830) get over the problem in a very cunning way. Although it is possible to switch the PA heaters off, they are in fact kept on for transverter feeds, but the screen grids can be earthed, thus disabling the PA whilst maintaining the input grid/cathode path, the heaters keeping the cathode warm. ALC is generated in the grid circuitry, and so the transverter feed is subject to ALC which greatly helps linearity. Under such circumstances the input preset of the transverter can be adjusted to allow maximum output signal from the ALC'd transceiver to give an output which is below the point where the equipment starts spreading, a typical Microwave Modules transverter for example, being set up to give no more than 6-8w.

If the linear itself requires less drive than this, for maximum output under normal conditions, then the transverter's input preset should be adjusted to decrease the transverter's output drive to the linear and thus further improve linearity.

Yet another good looking transceiver, the Yaesu FT-225RD 2m transceiver with digital readout. All modes, of course.



But what if the main transceiver cannot have ALC within it if the PA is switched off? In my opinion it is absolutely essential to have ALC from the transverter or the linear returning to the transceiver in this case. There are still some more problems to consider though, and it is amazing how frequently I have heard inappropriate matching even with ALC present. The maximum output of the transceiver with no ALC present, must not be at a level which can under any conditions over-drive the transverter, or the transverter over-drive the linear. A few operators have increased ALC levels to cut RF levels down, but this is wrong, since in many circumstances the system gain whips up perhaps by 20dB, when the operator stops talking. So IF noise and even any suppressed carrier breakthrough or hum comes right up.

Reducing gain

Such effects can cause distress not only to the listeners monitoring the transmission, but to many others using frequencies fairly close by. You may well have to insert resistive attenuators in the 28MHz feed to the transverter to cut the drive level down appropriately, if the transverter does not have an appropriate preset. Another point that may be worth mentioning is that some valve linears require relatively little drive for full output, but backing off the input gain to the transverter may not be the optimum way of reducing the system gain. A transverter designed to give 10w output which is backed off to 1w may have some local oscillator breakthrough into the linear of 116MHz (for example) and some linears can have resonances in their input circuits due to poor design or inappropriate setting up which can further exaggerate the breakthrough.

My first 432MHz/28MHz transverter had a really nasty problem which reared its ugly head first thing in the morning after the night before! I was blocking television for an entire block of flats half a mile away (which I must admit was a disaster area), so what on earth was wrong? A little investigation showed that no-one could receive ITV within an embarrassingly large radius, and it dawned on me that $(3 \times 28) + 404 = 488$ (MHz) slap bang in the middle of ITV. This problem was occurring in the mixer and was exaggerated by the post mixing bandwidth being too great, both in the transverter and in the linear, resulting in the 488MHz component being only at -30dB from output of the linear which was set up for 400W PEP. 400mW output in the middle of a TV carrier is not conducive to friendly relationships with neighbours, and so I soon changed over to a Microwave Modules system which after much adjustment, together with careful tuning of the linear, does not give any detectable output on my spectrum analyser at 488MHz. A few other amateurs have had exactly the same problem, but have thought the TVI was caused by the main signal swamping the telly, which sometimes it is.

There are very few transverters available for the 4m band, and whilst many 4m

addicts roll their own, the Microwave Modules one seems popular, two versions being available. You can either transvert from 28MHz or 144MHz in the two versions, both giving around 10w PEP output. The 2m 100w linear from MM can be supplied for 4m, to special order. In the London area, and presumably in many other urban areas of high population density, there are serious problems receiving 4m with transverters because of the number of image or spurious signals received which are overlaid on the 4m band.

If we mix the third harmonic of 42MHz (the local oscillator of the average 4m transverter), with 97.6MHz (Chiltern radio, near Luton) we get a whopper at 28.4MHz, which would be the same dial position on our HF receiver as we would also require for 70.4MHz. It is obvious that very high Q circuits are required for 4m RF input stages, and that local oscillators should be as clean as possible. G3JYP in Appleby, Cumbria has made an enormous high Q filter which he uses in his coax aerial feed for 4m to cut out such interference. Don't forget that the same ugly process will also work on transmit, so you might get some very irate neighbours trying to listen to their local IBA station whilst you are on 4m!

“... by far the most economic answer ...”

I wonder if I have scared you away from transverters yet! You might be thinking that expensive separate multimode black boxes are the best way out for both 2m and 70cms, but this is not necessarily so, unless you want to transmit and receive independently and at the same time on the two bands. I suggest that a 2m multimode black box together with a Microwave Modules transverter from 2m to 70cms is by far the most economic answer, for the following reasons: a 2m box plus the 70cm transverter will cost a lot less than two separate boxes. The MM transverter has built-in and switchable repeater and reverse repeater functions allowing you to use the main box in simplex mode when you want repeater operation on 70cms. You will have to modify the main box for tone burst availability on simplex, but this should be the only snag.

The MM transverter combination should be considerably more sensitive than the average 70cm black box, and furthermore, can be remote controlled, including repeater shift if required, allowing you to put the transverter at the masthead with its obvious benefits. If you do this, you will of course limit yourself to 10w output on TX, and you will have to waterproof the transverter by putting sealing compound (as used for car gaskets) between the lid and case, and also around all the sockets. In some locations you may also require an accessory bandpass filter in between the transverter and aerial to reject sprogs etc. A simple coaxial relay, and an appropriate power attenuator, to feed the 70cm transverter is all that you will need, as well as

a good antenna, to complete the installation. You can even put the relay at the top and save in coax cable cost. This also has the advantage of giving you a full 10w at the antenna rather than having to cope with the coaxial cable loss.

This system works extremely well under mobile conditions, and you only need the main 2m rig to be immediately accessible under the dashboard. A small panel with coaxial relay and repeater switches for 70cms can be positioned by the side of the main rig. If you are particularly keen on FM then you are likely to use the repeaters. Microwave Modules have just announced a new version of their 2m box with switchable repeater/reverse repeater functions, rather like their 70cm one, thus allowing rigs like the FT102 or IC740 to be used for repeater operation other than the tone burst facility, which can easily be built in to a little box on the mike input.

Your final choice

For 23cms, you can either transvert from 28 or 144MHz, the latter being very much better because of image problems with 28MHz, giving outputs on 1240MHz as well as 1296MHz. The higher IF of 144MHz is much easier to deal with because the image frequency will be virtually filtered right out within the transverter. Thus the black box, providing it has good filters and facilities, is better at driving 23cm transverters than the alternative system, which I use myself. I transvert from 28MHz to 2m with one Microwave Modules transverter, and then up to 23cms with another (more convenient but frankly not the best from a tidy technical point of view).

I hope you are now in a position to make your final choice. The best system (technically) is probably to use the best possible VHF or UHF rig and modify it appropriately, bearing in mind all the problems I have raised. If you do not have the experience required, and you are keen on CW and DX working, you are probably better off using transverters and a very good HF transceiver. For contest working, where you may need optimised dynamic range capability, a really good black box and linear will probably be better, and for mobile a similar installation is far more manageable than an HF rig with transverter. If you are not interested in attaining a Class A licence, then you are most certainly better off (financially) with a VHF box, and it is perhaps a pity that no one has yet made a really hot transceiver with perhaps 100mW output for 28-30MHz primarily for feeding transverters.

Let me now spill some beans by announcing incredibly strong rumours that Mutek will shortly release a transverter to give complete transmit and receive on all bands from 160-10m from a 2m black box input, the HF output being 10w (all modes) and undoubtedly built to Mutek's high performance standards. This nice little snippet may well influence you to start with a 2m multimode rig and consider adding the transverter later, when you get an A licence.

• MULTI-BAND • • CENTRE-FED TOPS •

By John D. Heys, G3BDQ

A New Look at
Wire Aerials: 2

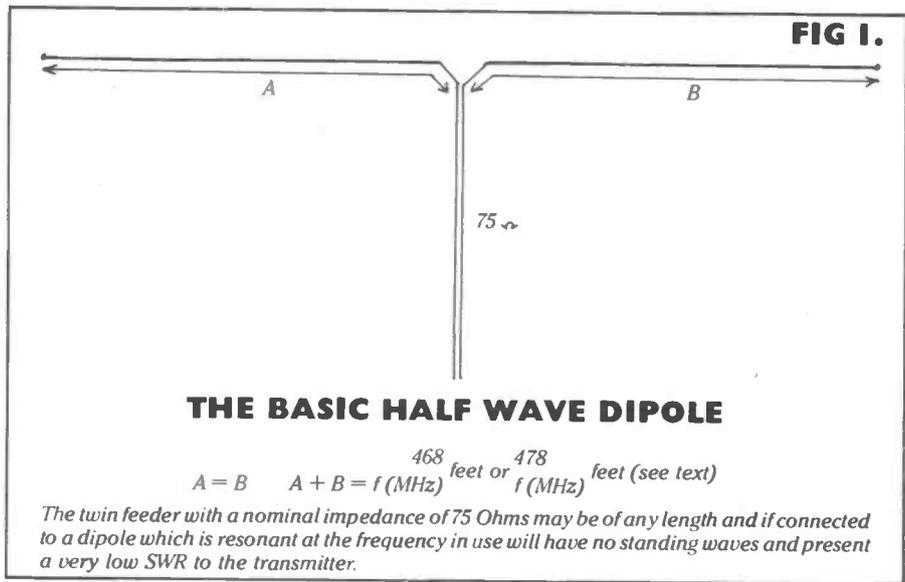
My previous articles on practical end fed wires stressed that such antennas could be of any length. This is a useful characteristic also of centre fed wires. End fed horizontal wires which are only about a quarter wavelength long are virtually useless as radiators because their high current section, which contributes most to radiating, is deep in the shack at the ATU!

Centre feeding a quarter wavelength of wire which is also horizontal will give us an aerial that will certainly give fair results if it is up at a reasonable height (30ft or more for bands HF of 7MHz) although its DX performance will not be startling. This means that all those unfortunate souls (yours truly was once in this category) with pocket handkerchief-sized gardens or back yards are not entirely denied access to the HF bands and can work some of the available DX which comes so easily to our more fortunate brethren having considerable real estate.

Such a centre fed system, just 70 feet long helped win a contest back in the early fifties. Most of the QSOs were with British and European stations on 7 and 3.5MHz and the fact that the wire was only some 30 feet up helped to give the needed high angle radiation.

Length of top and feeder

Centre fed wires (which must *not* be confused with resonant dipoles) must be balanced if they are to work. This factor, and not their length, is the most important consideration. Because the top is not normally chosen to be a self resonant length on any of the HF bands, the centre feed impedance cannot be easily deduced. It is rarely 75 Ohms. This does not matter because the feed system can naturally accommodate *any* impedance up there. This miracle feeder is high impedance twin line, either of the home-brew variety or the commercially available 300 Ohm ribbon. This latter has certain advantages and also disadvantages which will be examined later in this article. There is



This antenna will provide 3dB (double power) gain on 14MHz in two directions at right angles to the wire and also four minor lobes each at about 30 degrees to the plane of the wire top. On the 3.5MHz band it becomes a 'short' dipole (but longer than 1/4 wave). On 7MHz it is a 'long' dipole and on the 21 and 28MHz bands radiates like a long wire of the same dimensions with between 1 and 2dB gains. With the down feed strapped and tuned against a good earth this antenna will give good results on 1.8MHz too.

Although not harmonically related to our 'traditional' HF bands the new 10, 18 and 24MHz bands can be used with this aerial. On 10MHz it is just a little longer than a half wave dipole and on the other two bands it will act as a long wire. Centre fed antennas can be used on any band and are amongst the most versatile of all designs.

often a misunderstanding of the role played by the feeder in these aerials so it is best to first sweep away any misconceptions!

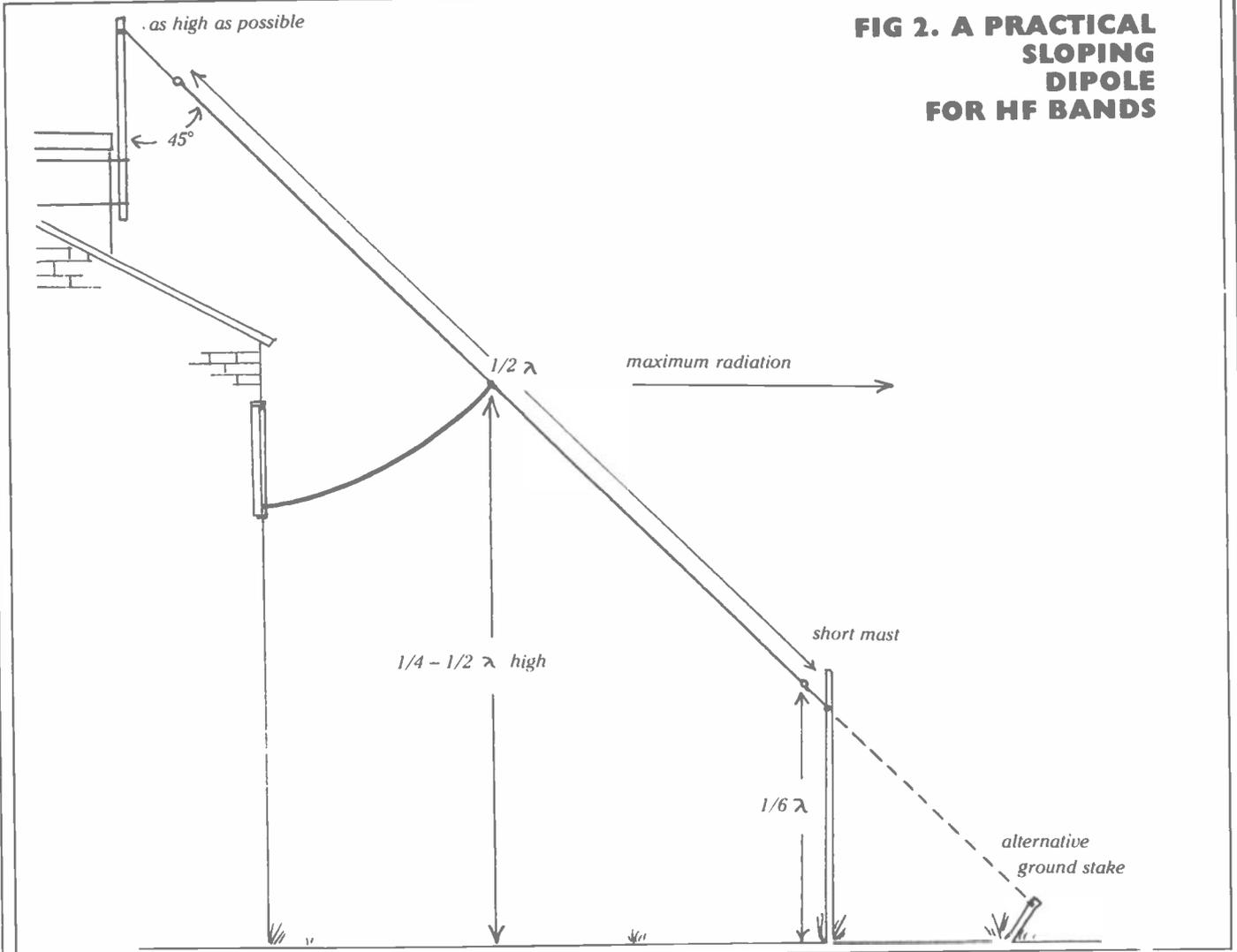
Open wire feeders do not work like low impedance coaxial cable or flat line of the types used to feed half wave dipoles, various beams or other self resonant systems. Instead they automatically match the centre impedance of the top and at the same time all along their length have 'standing waves' and show much the same properties as end fed wires. The impedance down at the shack end depends upon the impedance up at the centre feed point and also the *length* of the feeder. Feeder length plays (or should play) no part in the feed to resonant antennas such as dipoles and beams.

A way to understand this is to first imagine an end fed wire arranged as an inverted L. If this wire is one wavelength long (two half waves end to end) there will be high impedance at both ends of the aerial. Should the total wire length instead be reduced to 3/4-wave with the flat top remaining as a half wave the

down lead will be only 1/4-wave long and will have a high impedance at the top to match the flat section and a low impedance down at the bottom, somewhere in the region of 25-50 Ohms. All centre fed antennas of the type under discussion may be regarded as being made from two L aerials end fed in anti-phase. If the down leads are positioned reasonably

Les Moxon, G6XN, has calculated that the power loss from radiation along a 300 foot open wire line with a spacing of 6ins and 14MHz would be around one third of a watt when the total power in the line was 600 watts! This means a loss of less than one thousandth of one S point, and is much better than the 3dB loss (half power) using the same length of coax. Bearing in mind that the maximum antenna radiation happens at the point or points of greatest antenna current it must now be seen that should the top of the centre fed wire be shorter than half a wavelength, this maximum current point will be some way down the feed line and will contribute little or nothing to the radiation. Using a 1/4-wave top the current up there will be quite small and at this point QRP

FIG 2. A PRACTICAL SLOPING DIPOLE FOR HF BANDS



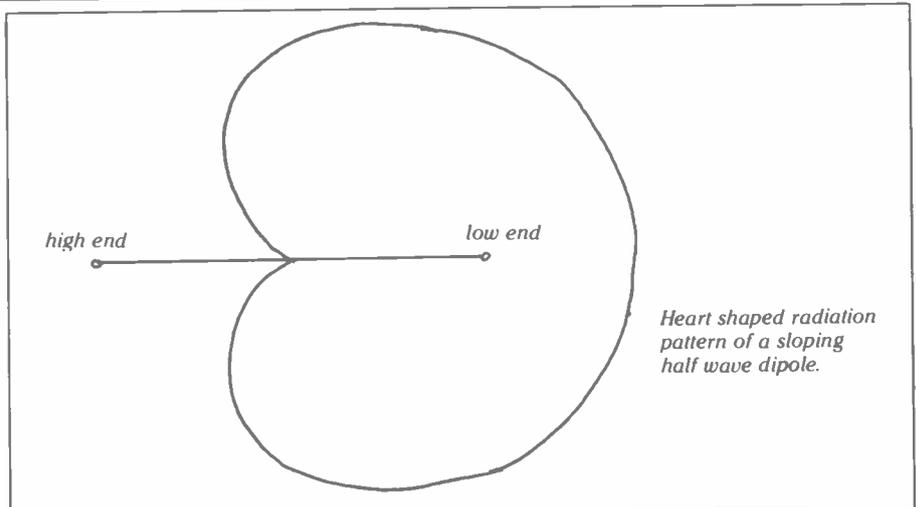
close to each other (close that is in wavelength terms) the RF voltages and currents in these leads will cancel out and radiation from them will be very small.

operators will have abandoned ship! With some 100 watts of power, however, a quarter wave top will still provide lots of interesting contacts and even some DX.

Matching and performance

Just as our old friend the end fed wire may have certain 'nasty' lengths which are hard to match into the ATU, the centre fed wire antenna has similar problems on some bands. It is not just the length of the top, but the total length of half the top and the whole length of one feeder leg which makes up the effective length. Difficulties met in matching into the ATU on some bands may be overcome by lengthening or shortening the feed line by a few feet. The ATU must have the flexibility to accommodate quite a range of impedances and it must also be a balanced device.

The writer has always contrived to adjust the length of his feeders so that on all bands used the impedance presented to the ATU ranges from the region of 200 to 500 Ohms. At all costs avoid very high impedance at the ATU end of the feeder



or there may be a case of 'RF all over the shack' syndrome!

Guesstimating their likely performance

Having now discussed the essentials of centre fed wires it is now perhaps appropriate to estimate (guesstimate?) their likely performance. The inherent balance of the centre fed aerial is important and can be lost if the top slopes considerably and is much nearer the ground at one

end. Although this gives rise to different current levels in each leg of the feeder the writer has found that in practice a sloping aerial has always worked well, and being like many amateur antennas which are not really high enough has radiated well in most directions with no noticeable pattern. The beautifully symmetrical horizontal radiation patterns shown in most text books on aeriels are seldom realised by amateur installations. Real life set ups often have inadequate masting arrangements, nearby trees, buildings and what have you, together with unknown earth factors.

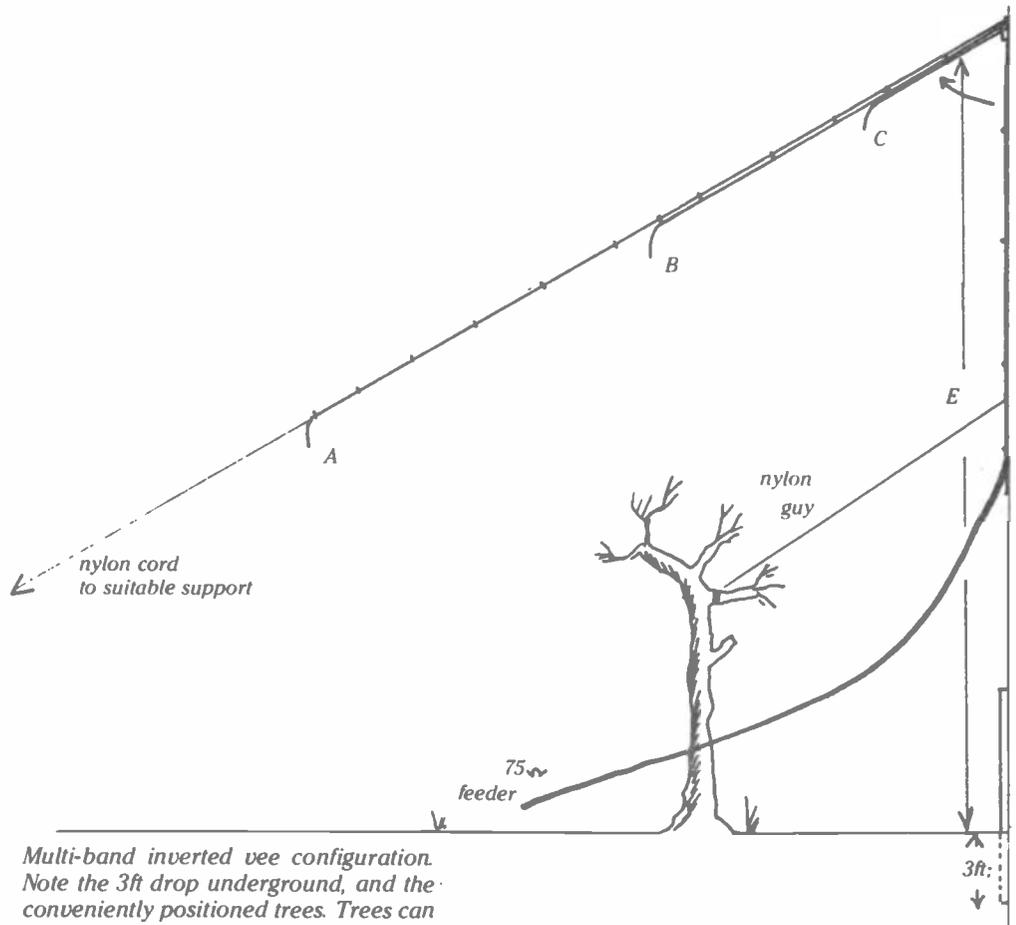
A New Look at Wire Aerials: 2

One important difference between the end fed and the centre fed wire occurs when the top of the latter is about one wavelength long. Instead of the four lobes associated with the end fed wire the centre fed top becomes two half wave dipole but in its preferred directions, has a theoretical gain of 2dB over a dipole. This gain can be increased to about 3dB if each leg at the top is lengthened to 0.64 wavelength. At this length there will also be four minor lobes which run nearer the axis of the wire, and when the total length of the top is two wavelengths or more the radiation patterns and gains become similar to those of conventional long wire aerials.

Marconi antenna and G5RV

The centre fed wire has yet another advantage over the end fed jobs; it makes an efficient 'Marconi' type aerial for the LF bands. If the two wires in the feeder are strapped together at the shack end and tuned against a good earth or a counterpoise system the feeder will behave as a vertical radiator. The top behaves as an element of top loading and does not contribute towards the radiation (the currents in the top are then anti-phase and cancel out). The higher the antenna the better the system becomes as a vertical on Top Band or Eighty.

Some readers may well now be thinking "What about the G5RV antenna?" This well-known centre fed aerial which was devised and popularised by Louis Varney is a compromise system and was designed to enable the easy connection and approximate matching to 50 Ohm output impedance transceivers via coax feeder. Although many people use the 5RV without an ATU its designer suggests that one ought to be used both with the original 100 foot top or with the half size version. Even when using an ATU there remains some difficulty in matching the coaxial feeder to the top wire 17 foot section which connects to the centre of the antenna. Pruning and cut-and-try of this open wire section will allow quite a



Multi-band inverted vee configuration. Note the 3ft drop underground, and the conveniently positioned trees. Trees can be replaced by good ground, incidentally. In this case the main mast is as high as possible, and at least half a wavelength on the lowest band. See practical article in next month's Amateur Radio for good advice on erecting masts!

FIG 3. A MULTI-B

respectable match on one band, but it will be found that this does not hold for the other bands.

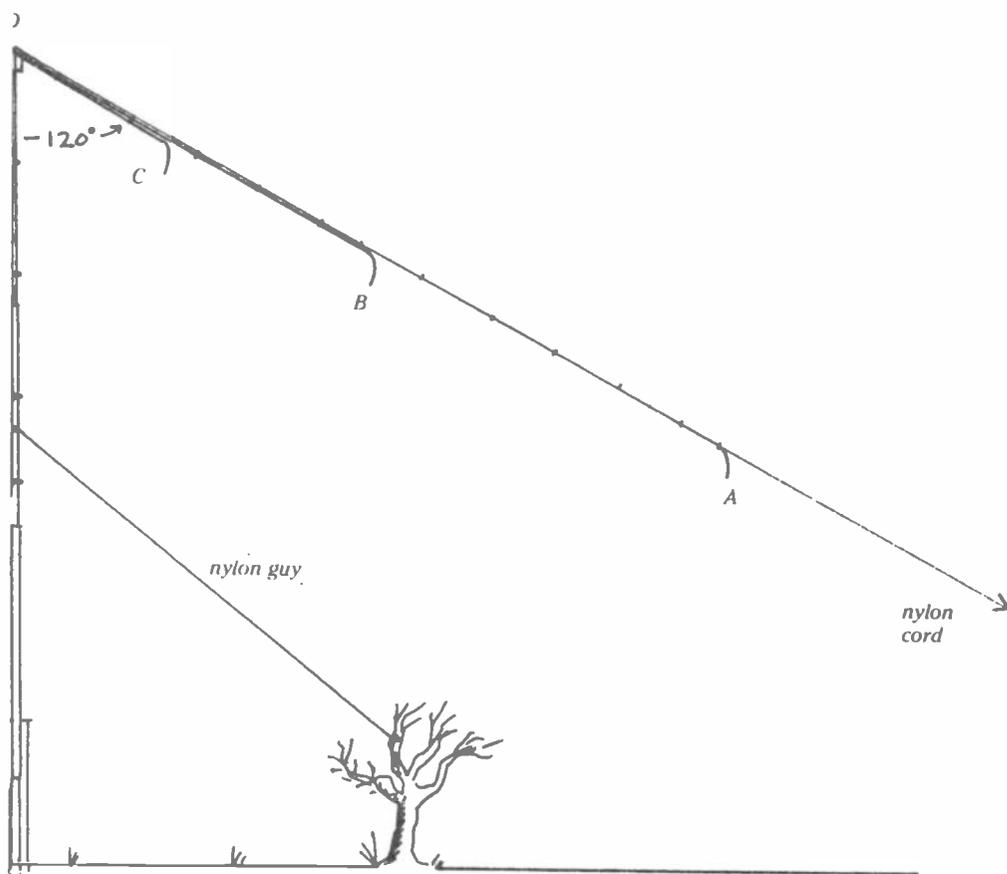
The writer has an aversion to all traps!

The writer has never made or used a G5RV but has discussed the aerial with many of its users. Most seem to find that it puts out a good signal (the full sized version) on 80 metres but that SWR problems and power losses occur on the higher frequencies. The G5RV coax feed right into the shack is convenient and band change is simple, but the price paid for this is a reduction in aerial efficiency possible feeder radiation (TVI?) and the feeling that one could do a lot better using conventional open wire line right through. One even hears of trapped versions of the G5RV, but the less said about these the better! The writer has a strong aversion to all traps, an opinion shared incidentally by 'Mr Aerial' himself Les Moxon, G6XN.

Practical considerations

To maintain a correct balance the feeder from a centre fed wire must drop vertically for at least $\frac{1}{4}$ and preferably $\frac{1}{2}$ wavelength before running into the shack. An easy way to achieve this is to position the antenna centre above the lead-in point or to drop the feeder down and then run it horizontally to the shack. This aerial type is well suited to those properties which have a garden at both the front and the back of the house and then long feeder runs are not needed. On all frequencies the ends of the top will carry high RF voltages so some attention must be paid to the insulation at those points, and it would be as well to keep the ends well away from metal masts trees etc. At least 6ft or nylon or similar rope between the end insulators and the support points is desirable.

Making open wire line can be fun! Before WW2 the recommended method



- A = dropped ends of 7MHz dipole.
- B = ends of 14MHz dipole.
- C = common connections to feeder.
- D = common connections to feeder.
- E = as high as possible - at least half a wavelength on lowest band.

Multi-band inverted vee configuration. Note the 3ft drop underground, and the conveniently positioned trees. Trees can be replaced by good ground, incidentally. In this case the main mast is as high as possible, and at least half a wavelength on the lowest band. See practical article in next month's Amateur Radio for good advice on erecting masts!

times. Try to keep the top of the aerial as taut and horizontal as possible using counter weights which will compensate for additional feeder weight during winter icing conditions.

Ribbon feeder

A mention was made earlier of 300 Ohm ribbon feeder which is a reasonably cheap and easy way to feed centre feed aerials. Unfortunately the commonly found 'white' product can get brittle and change its structure after long exposure to the ultra-violet rays in sunlight. Its plastic covering seems to let moisture through and many users have found that the wires inside have become very oxidised. As RF travels on the surface of wires this can seriously affect performance. The earlier type of ribbon which was black seems to have been a much better product and the writer has had some for 30 years which is still good enough for general use.

All 300 Ohm ribbon changes its impedance when wet or covered with ice or snow. No one wants a 'dry weather' antenna, so one way to improve ribbon performance is to use a penknife or cutting tool to remove sections of the plastic insulant at regular intervals. The pieces taken using this method cannot be very big or the wires start to get 'floppy'. An excellent alternative to the cutting technique is to punch out a long line of circular holes with a leather punch. These tools have a rotatable 'wheel' which carries six punch dies of ascending diameter, and the second largest which knocks out 1/8-inch diameter holes is ideal for 300 Ohm ribbon. The ribbon can have as many as five perforations for each inch of length and remain viable. It will then have greatly enhanced weather resistance. Most good craft shops stock leather punches. They are useful for many jobs around the house or in the shack and well worth a little capital outlay.

AND INVERTED VEE

was to boil wooden dowel rods in paraffin wax for at least 30 minutes. Few of us would be popular with our XYLs or neighbours if we did this now and fortunately there are a number of less dramatic alternatives for us to turn to. Any strips of stiff insulating material, preferably shiny and water shedding from about 4 to 6ins long may be used. One feed line made by the author used the cylindrical plastic hair rollers purchased from Messrs Woolworth as spreaders. They are particularly light-weight and very effective. The best solution is to buy some lengths of 1/4in diameter polystyrene rod (used for control extensions) and then cut it into suitable pieces. Alternatively, solid fibre glass rod 10mm diameter is available from South Wales Communications Ltd. and may be bought by the metre. One spacer every 1 1/2 to two feet should suffice, and each one is held in position with small tie wires which wrap a few times around the feeder wire. Drilling holes at each end of the spreaders to take the feeder is the best way to secure them but it is a time consuming exercise.

The really elegant and professional way to do the job is to use a thermo-plastic material and to pass a big DC current through the wires to heat them sufficiently to cause a slight melting at the contact points. On cooling the spreaders will be firmly fixed to the wires. Making up open wire feed lines is best done out of doors on a calm fine day, and the ends of the line can be fixed to suitable anchorage points before the spreaders go on. Enamelled copper wire of 18 to 16swg is heavy enough to be self supporting between the spreaders and will not impose too heavy a load on the antenna centre. Remember that the inner ends of the antenna top where the feeder connects may be at high impedance on some bands so a good centre insulator is needed; a much better one than the bit of plastic which suffices at the centre of half wave dipoles.

The connections must be mechanically sound and no strains put upon the feed line. If 300 Ohm ribbon is used, particular care must be taken for its internal wires are weak and soon break if bent several

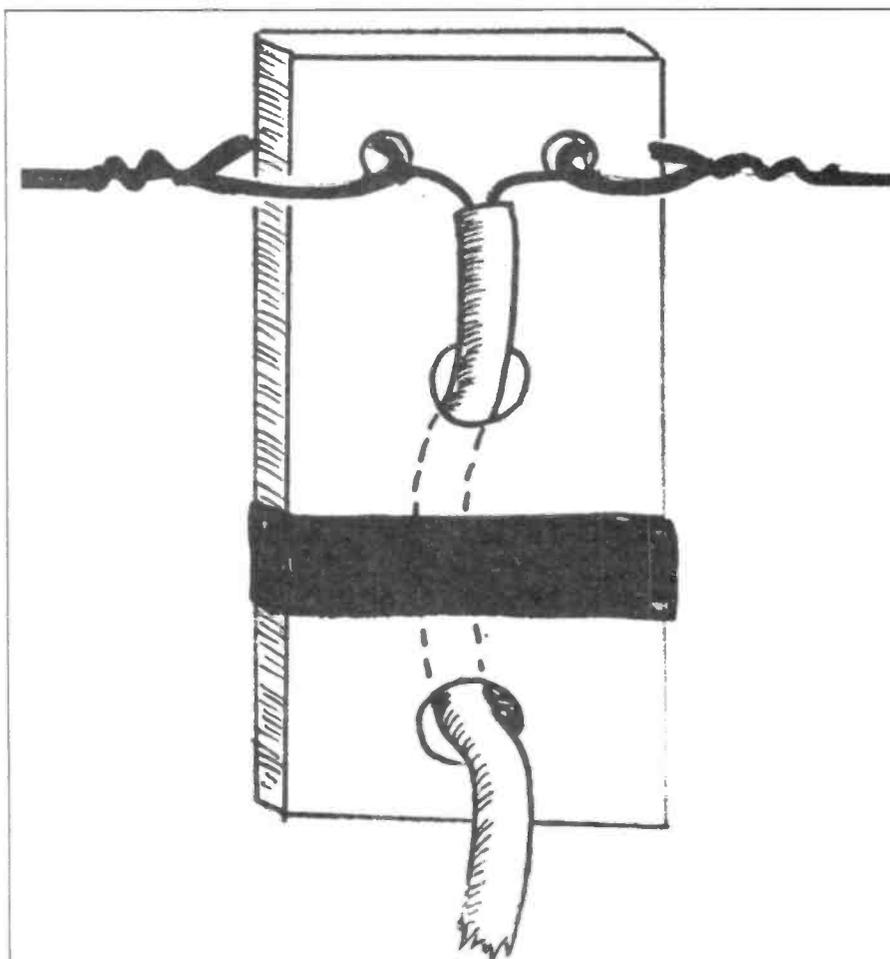
A New Look at Wire Aerials:2

Whatever kind of feeder is used it must be kept well away from metal gutterings, downpipe etc. The pundits have always said that sharp bends in open wire feed line must be avoided, but experience has shown that so long as the line has no sharper angles than 90 degrees there will be no problems. The losses from long feeder runs are minimal and up to 400 or more feet will work well. Long feeds allow the erection of a centre fed antenna well away where the wire can be high and in the clear. If out of sight the neighbours are less likely to blame any TV or hi-fi faults upon your activities!

Modifying an ATU

Unfortunately very few commercially-made ATUs seem to be designed for use with balanced open wire feeders. This means a little bench work to produce a simple tuned circuit using preferably a split stator variable capacitor (the writer has got away with a single capacitor). Such a circuit will allow the feed line to be 'croc clipped' on to the coil to find the point giving the lowest SWR. Always use very low power when setting up for low SWR readings. When the impedance at the end of the line is high the taps will be at or near the ends of the ATU coil. When there is a low impedance they will be close together near the coil middle. Plug-in coils are a 'must' if more than one band is to be used although the 21 and 28MHz can use the same coil, as is also the case with the 14 and new 10MHz band.

A rough but reliable guide to coil inductance is to arrange things so that the amount of capacitance needed for resonance in pico-Farads tallies with the wavelength in metres! On 20 metres a running capacitance of about 20pF is about right and provides a tuned circuit 'Q' of about 12. This rule of thumb formula has always worked for the writer who tends to avoid high maths like the plague! A two turn insulated link coupling made from stiff wire is pushed into the centre of the coil winding and is joined to the SWR meter and rig by coax. Some adjustments can be made to the coupling when the coil is self supporting and this



DIPOLE CENTRE CONNECTIONS

The rectangular block is of strong insulating material about 1/4in thick. Twist and solder the ends of the dipole elements and solder SHORT leads to them from the twin feeder. The feeder is fed through two holes in the block and also taped. No strain is imposed upon the feeder wires.

will enable a true 1:1 SWR to be achieved.

Performance

My local club used a centre fed wire during the 1982 SSB Field Day and had many fine DX contacts with only 100 watts output. The writer's most recent experience of such an aerial began when we were granted the new 10MHz band. A 45-foot top centre fed with the deadly 'white' ribbon feeder was quickly slung from a chimney stack to a front garden

tree and at no point did its height exceed 28 feet.

This little antenna usefully fills a gap in the pattern of the long wire and enables easy contact with VK and ZL in the mornings on 30 metres. It tunes up well on 14MHz and on that band gives useful coverage of South America and VP8 despite its nearness to the ground. Centre fed wires have been around now for about 50 years but they are still to be classed amongst the simplest and yet most effective cheap antenna systems.

TRANSFORMERS TRIED AND TESTED

One of the most expensive parts of any home construction project is the mains power pack and more specifically, the mains transformer. Yet in many cases this need not be so for there are still many available at almost give-away prices at radio club junk sales, radio surplus dealers, or Women Institutes' or Scouts' jumble sales. In the latter case, however, they are almost invariably attached to the equipment for which they were originally designed – usually old valve broadcast receivers.

Very often, the transformers purchased at surplus dealers will have originally been constructed for the armed services and their connections and ratings will be clearly marked. Those taken from old broadcast receivers, however, were usually designed for the particular set and rarely bear any identification markings whatsoever. Using these might seem an unsurmountable problem, but it is not, for the connections can be easily determined by means of a series of resistance checks, and the output voltages and power ratings by examination of the equipment from which it was taken or alternatively by AV voltage measurements and intelligent "guesstimation".

Does it have one?

When buying an old broadcast receiver for the sake of its mains transformer it is, needless to say, important to check that the set does contain one. By this I do not mean that someone has beaten you to the desirable device but that many sets in the late pre-war and post-war years did not contain one. Instead the high tension voltage was obtained by rectifying the mains voltage directly and the valves were lit by wiring the heaters in series across the mains with a large ceramic wire wound resistor to drop the surplus voltage. In some other cases the mains transformer may be hidden behind or under other components and if the set cannot be examined closely it may not be seen and its presence or absence must be deduced from other indications.

There are several clues to whether a set will contain a mains transformer. The first, and most obvious is whether you can actually see a transformer of adequate size! In most receivers of that era there were three transformer-like objects. These were, in descending order of size; the mains transformer, the HT smoothing choke and the audio output transformer.

You can use resistance checks to find out whether those connections are what you thought they were, on transformers dug up at junk sales. Here, Ken Williams designs a simple power supply for valve equipment, and tells us how to guesstimate transformer ratings from the source and size of the things.

The latter can easily be identified by the fact that it is directly connected to the loudspeaker whilst the smoothing choke has only two connections.

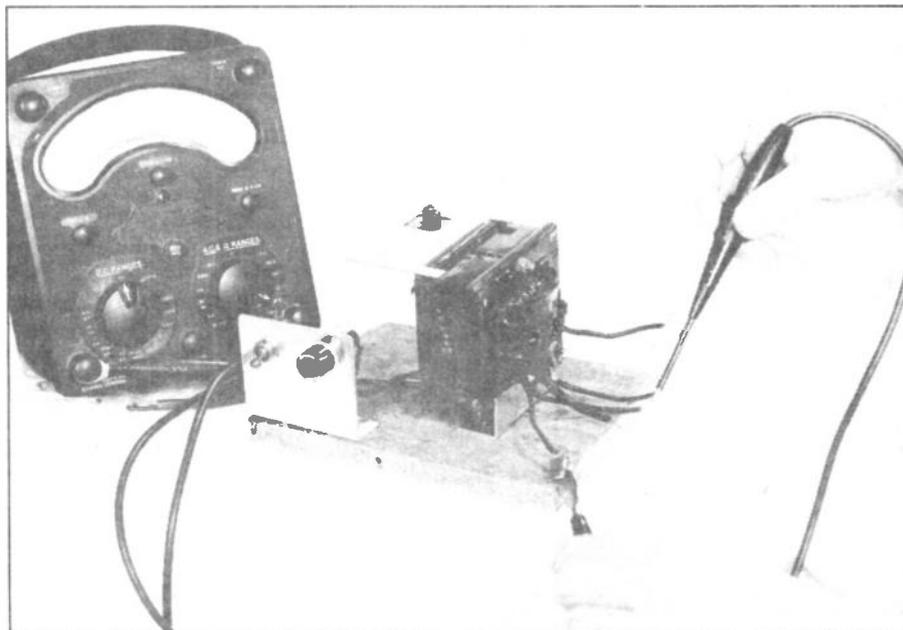
A second clue comes from the valve types. If the majority of the valves have a 6 or an E at the beginning of their type number, the set will almost certainly have a mains transformer. If the valve type numbers begin with different numbers such as 12, 35 or 50 or U or C then the set will not have a mains transformer. Valves with type numbers starting with 1, D or K are battery-operated and again no transformer will be present. The last clue is the presence or absence of a mains dropper resistor. This is usually a tubular ceramic type, half to one inch in diameter, several inches long and fitted with several fixed or adjustable tapping points. As this is used to

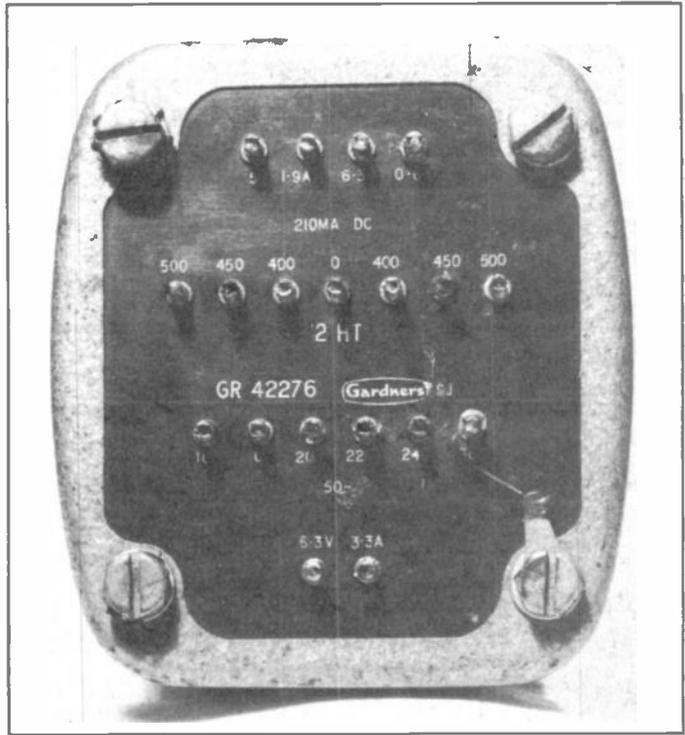
drop the surplus voltage between that required by the series heater chain and the mains voltage, its presence means that a mains transformer is absent.

If a mains transformer is purchased complete with broadcast receiver, determination of the connections is simplicity itself. Firstly, the mains input winding will be obvious for it is connected directly to the mains cord via the on-off switch (often ganged with the volume control). There are usually three secondary windings; a centre tapped high voltage and two low voltage windings, one of which supplies the rectifier heater and the other for the heaters of the other valves. These are of much thicker wire than the high voltage winding. The rectifier heater winding can be identified quite easily for it only goes to one valve. In most cases it will be rated at five volts, two amperes. The other low voltage winding will be connected directly to the remaining three or four valves. This will usually be rated at 6.3 volts, and something in the region of three amperes.

The high voltage winding will be connected directly to the anode connections of the rectifier valve base with the centre tap earthed. Most broadcast sets of that period needed a voltage of about 200 to 250 volts at a current of 60 or 70mA. The voltage drop across valve rectifiers is often quite

A test rig for electrical checks on transformers. As the transformer illustrated above is for drop-through mounting, a small support bracket had to be made from scrap alloy.





TRANSFORMERS TRIED AND TESTED

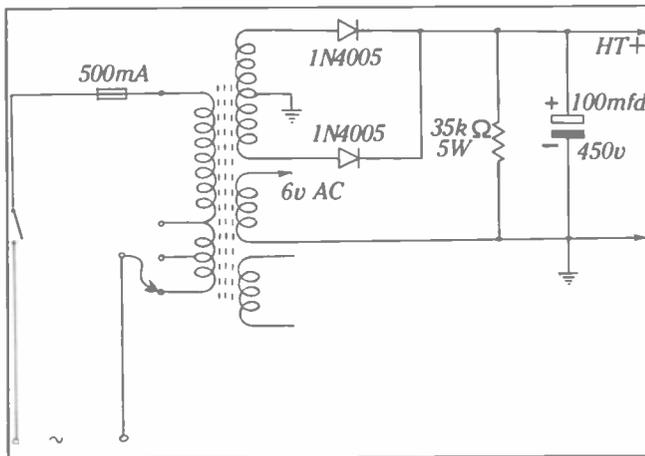
considerable, necessitating a high voltage winding of about 250 volts on either side of the centre tap.

There are two exceptions to this. Firstly, where the receiver uses valves with B5 or B7 bases, all the valves including the rectifier will be four-volt types and consequently that will be the voltage of the low voltage windings. Secondly, in the latter days of the valve era, a series of rectifiers with a high cathode/heater insulation were developed. This allowed the rectifier to be operated from the same low voltage as the other valves, thus only one low voltage winding was needed.

More recently, rectifiers with a high cathode/heater insulation were developed

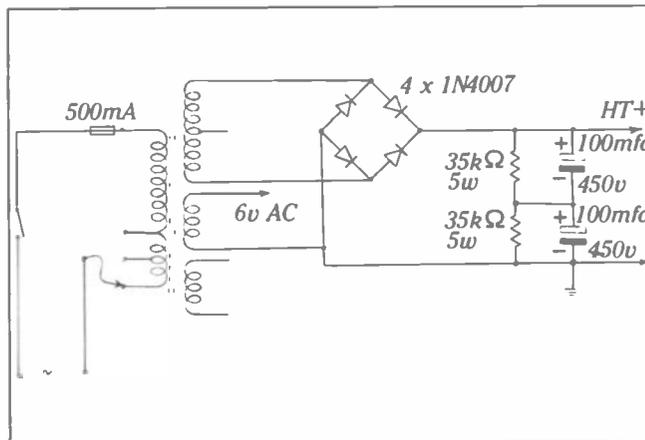
If the transformer has been obtained separately, the connections will have to be identified by other means. For this, all that is required is a simple multimeter which has both resistance and AC voltage ranges and a few inches of masking tape to mark the connections once identified.

Switch the multimeter to the ohms range and place one of the prods on any of the thinner wires of the transformer. With the other prod, seek continuity with any other wires. If no continuity is found, you have located the connection to the shield between primary and secondary windings. If connection is found to two other wires, both being approximately the same resist-



Above: Two views of a medium power transformer removed from commercial equipment. Although there were traces of rust on the outer casing of this transformer, the windings were in perfect condition.

Left: Standard bi-phase (or full wave) rectifier circuit. The HT output will be in the order of 300-350 volts, depending upon the load.



Left, below: Bridge rectifier across the whole secondary winding. Output 600-700 volts, depending upon load. Note the two resistors which act both as a bleeder across the output and also to equalise the voltages across the electrolytic capacitors.

ance or alternatively one being twice the other, then the high voltage secondary winding has been located. Each half of the winding will have a resistance in the order of 100 to 300ohms.

If, on the other hand, three other connections are found, then the primary winding has been located. Three of these connections will be found to be joined by two quite low resistance windings perhaps in the order of five or 10ohms whilst the resistance to the other connection is much higher, 100 to 300ohms being normal. This

is the 0 to 200v input winding with the low resistance sections giving the 220 and 240 volt taps.

Having determined the primary and high voltage secondary connections, only the low voltage secondary connections remain. These will be of very low resistance, probably in the order of 0.5 to two ohms. These are more easily identified when power is applied to the transformer – the next stage. Mount the transformer temporarily on a "breadboard" and connect

power to the primary winding via a switch and a low-value fuse. If the connections are flying leads make sure that none can short circuit to another. If necessary, temporarily connect them to a tagstrip.

Set the multimeter to its highest AC range and then switch mains power to the transformer. Measure the mains voltage at the transformer input and confirm that the meter reads approximately 240 volts. Then measure the voltages at the other terminations of the primary winding and check that the meter reads 220 volts and 200 volts respectively. If one of the terminations reads higher than 240 volts, then that termination has been misidentified as this should be the 240 volt termination. Disconnect the mains and confirm this with resistance checks.

The designer will have allowed for voltage drop due to the resistance of the winding

With power applied, check the voltage across each half of the secondary high voltage winding. Both readings should be the same and in the region of 225 to 275 volts. Finally, switch the multimeter to a range about 10 volts full scale deflection and measure the output of the low voltage windings. The higher of the two will be the six volt winding and the lower, the five volt. Each will probably read a little high for the designer will have allowed for voltage drop due to the resistance of the winding.

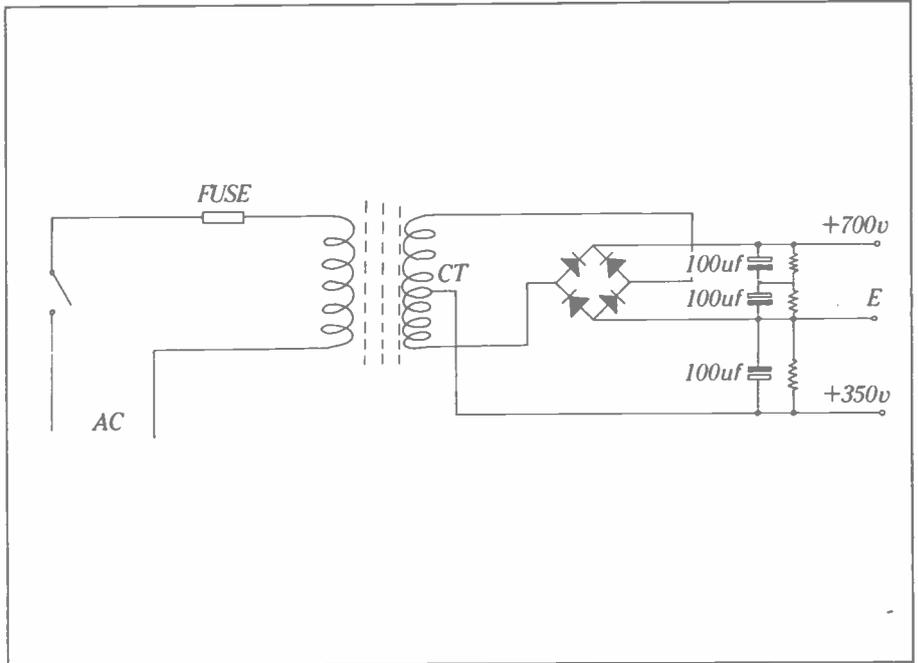
You have now identified and checked all the windings on your unknown transformer.

Power ratings

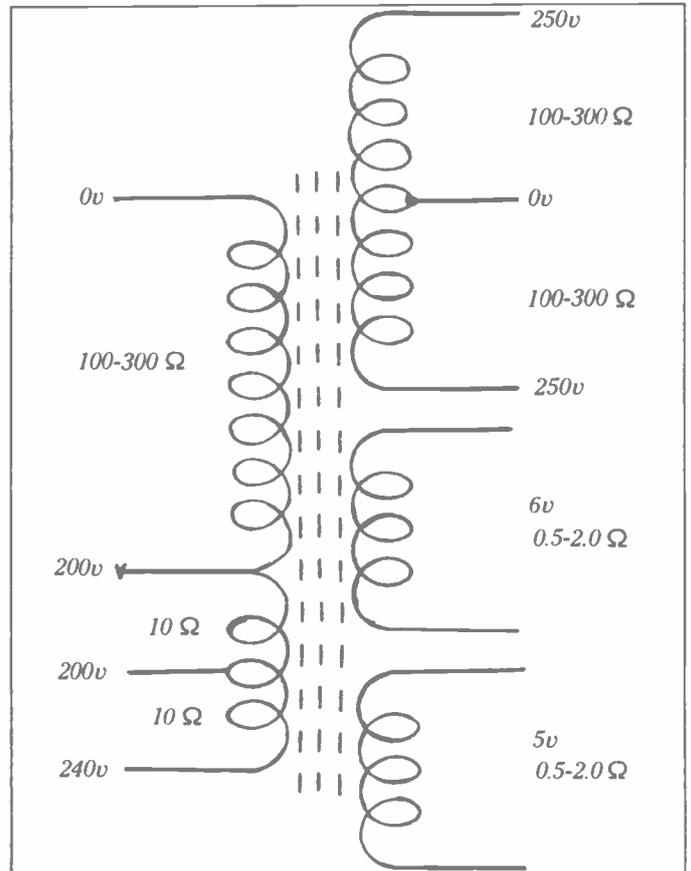
Most valve broadcast sets required about 50 to 60 watts of power, consequently the size of their mains transformers can be used as a yardstick towards "guess-timating" the power ratings of transformers from other sources for, in general, the total power rating of a transformer is roughly proportional to the amount of iron in the laminations. Ex-service transformers, such as the "Parmeko Admiralty Pattern", still quite common, are extremely generously rated and in Amateur Intermittent Service can be safely run at up to twice the indicated power rating.

If the transformer is required for solid state equipment, the high voltage secondary can be ignored provided that there is no danger of the high voltage coming in contact with the semi-conductor circuits. The low voltage secondaries can be wired in series to give 11 volts AC which when rectified with a bridge rectifier and smoothed will provide a 15 volt supply.

When the transformer is being used to power a CW or SSB valve transmitter, a much higher output voltage can be obtained by disconnecting the high voltage winding centre tap from earth and bridge rectifying



Above: How to have your cake and eat it! A dual power supply using a single transformer winding and a single bridge rectifier, yet providing two different output voltages. The high output is 600-700 volts and the low output 300-350 volts. Remember that the total power rating of the transformer must not be exceeded.



Right: The resistance readings that you might expect across ex-broadcast receiver transformer windings.

across the whole winding. This will then provide 500 volts AC which will, when rectified and smoothed, give about 700 volts DC. However, as the power rating of the transformer cannot be increased, this would appear to limit the output current to 30 to 40mA which would not be very much use. Fortunately this is not so, for the principle of operation of capacitor filters is that the majority of the power is taken from the capacitor which is "topped up" from the transformer and rectifier during periods of low demand. As the duty cycle of SSB and CW transmitters is very low, quite a high peak current can be drawn, its value depending largely on the value of the capacitor.

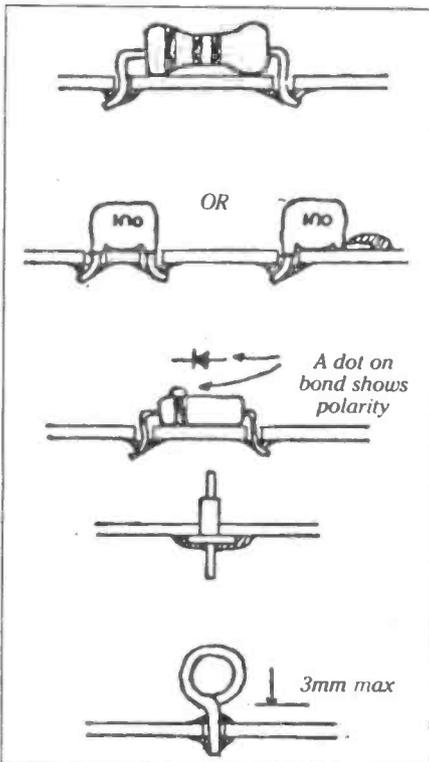
A warning

Throughout this article there have been many references to AC voltages and measuring AC voltages. Remember that by convention the figures mentioned are Root Mean Square Voltages which are only about .7 of the peak voltage present. In selecting rectifiers to use with transformer it is necessary to allow for this. Thus, to rectify a 250-0-250v winding, two rectifiers of at least 350v Peak Inverse Voltage (PIV), and preferably 500v PIV, are required. For bridge rectifying across the whole winding, the four rectifiers should each be rated at at least 750v PIV and preferably 1000v PIV.

BUILDING A SYNTHESISER

Amateur
RADIO
HOME PROJECT

Nigel Gresley breaks out the soldering iron and other bits and pieces in order to put together a synthesiser, bought from Wood and Douglas in kit form. Was it as easy as he first thought? Apart from a minor problem or two, everything went as planned. Here, our tame engineer talks us through the build from start to finish.



Above: Methods of attaching capacitors to the pcb. Miniature coax cable should be used for all RF signal connections. Below: 70FM05R series - conversion to external oscillator drive.

Everyone's heard of synthesisers. They feature in practically every rig from the Land of the Rising Sun these days. But almost no-one understands them. Learned journals tend to talk glibly about things like jitter, phase noise and sidebands as though they were as familiar as morning coffee, but most people don't really have a clue as to what it's all about. Well, what we're going to do is to describe in simple terms how the beast is supposed to work and then we'll show you how to build one from a kit - in this case it's from Wood and Douglas, whose UHF FM transmitter and receiver we had a look at a while back.

So, what's a synthesiser anyway? It's basically a way of generating frequencies for amplification and modulation and what-have-you later on in the wireless, and it's a sort of 'different' VFO. A frequency synthesiser is designed around the principle of something called a phase-locked loop. Now don't panic, chaps, we'll get to that in a bit - and the rough idea is to lock a free-running oscillator to one which is crystal-controlled and therefore a lot more stable.

When a phase-locked loop is "in lock", the two oscillators - the "reference" or crystal-controlled one and the "variable" - are running at the same frequency. If you try to alter the frequency, say by waving your mit in the general direction of the coil of the variable oscillator, you'll find that the loop will compensate for this and, if you like, "correct" the variable oscillator to keep it on the right frequency.

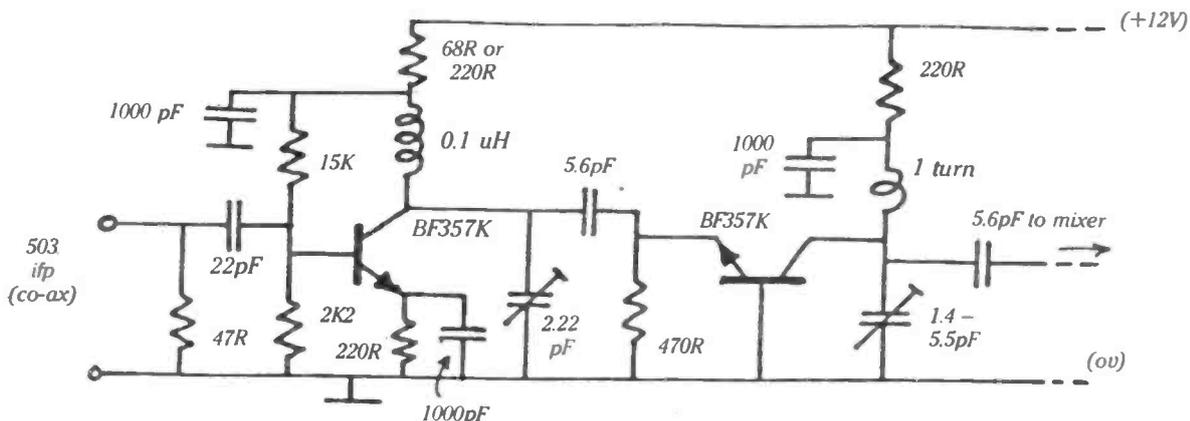
What happens is that the reference frequency is compared with the variable frequency in something called a "phase comparator" circuit. This consists of some kind of mixer which uses transistors or diodes as the non-linear element which every mixer has to have otherwise it won't mix. Now the output of the phase comparator is a voltage - don't worry about the finer detail for now, just take our word for it otherwise we'll be here all day and you'll start nodding off - and this

Metal mounting screws

voltage varies with the difference between the reference and the variable oscillators. This is very handy because if you amplify it, it can provide an error signal which can be used to control the frequency of the variable oscillator and tell it to get back on frequency pretty smartish or it'll smash the variable oscillator's transistors over the head. So one thing we need to do is to make a variable oscillator whose frequency is controllable by a voltage - this is dead easy and indeed from here on in we'll refer to the variable oscillator as a **voltage controlled oscillator**, or VCO as it's usually known.

This is an important thing to twig because all the clever magazines airily refer to VCOs as though they were given away free with the morning paper and lots of people (we hear on the wireless)

70FM05R Series - Conversion to External Oscillator Drive



don't know what one is and are too shy to admit it. So don't forget – VCO stands for voltage controlled oscillator, and it just means an oscillator whose frequency can be controlled by sticking some volts in the right place.

The usual way to do this, by the way, is with varicap diodes, which have the rather handy property of changing their capacitance according to the voltage across them. Gresley's Fourteenth Law says "the more the volts the less the puffs". Actually – please don't take that the wrong way . . .

Crystals are costly

Anyhow, the story so far is that we've got a VCO whose output is mixed with the output of a reference oscillator so as to provide a DC error voltage which is fed back to control the frequency of the VCO. Pause for the roll of drums and hey presto, one phase-locked loop, sir; would you like chips or saute with it? We have to keep it simple at Bicester otherwise we get all messed up and have heavy interviews with the MD . . .

In fact, of course, there's a lot more to phase-locked loops than that, as you'll find out later on in your career, but don't panic – it'll all fall into place by and by.

Well, this is all very well, we hear you say, but why not just use a crystal for each frequency you want and get rid of all this VCO and phase comparator stuff? If you did you'd need one crystal for every output frequency you wanted in your wireless and this can get more than somewhat costly – as many of us found out in the early days! The next really clever bit is to introduce an offset into our phase-locked loop (which we'll refer to as a PLL from now on to save on ink – we have to make a profit, you know) so that the thing can produce outputs on different frequencies.

This is kind of tricky because it'd need to be extremely accurate and stable and also variable; hmm, quite a tall order. However, if you could do such a thing you'd end up being able to make the VCO lock up to provide lots of different output frequencies, which, if you think about it, would be very handy. Men, it can be done – but this is where we leave off the fancy RF stuff such as oscillators and suchlike and start coming over all digital. Don't panic – it'll all come . . .

What you do first of all is to take the output of the VCO and smash it into some suitable circuitry so that you get more or less a square wave out of the end. You then stick this into a piece of logic which is called a **divider**, basically because it divides, Brian. Now, this has to be very stable and divide by some nice whole number like 100 or 101 or whatever – it



mustn't ever, ever, divide by anything in between even if you want it to. The idea is that if you poke 100 pulses into it, or 101, or however many it happens to be, you get just one out – this stability, in fact, is an inherent property of a logic-type divider and it's just what the doctor ordered for synthesisers as we'll see.

Now then. The next sneaky thing is that it's possible to get dividers where the division ratio is **programmable**, as the Clever Dicks say, or adjustable, as we say in Bicester. By division ratio, we simply mean, for instance, 100:1 or 101:1 or whatever, as in the example. Note that the division is always in whole numbers

Gresley's 14th Law says: the more the volts the less the puffs . . .

and never in nasty fractions – nice easy stuff. Bearing in mind the principle of the PLL which we discussed a while ago, the VCO is forced to lock up to the reference oscillator, because the error voltage tells it to, only now we've stuck this divider in the way.

What happens then? Let's take an example and look at it – let's imagine that the reference frequency is set by a crystal to 25kHz and that the VCO can operate anywhere between 2 and 3MHz: it'll go wherever the error voltage tells it to, remember. If we then arrange for our divider to divide by 100, which it will do exactly if we so desire, then the frequency which emerges from it after we've stuffed the VCO output into it will be somewhere between 20 and 30kHz depending on wherever the VCO happens to be frequency-wise at the time. Now the phase

Technical bod examines the Wood and Douglas diagram, then smiles sweetly (?) when he finally understands what's in store!

comparator will detect the error between the 25kHz reference and the divider output and it will come over all bossy and change the VCO frequency in order to minimise the error. The loop will lock up when the divider output is 25kHz, or in other words when it's the same as the reference frequency, and so the actual frequency of the VCO will be 25kHz times 100 which is 2.5MHz. Amazingly smart, isn't it?

The state of play is that we have a VCO which is locked up at quite a high frequency, which is possibly more useful than that of the basic PLL. But wait! Things get even cleverer by and by; if we then tell the divider to change to a different division ratio such as 101, there will then be a new error signal present at the output of the phase comparator. The VCO gets told to do something about it, because of the voltage changing its frequency, and the system will lock up on to a new frequency which is 25kHz times 101 ie 2.525MHz. This, of course, is 25kHz higher than the old frequency, and it just so happens that the reference oscillator's frequency is 25kHz . . . can this be leading somewhere? Yes, folks, it is. If you try any division ratio which the divider can handle without bursting into flames or blowing all the house fuses, you'll find that the difference between consecutive divisions will always be 25kHz – which is, of course, the reference frequency.

The Clever Dicks will have sussed already that if you were to mix this VCO output up to VHF you'd end up with a very useful transmitter with 25kHz channel spacing; in practice, you'd choose

BUILDING A SYNTHESISER

very much higher VCO frequencies so that getting up to the final output frequency was a bit easier and to keep any spurious outputs down to a lower level. All synthesisers, by the way, have some of those – it's the usual RF bugs and you can't get completely shot of them, although some synthesisers do much better than others. You can't go too high, though, because programmable dividers only go up to a few tens of MHz – well, most of them anyway. If you want to go any higher you have to use something called a prescaler, which is usually a fixed divider dividing by 10 or 100, and the output of this then drives your fancy lower-frequency programmable divider.

Another method which you'll come across is to mix the frequency of the VCO down to a more reasonable amount, and this is the method which Wood and Douglas use in their 70cm machine. Here, the VCO does its stuff at about 140MHz and it gets mixed with the output of a crystal oscillator at 69MHz which is doubled up to 138MHz. 140 minus 138 is 2MHz, which is easy for a low-cost programmable divider to handle (why fork out lots of cash on expensive ICs when a much cheaper and just as effective approach is available, even though you need to be a bit more careful on the RF side?). In fact, there are advantages and disadvantages in all these techniques

although we'll leave them for now so that we've got some brain cells left for later on!

Just to finish this bit of the article, can any Smart Alec see the easy way to modulate the VCO with FM? I thought as much. If you make the response time of the PLL fairly slow, or in other words make it take a while to lock up again when you change the division ratio, and then stick some audio on to the error signal, the VCO will follow this and hence it'll be frequency modulated. Mind you, if the response of the PLL is fast it'll treat the audio as an error and correct it – hey presto, no FM!

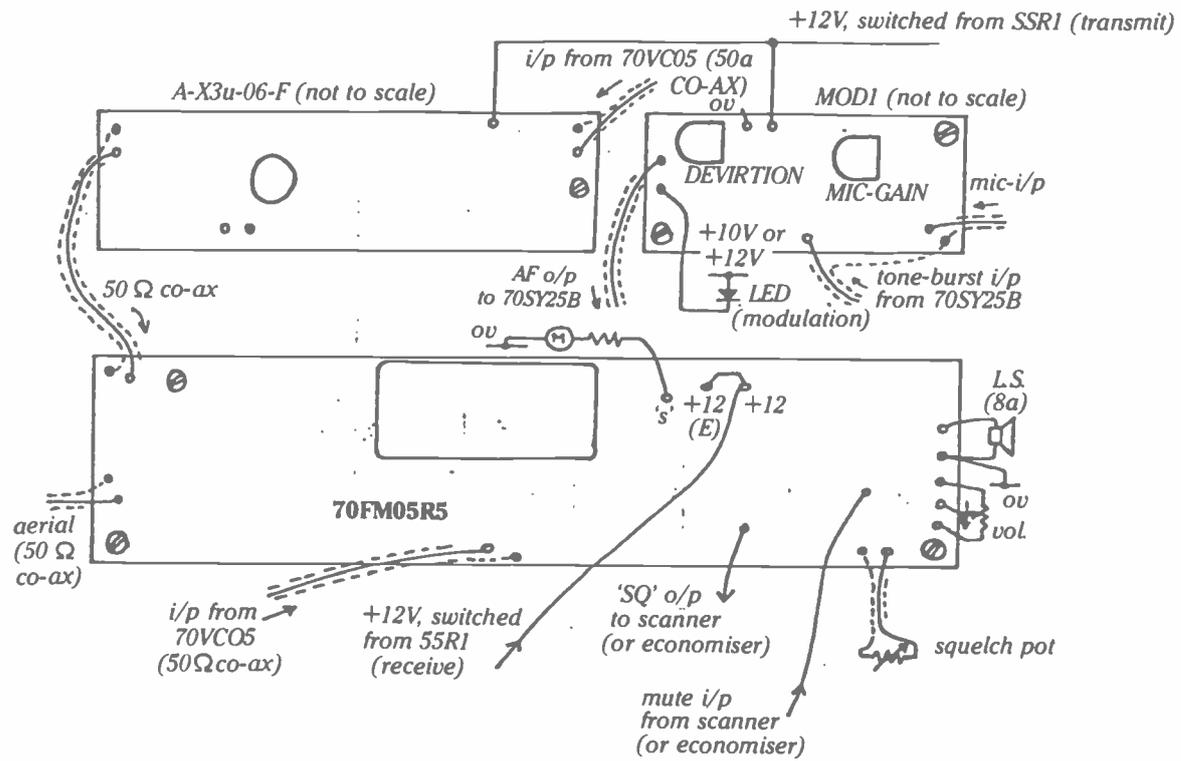
Another interesting point is that if you have a PLL running at the IF of your receiver – say 10.7MHz, for instance – and you stick that IF of the receiver into the phase comparator where the reference usually goes, you'll find that if you're receiving an FM transmission and the loop is fast enough, you'll find perfectly demodulated audio sitting on top of the error signal! What happens is that the VCO is made to follow the incoming signal by the fast loop, and since the reference itself is wobbling about (because it's an FM carrier) the VCO wobbles about in sympathy – as we know, in order to make the VCO wobble the error signal itself must likewise wobble and if you take a high impedance amplifier and apply the error signal to it, the wobbling

What you get for your money

gets retrieved as audio. By jingo, Carruthers, clever stuff . . .

Enough of this wobbling about; what about the Wood and Douglas machine? It's their Model 70SY 25B, and along with it comes the 70VCO5 which is the transmit and receive oscillator board, ie the bit that the synthesiser controls. The first impression of the kit is that that they've sent you two of them by mistake – there are a hell of a lot of bits and pieces. Wood and Douglas say that this is a very advanced project and in a way they're not kidding; reading through the info provided suggests fairly straightforward constructional techniques but it's when you get to the setting up instructions that mild hysteria sets in! Muttering "it's bound to work first time" under my breath I decided to wade in and see what happened.

Two boards are provided; the synth itself measures about 4in by 3in and the VCO 3½in by 2in. The boards themselves are fairly well made and had been roller-tinned, which was a Good Thing. Judging by the PCB tracks it looked as though the VCO board was going to be the more demanding; the component density



Interconnection diagram for receiver, transmitter and modulator in 70cm synthesised transceiver.

looked very high and indeed most of the resistors on the layout plan were standing upright so as to squeeze them all in (sounds like the commuters on my train into work). As with the Tx and Rx which we looked at recently, there aren't any component markings on the board but a bit of thought and care, a lot of referring to the layout plan and gallons of coffee should make for success (I told myself). The boards are double-sided and connections to both sides are quite frequent; there are also wire links connecting one side of the board to the other and I found out the hard way that it was easy to miss these on the layout plan.

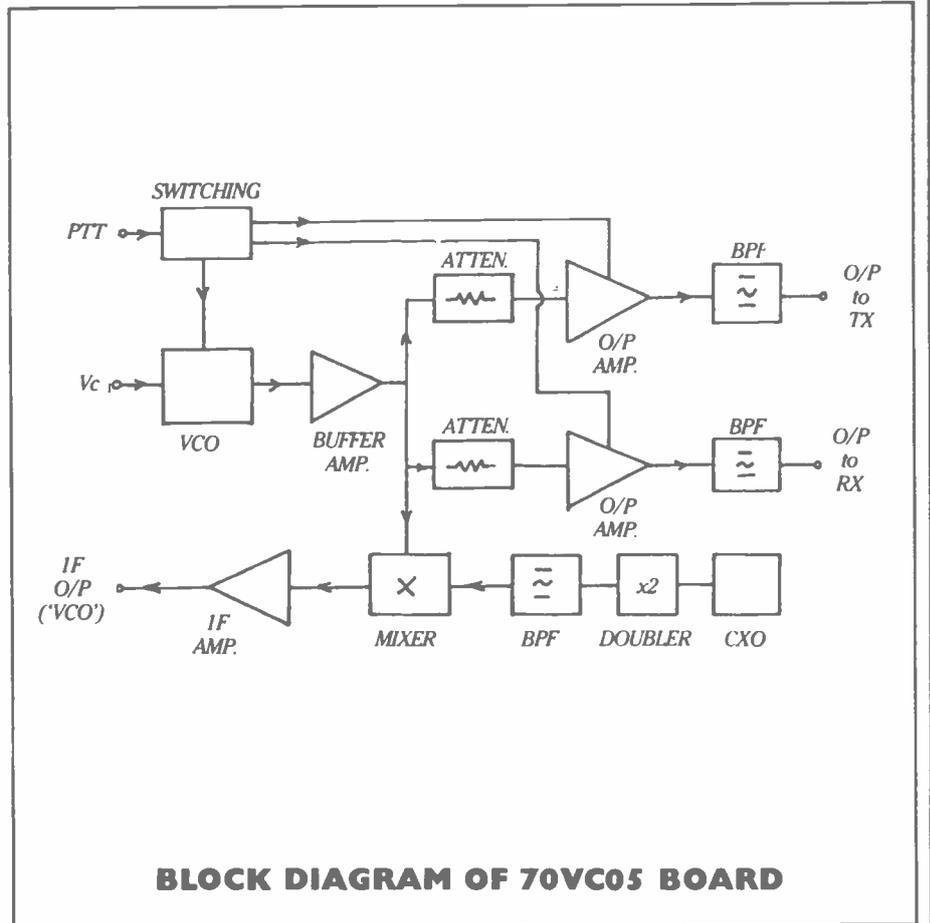
However, eventually I screwed up what courage I had left at the end of a day and plugged in the iron. I used a miniature 25watt iron and 22swg solder and there's no way you can use the trusty old kettle-mender on this board; the distance between many of the tracks is less than 1/32in so if you haven't got a small iron you'll need one for this kit.

Two minutes into the project and one very tedious point started to stare me in the face. The layout plan has all the components numbered, as does the circuit diagram, and this means that to find out which R or C or whatever goes in which 'oles you have to look it up on the chart provided. Well, that doesn't cause earthquakes and tidal waves but it's fatally easy to misread the chart and put the wrong bit in, especially when you've been concentrating for a couple of hours

“The VCO worked perfectly as soon as the appropriate volts were applied - which had to be good”

and the old brain cells are getting a bit tired without you realising it. First you discover that you haven't got any 100 Ohm resistors left and you wonder why; you definitely need one for R6. You then discover that you used it for R7, which should have been 10K - fine, mystery solved, but now try getting the 100 Ohm out without (a) frying your finger and (b) wrecking the tracks on the PCB. Oh brother, that ain't easy, the thin tracks are very likely to lift off the board as you attack them with your iron and melt the adhesive, and you need either desoldering wick or a solder sucker if you're not going to end up linking across the broken bit with pieces of wire.

I would have sold my granny into slavery to have seen component values as well as numbers on the circuit diagram - you can get a much better idea of what's supposed to be happening. Maybe a couple of copies of the layout plans,



BLOCK DIAGRAM OF 70VC05 BOARD

one with numbers and the other with values would have been even better.

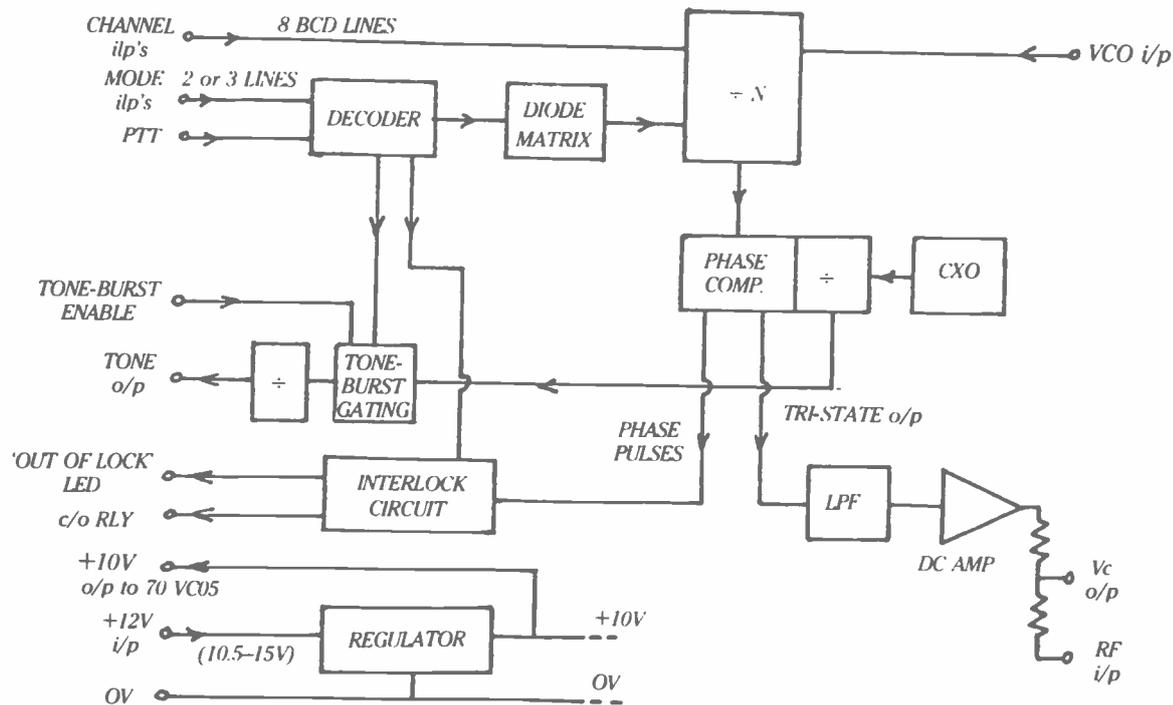
Stop wingeing, boy, and get on with it. I did resist the temptation to "do it my way", and so slavishly followed the instructions, although I damn near marked up the diagrams beforehand. Anyway, I built and tested the VCO first because I figured that I could use that to test the synth itself without a signal generator; the instructions themselves were clear and simple and there was no real problem. But then - another tedious point. The photocopied sheets are all done double-sided, presumably to save a shekel or two, but this means you're continually flipping loose pages backwards and forwards instead of being able to lay everything in front of you with all the relevant info being visible. As it was, the step-by-step instructions were on page 8 and the component value chart on page 7 - oh well, it'll give me some exercise...!

However, glory be, the VCO worked perfectly as soon as the appropriate volts were applied, which had to be good. It took a bit of time to set it up since the trimmers are fairly coarse in adjustment, but it all came together. I'd reckon you need a counter at the very minimum, good up to 150MHz, and a scope would be helpful although it isn't essential. The two VCO buffers, one for Tx and the other for Rx, did their stuff OK, so that was another bit sorted out. The final section of the board mixes the VCO output with a local oscillator on 138MHz, and the product of this mixer is an IF of about 6MHz on transmit and 2MHz on receive. This is supposed to be amplified

Block diagram of the 70VC05 board. All the diagrams illustrated on these pages come with the building instructions from Wood and Douglas.

by a broadband amp to provide about five volts peak-to-peak for the synth, but as it was I wasn't getting more than about two out of it; it was definitely coffee-and-fiddle time. After a lot of messing about, guess what - I'd put the MOSFET mixer in round the wrong way... With bated breath, I swapped it round and, thankfully, out popped about seven volts P-P - whoosh. I'd missed the indent mark on the source lead of the FET and thought from previous experience that on the drawing of the device it was being shown uppermost. Ah well, never again (joke).

Next it was time for the synth board and amazingly enough it seemed to work first time. The instructions call for quite a lot of logic checking, but when this was done and the synth board connected up to the VCO the system ought to be in a position to lock up and it should be possible to check the output frequencies against 432MHz channel numbers - they give you a chart for this. The only thing here is that you need to provide a binary code to the divider in order to tell it what division ratio you're after and the only really easy and straight-forward way to do this is to use a couple of BCD thumbwheels at about £3 each - in fact, unless you're prepared to build up some sort of logic-based controller with a keypad or thereabouts, or hard-wire some rotary switches (which is distinctly naff), thumbwheels are about the only practical solution. W & D don't provide any with the kit,



BLOCK DIAGRAM OF 70SY25B BOARD

although they will flog you some separately. There's a drawing provided with the kit which shows you how to connect them up, although there's also a lot of stuff on the drawing that's to do with their "Proscan" channel scanner and this is a touch misleading because it shows diodes in series with some of the outputs from the thumbwheels. These are completely unnecessary if you aren't using the scanner, unless I've had a total cerebral collapse, and I reckon a dedicated drawing would have been a better idea.

So having got it all going, I thought I'd see how it worked when connected up to a receiver; in this case the W & D 70FM05RS that we used last time. You need to modify the local oscillator a bit to provide the necessary interface, and this requires an R and C and also a choke; this latter was a pig because it needed to be a miniature one to fit on the board and it wasn't supplied. However, W & D do sell them separately. Having got it all together, I switched on and it worked! It all seemed to be very good, and GB3HR came storming on through six inches of wire, although I could hear a bit of quieting on some frequencies which must have been due to stray harmonics from various bits of the VCO. A bit of screening, in the shape of a die-cast box or thereabouts, ought to sort that one out although I hadn't got one handy at the time.

The last giant step was to try it out with

the TX - this was the same as the one we used last time without the oscillator and with just a bit of gain at 144MHz, a tripler and a PA on 432MHz. The synth output is designed to drive this directly, and after mistakenly tuning up to 288 instead of 432MHz it worked like the proverbial charm, no sweat. I was ever so pleased with myself.

Impeccable performance

Synthesised 70cm FM transceiver kits don't exactly grow on trees, so Wood and Douglas deserve ten marks out of ten for this lot. I was very pleased indeed with the finished article, both physically and technically; the design was obviously repeatable and the technical performance was impeccable. It's all well laid out, if you're fairly familiar with small-scale soldering and not afraid of miniature circuitry, and there seems not the slightest reason why anyone with no previous experience with CMOS logic couldn't get it all to work beautifully.

A bit of RF experience would certainly help, since that's undoubtedly the trickiest part of it, and the only real criticism I have is the way in which they've laid out the instructions. Let's hope they find it in their hearts to breathe on them a bit, because this really is a superb little kit

Block diagram of the 70SY25B board.

and it deserves to sell like the proverbial hot cakes.

AMATEUR RADIO SAVES YOU MONEY

If you are into home brew, or building from kits and want bits and pieces, turn to pages 70, 71 and 72 and study the classified ads.

Note that they are FREE classified ads, so if you have anything you want to sell, advertising it on these pages.

Vale of White Horse AR Society

On May 3rd, this club hosts a talk by Dave Walker, G3BLS, on Morse, while on June 7th John Morris, G4ANB and a contributor to Amateur Radio, gives a talk on computing and the amateur.

Just a few weeks ago, the club's newsletter editor Alan Lovegreen, G4FLX, was talking with Ted Wake, G5RP, who had "reluctantly" confessed that he had over the previous couple of weeks, worked the Heard Island Expedition on SSB, "but he was disappointed because he had not worked them CW which would have been easier".

In the conversation that followed, it came out that of the 315 DXCC stations it is possible to log, Ted Wake has all but four of them. "Then he told me" says the editor, "that these four are not inhabited and mentioned that one is only used as a base by pirates". These four are: CE OX San Felix Isles off the coast of Chile, Spratly Isles to the north of Borneo, 3Y The Bouvet Isles of Antarctica, south of West Africa, and VU7, The Laccadive Isles, off the west coast of India.

Amateur Radio agrees with Alan Lovegreen, that somebody should have a quiet word with Cunard (or someone) about taking Ted Wake and Margaret on a very special world cruise so that he can put this matter right for everybody else!

Edgware & D Radio Society

You probably just missed the talk by G3RPE of the RSGB on April 28th, but if you did, never mind because this club has a varied range of activities, from demonstrations, beginners talks, visits to amateur radio dealers, and talks by people like Mr. Dain Evans of the RSGB's Forward Planning Group.

Edgware is a lively group, and they meet at 145 Orange Hill Road, Burnt Oak, Edgware, on the second and fourth Thursdays of each month, starting at 8pm. More information from the Secretary, Howard Drury, G4HMD, at 11 Batchworth Lane, Northwood. Telephone number is Northwood 22776.

CLUB NEWS

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

Derby & DAR Society

This club includes in its future programme the May 4th junk sale, May 11th computer arithmetic, by Professor Chaddock, May 25th underwater acoustic imaging, an illustrated talk by G8TSQ of Loughborough University (wet suits not required!), while on June 1st is another of the useful junk sales.

Every Wednesday evening, the club meets on the top floor of the Oddfellows Hall, 119 Green Lane, Derby, from 7.30pm, when tea, coffee and refreshments are served; more information from Jenny, G4EYM, telephone Derby 556875 during reasonable hours, please... Looking through the club's journal, we notice a National HRO, as original, with six coils, and speaker for £50, and an unused MM 144/70 2m to 4m transverter, for £90. Interested? Get in touch with Jenny to begin with anyway.

Thornton Cleveleys AR Society

This particular club is located at the 1st Norbreck Scout Group Hut, Carr Road, Bispham, near Blackpool, and their programme for May looks like this: May 2nd natter night, May 9th talk by Harry Gregory G3GIY, May 16th talk on subject of maps, May 23rd auction sale of surplus equipment, May 30th planning for NFD.

Meetings normally begin at 7.45pm and after many talks, the club station is aired with their call signs G4ATH and G6GMW. More information on this busy club from Mrs. Jen Ward G8YOK, Secretary, QTHR 143 Arundel Drive, Poulton le Fylde, Blackpool, Lancs FY6 7TZ. Telephone Poulton le Fylde 890114.

North Devon Radio Club

This club meets on the fourth Wednesday of each month, starting at 7.30pm at Pilton Community College, Chadford Lane, Barnstaple (even months) and Bideford Community College, Abbots Lane Road, Bideford, (odd months). Person to contact here is the Secretary, G. Hughes, G4CG, "Crinnis", High Wall, Sticklepath, Barnstaple, Devon.

RSGB - City of Bristol Group

This group is in the process of organising the 26th Amateur Radio Mobile Rally, to be held at Longleat Park, Longleat, near Warminster, Wiltshire, on Sunday, June 26th. Table space is being offered, on a first-come-first-served basis, and these tables cost £13. There are camping facilities for traders, and exemption discs for access to the park will be the same as last year, we are told.

The rally starts at 10am and "in accordance with the RSGB's rally and exhibition policy", CB radio equipment must not be displayed nor advertised. Man to speak to is Colin Rose, G8YCV, at Westfield Orchard, 10 Englishcombe Lane, Bath, BA2 2ED. Telephone evenings 0225 311687.

Southdown AR Society

This club is entering a goodly number of contests this year, and their list of activities is varied, meetings being held at The Chaseley Home of Disabled Ex-servicemen, Southcliff, Eastbourne, Sussex, from 7.30 onwards. Further information from the Secretary, T. Rawlance, G4MVN, 18 Royal Sussex Crescent, Eastbourne.

RAIBC

There's a special event station operating on Saturday, May 14th. It's the Bournemouth and District RAIBC's station located at the Old Power Station, Bargates, Christchurch, Dorset, which is the home of the Wedgwood Electrical Collection, callsign GB2WEC.

The collection displays the progress of the electricity supply industry from its primitive and precarious inception up to the present day and will be open to visitors between 10am to 5pm while the station is on the air. Talk in will be available on VHF and the station will be active on 2m FM, 10,15, 20, and 80m SSB and CW with a special QSL card for the event. QSLs will be sent via the RSGB or direct, if sent with an SAE to Bob Burrows, G6DUN QTHR. Further details from Bob Burrows at 0202 474305.

Bury Radio Society

Confessions of a repairman is the title of a talk by Clive Haristy at the May 10th meeting of Bury RS at the Mosses Community Centre, Cecil Street, Bury, Lancs. Meetings are held every Tuesday evening, at 8pm, and while most meetings are informal, the main activities are held usually on the second Tuesday of each month.

Newcomers are invited to contact the Secretary, Brian Tyldesley, G60KE, at 4 Colne Road, Burnley. Burnley 24254 is the telephone number.

Wigston AR Club

A building project of a 30w 2m linear has just been completed by this club. The next project is a 2m beam aerial, and simple transistor tester, and if you're interested you can get in touch with Alan Faint G6GWH, Secretary, on 0858 62827. Meetings are held every Friday at the United Reform Church, Long Street, Wigston, Leicester, from 7.30pm.

Radio Society of Harrow

This club meets at the Harrow Arts Centre, High Road, Harrow Weald, on Friday evenings, and on May 6th there is an informal and practical meeting on all things amateur radio.

LETTERS

Spark sets

I found the picture of the spark transmitter shown on page 49 of the No. 3 issue of *Amateur Radio* very interesting.

From the photograph it appears to be an "Asynchronous Gap" type transmitter, and the portion shown, consisting of spark gap, condenser, and primary inductance, would make up the oscillatory circuit of such a set. The spark gap is the studded wheel mounted on the shaft of the electric motor, while the condenser is the tank-like box at the lower right. This type of condenser usually consisted of zing plates separated by flint glass dielectrics. The condenser was normally split into two separate banks of plates which could be placed in series or parallel by means of brass connecting strips, thus enabling two values of capacity to be obtained. The whole assembly was mounted in an iron tank, and filled with oil for cooling, and to prevent brushing at the edges of the plates due to the high voltages employed.

The Asynchronous Gap type transmitter produced a high spark train frequency from a low frequency supply, and gave a higher more readable note at the receiver.

When I first went to sea as a Radio Officer in the 1930s most ships were still fitted with spark sets, hence the familiar nickname, "Sparks" borne by every ship's operator since Marconi. At sea, spark sets usually came in three sizes. A 1½kW, rotary set, often known as a "stone crusher", a ½kW rotary set, and a smaller ¼kW, quenched gap (fixed-gap) set, normally fitted as an emergency, and driven from batteries.

Working on frequencies of 500 to 375kc/s, they had a daylight range of about 250/300 miles, but at night the range was greatly extended. At night it was often possible to work both sides from the middle of the Western Ocean, getting QSA 2/3 from both Lands End (GLD) and Chatham Massachusetts (WCC) simultaneously.

With all the modern technology I often feel that

much of the romance has gone from radio. Although I have not been at sea for many a long year I do occasionally "set watch" on 500 and the HF frequencies for old times' sake, and to see what the lads are doing. Alas never a spark note these days.

**Leonard Moss,
Westbrook, Margate, Kent.**
We've never heard from anyone who's actually used a spark Tx, and we certainly agree about the romance! Anyone out there like to do an article on spark transmitters? Yes, we know you can't use 'em, but it'd be interesting to know how it was done.-Ed.

No reviews!

Although in the RAF my job is a professional radio technician, my interest in amateur radio is recently renewed. The lingo is very different from my working environment - technology moves too fast these days for the armed forces to keep up and the equipment today is much more specialised and reliable.

As a member of RAF Kinloss Amateur Radio Club (GM3HRZ) I have asked other members to read my copies of *Amateur Radio* and give their opinions. Some of them have just obtained their Class B licences and we have one or two old timers with Class A chits. Response to your magazine throughout is that it's great to see a newcomer on the shelves who can show the others a thing or two without blinding readers with science. Stick to your guns and you're on to a winner. I noted though, that the last issue had no book reviews. Having now read those you reviewed in the first issue, I'm not sure now which books to buy. Enough criticism for now! Keep up the good work.

**F.J. Watson,
Morayshire.**

Q-code errors

Just a few lines to congratulate all involved in producing such an excellent magazine as *Amateur Radio*, which has long been overdue. I missed issue 1, but found the second

issue to be informative, balanced and wide ranging in topics - superb!

In the next issue, clarification on the use of the Q code would be of value as this is an area of great misunderstanding among Class B licence holders. Unfortunately nobody corrects them and the errors are heard ever more over the air. The use of Q codes during phone contacts is nebulous anyway, and having use of the Q code misrepresented as on page 29 of issue 2 of *Amateur Radio* magazine (Long Distance Information) does nothing to help the matter.

He states: "the DX might have called CQ when he first came on the air but then it'll be a case of him saying his callsign once, followed by QRZ. QRZ is Q code for Who is calling me?"

The Q code is in two sections, and to put the question, a question mark is needed, hence "QRZ question mark" on phone sounds verbose when the purpose of the Q code is to speed up communication and it comes into its own in cw work. What's wrong with plain language on phone or at worst "CQ DX" and not "QRZ DZ?"

**J. Saunders, G30LU,
Braintree, Essex.**

We take your point. It's worth a future article to clarify matters. See future issues of Amateur Radio.-Ed.

Million boxes . . .

Well, Amen to the all-new magazine *Amateur Radio* whose second edition fell into my lap by default.

I am a new ham (but 61-year-old man) from distant British Columbia in Canada. I had belly-ached at ARRL's *QST Magazine* which, for the new enthusiast, would have read just as well in Greek. Over there I take the lighter *CQ Magazine* which can still stun me with its excursions into esoteric descriptions into things beyond my ken.

Having devoured some old British productions of *Short-Wave* (circa 1973) I hastened to their address at 55 Victoria

Street, Lunnon. It was won est and neighbouring peasants were unable to help. Eventually a very prominent American organisation in the well known Tottenham Court Road who shall be nameless directed me to the wrong place . . . 35 Doughty Street where I discovered a crummy little office containing a million cardboard boxes but two delightful young people who sold me Moxon's new edition: *HF Antennas*, and also gave me the address of their opposition yet, *Short Wave* in Welwyn Garden City. They sent me their magazine and I sent them a newsy story from back home.

By now my vacation over here had been dampened by having my ageing brain cells unable to cope with RSGB's *Radio Communication* nor the somewhat similar *Short Wave*.

Struggling through bookstores full of *Penthouse*, *Playboy* and other products of higher education, my charming hostess in Elstree said, suddenly: "There's a book here called *Amateur Radio*. Is this anything to do with this peculiar fad of yours?"

Bless her cotton socks. I bought it, took it to her house, devoured it simply and understandably, bestowed a shy kiss on the dear girl's brow, read it again, seduced her into letting me phone long-distance to this fine chap Christopher Drake who writes so ably, arranged to pay for the privilege of getting the first edition and offered the price of a year's subscription forthwith . . . whatever the cost.

At last . . . something we humble morons can follow, understand, learn from and almost pass to the XYL so that, she too, can follow those peculiar technologies which have been threatening the marital bliss.

My grateful thanks to the Bicester team.

Fred Waterhouse, VE7BPG.

Q & A

Q. "Can you suggest a source of supply for the 2N3679A transistor? It was specified in a design in American magazine recently, but no-one in this country has ever heard of it!" **C. Jeavons, Coventry A.** We get several enquiries like this, so we'll try and deal with general principles. Also, you might like to take a look at our demon-tweak article on getting the best out of American designs and equipment. Basically, it all depends on what the transistor is supposed to do, and you may well find that certain components are produced only for one or two countries and can't be found in others. We can't find an equivalent for it either, so we'd suggest having a look at the circuit, seeing what the device is supposed to do, what voltages and currents it has to pass, what frequency, if any, it's supposed to work at and roughly what sort of gain it has.

This is expressed in data sheets as h_{fe} if it's a small-signal device, and h_{FE} if it's supposed to be handling any power, and if possible it helps if you can deduce from the circuit how much gain the device is being asked to contribute. That way you can find something that should be somewhere near. The other thing that might matter if it's an RF device is something called the f_T , which is a fancy way of expressing the usefulness of the device at certain frequencies. So if it is a series-pass transistor in a power supply, for instance, or a switching device, you can forget all about it.

In general, you get a feel for what transistor to use to replace things, and we feel here that we tend to use about a dozen types a lot and others very rarely. For instance, a 2N3771 or 2N3055 does for high-power audio or regulators; BFX85s are handy for medium-power switching or driving relays; BC107s and BFY50s are a good old bog-standard device for heaps of things almost up to VHF, whereas the BF115 and BF257 get used for more or less anything RF-ish. Our standard FETs are 2N2926 and 2N3819, with the odd 3N204 if we're doing anything a bit better;

the BFR91 also gets used for all sorts of odds and ends at 432MHz. Our standard multiplier for transmitters is the ZTX109 - we bought a load at a rally ages ago and they're extremely handy.

Armed with that lot we get through most things. Our standard signal-type diode is the 1N4148, and a good power rectifier is the 1N4007. If we're messing about with SCRs, a BTX18400 usually does the trick.

So - that's what we do, and it's rare that we need anything else unless we're after something clever like a 432MHz PA. Mind you, there are two or three of those that we'd have in mind according to the power level!

That's our own approach, and it doesn't often go wrong. We do feel that people spend far too long messing around trying to find the exact equivalent to some exotic-sounding device when a good old BC107 would do the job perfectly well.

Q. "Can you explain what a super-regenerative receiver is and does it have any use on the amateur bands?" **D. Rigby, Blackpool**

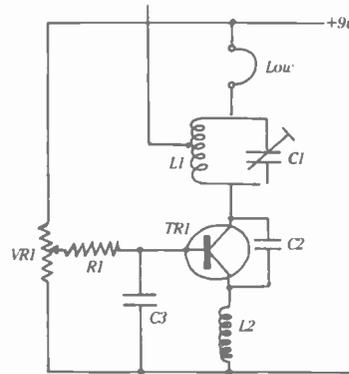
A. The super-regen is quite a complicated beast. Basically, it's possible to make a radio receiver that uses feedback to increase its gain at radio frequencies - positive feedback, that is - and there's a limit to how much gain you can get out of it before it goes unstable. In the super-regen, the idea is to apply lots to feedback which, if you kept it up, would take the thing well into oscillation; but if you interrupt the feedback at a high frequency (usually called the quench frequency) you end up with a detector stage with a colossal amount of gain that's actually proportional to frequency.

The super-regen was used a lot in the early days of VHF and UHF but it's fallen out of favour because it does have some rather tricky characteristics such as radiating on the frequency you're trying to listen to. However, for a simple VHF receiver you can't beat the super-regen detector if you use an RF stage with it to stop it radiating. Here's a little

circuit for one for the 144MHz band that we dreamed up. It worked like a bomb!

This is a "self-quenching" super-regen, and you can build it in VHF birds-nest fashion in about ten minutes. We used a BC109 (if you please) in ours and it worked very well on 144MHz - it has

a sort of built-in squelch-in-reverse action and the terrific noise it produces in the headphones dies away as soon as it gets a whiff of signal. But don't connect an antenna directly - do use a broadband amplifier to save causing any problems to anyone else.



VR1 - 10K preset.

R1 - 68K

C1 - 5pF trimmer.

C2 - 2pF (try some twisted wire).

C3 - 100pF.

L1 - 5 turns round pencil, tapped 2 turns from cold end and spaced to 1" length.

L2 - RFC: 12 turns round pencil, about 26SWG enamelled.

TR1 - Any npn device with f_T better than 100MHz.

Low - impedance headphones, about 600R.

Q. "I'm interested in making a linear amplifier for the HF bands as cheaply as possible, running the full legal limit. What valves would you recommend?" **W. Knapman, Fairlie, Ayrshire**

A. There's a wide choice, depending on whether you want to come over all modern and use things like the 3-400Z and 3-500Z which are modern transmitting triodes, or go the classic way and use, say, a pair of 813s. We'd use the latter because (a) we love them and get all nostalgic every time we see one and (b) they're still relatively cheap compared with the more modern type of bottle.

Second choice might well be to use line output types like the PL509 or whatever; four of these could probably get you to 26dBW and you wouldn't need a lot of EHT because the types will really knock over anode current meters at relatively low

voltages; whereas 813s need about 3kV before they'll get up and go! We'd probably use 4CX250Bs as a third choice. We like the 250 family but you do need to know how to get the best out of them and they're an expensive way to go about the job as well as needing forced-air cooling. Simply sticking two or three in parallel and hoping it'll pan out is NOT recommended for this sort of bottle - we have seen some dreadful designs for HF "linears" using 250s which we'd bet are anything but linear.

So we'd suggest the old 813, or rather a pair of them, with about 3kV on the anodes and about 850 volts on the screens, driven in push-pull. It just so happens that we're working on an HF linear for the magazine, using more or less that configuration and with superb performance - it uses an EHT supply that dispenses with big and heavy mains transformers! Watch this space.....

Classified Ads

● **FOR SALE** Kenwood TR2400, 2 mtr handheld nicads, charger speaker/mike £135. Wanted AR88 or Rascal RA17. Also wanted VHF/UHF scanner, bear-cat or realistic types. Tel: 0704 43057.

● **REALISTIC DX100L**. Gen. coverage receiver SSB/CW/AM/ANL BFO, Normal, fine tune, signal meter. Perfect condition, 1 year old. £40. or handheld 40-channel CB walkie-talkie. Phone 021-353 7786 after 6pm.

● **CREED 7B** teleprinter ready for use on amateur bands. £10. Rascal RA63H SSB adaptor for RA17/RA117 £65. Rascal RA137A LF adaptor 10KHz-90KHz for RA17/RA117 £70. Home brew 2M FM transmitter. Mains PSU 10 watts £25. Class D. Wave-meter £10. Carriage extra on all items. S.J. Haseldine G8EBM. Leamington House, Windley Lane, Weston Underwood, Derbys. Tel: Brailsford (033 528) 755.

● **TRIO JR500SE** amateur band. HF receiver, mint condition. Little used, boxed and complete with manual £60. Tel: Bishops Stortford 812096.

● **WANTED**. 30mc/s-200mc/s. Gen. Cov. RX 240V. Phone office hours 0908-56222 ext 35.

● **SALE AR88**. Good condition, classic receiver, must be collected. Near Portsmouth. Phone Locksheatheath 2903 evenings.

● **ZX81 +16K** programs, 'Find-QRA' -input lat. and lon. to find your QRA locator. 'QRA' -for distance, bearing, points, etc. £3.50 inc. £1 for RAIBC. G8CEZ R. Fuller, 35, Chichester Walk, Wimborne, Dorset.

● **WANTED FOR CASH**. Hammarlund HQ180A triple conversion receiver. General coverage. Good working order. No mods. Heath, m'Pinjarra', Steephill Road, Ventnor, Isle of Wight. Tel: 854175.

● **SCARAB RTTY** interface unit for ZX81 includes service sheets £20 ono. K.J. Faulkner, 77 Rookfield Avenue, Sale. Tel: 061-969 0785.

● **WANTED** circuit diagram and service manual for AR88D, also RF & IF alignment tools. Mr. M. Nixon, 103 Patrick St, Grimsby, South Humberside DN32 9PQ.

● **COMMUNICATIONS** receiver Eddystone 730/4 £100 ono. Also BC221-AH frequency meter. Offers. Also 90 Practical Wireless magazines. Offers to Jackson, Station House, Fledborough, Dunhamon Trent, Newark, Notts. Tel: Dunham on Trent 364.

● **MARCONI GENERAL** purpose receiver type 2207E valve set full working condition. Weight 34kg 15kc-28MHz ex Atlantic weather ship. Receiver, headphones and technical handbook. Offers or w.h.y. Brian Devlin, 130 Carmichael Street, Ibrox, Glasgow G51 2WV. Tel: 041-440 1561.

TRIO 59RDS communications receiver. Excellent condition with manual. £50. Tel: Little Chalfont (02404) 3029.

● **WANTED OR SWOP** any amateur programmes for Texas T199/4A. Also wiring diagram for Yaesu SC1 console and tone encoder. B. Davis, G61 LR QTHR. Burntwood. Tel: 76741.

● **WANTED**, frequency counter to use on Realistic DX-100L RX P.O. Box 17, Olney, Bucks. MK46 4JH.

● **WANTED** General receiver in good order. Tel: after 8pm. Swindon (0793) 826680.

● **FOR SALE: ICOM 22A** £65. Motorola SWR modulation power meter with built in aerial matcher. Big Jim CB antenna £25-35. Borgwarner automatic gearbox. Model 35. completely reconditioned 14 months ago £65. or swap for rotator. M. Hilton, 30 Batford Road, Harpenden. Tel: 64349.

DATONG morse tutor p70. As new still boxed, G6IUN QTHR. Tel: 061 941 3930. £43.

● **YAESU FT290R** multimode portable nicads, charger, 5/8 whip magnetic base, tone 2M50W all mode linear value £325. Sell £225 or make me an offer. Tel: 01-360 8750 (Enfield).

● **FT101E** with DBM fitted. Excellent rig plus SP901 speaker only reason for sale going QRT. Good clean condition £345 ono. Call G4POL Oxford 67452 evenings or weekends.

● **FOR SALE DX200** brand new, boxed, 150KHz-30MHz communications receiver. Never been used. Bargain at £110. Phone Swainsthorpe 470428 (Norfolk).

● **TI SR 52** programmable pocket computer with forty scientific and business programs on magnetic cards. Complete with carrying case. Power pack, converter charger and leads. Instruction manual, workbook almost unused. Only £40. Telephone 032 456 2797.

● **MICROWAVE** Modules 432/144R transverter. Excellent condition, little used. £115.00 ono. Wanted. Mizuho MX4. Mr. J.B. Rowlands, 70 Braces Lane, Marlbrook, Bromsgrove. Tel: 021-445-3207.

● **YAESU FRG-7700** high-performance all mode communications receiver. Twelve channel memory fitted. Only four months old. Cost £425 will sell for only £325 ono. Tel: Graham on 061-740 4126 Securicor delivery at cost.

● **SALE PANASONIC** digital superhet LW, MW, SW, FM. Very sensitive 550K/c-30MHz still under guarantee RF3100 model £135. Phone 97-32787 (Waltham Cross).

● **WANTED FOR CR150/3** 'S' meter. Front panel. On/off switch. Power supply plug plus any spares for above. Phone evenings 01-736 6581.

● **FOR SALE: AR88D** with original handbook £105. Hallcrafters S27 receiver 27.6 - 143MHz coverage, AM/FM/SSB with original handbook £100. Both fully serviced by professional. Also CR100, working £40. Phone Tring (Herts) 2276.

● **REALISTIC DX-100L** Gen/cov. Receiver 150kHz-30MHz SSB/CW/AM S-meter coarse/fine tune. Ferrite rod built in telescopic whip provision for external antenna mains/or 12v/neg ground. Mint condition, little used, original packing and handbook, £50 ono. Tel: Bristol (0272) 602402.

● **ICOM IC251E** 2m Multimode Tx1Rx base station. Mint condition £425. ICOM ICS M5 desk mike, ICOM ICH M10 fist scanning mike, offers, Daiwa RM940 infrared mike. No connections £30. G4IOF. Tel: 01-486 8286.

● **DRAKE T4XB** transmitter AC power supply R4B Receiver all bands including W.A.R.C. transceiver capability SSB/CW/AM four filters passband notch, mint condition buyer collects £475. Trowbridge 3166. G4LW. 118 Bradford Road Trowbridge, Wilts.

● **NATIONAL HRO** unmodified vgc. 6 coilsets Lafayette aircraft receiver 108-136 mcs Navy B.29 long wave PCR ex-WD I.m.s. also KT66 valves. Any reasonable offers. Phone 0273 (Brighton) 737076.

● **WANTED** ex-RAF type "D" Morse key with dust cover. Frank Glynn, 41 Crossways Avenue, East Grinstead, Sussex. RH19 1JD. East Grinstead 22967.

● **HRO RECEIVER** Good working order. 7 coil packs power unit. £35. Buyer collects. N Sparrey, 3 Summit Rd, Clows Top, Kidderminster. Tel: 029 922 279.

● **WANTED: FT620**. Four metre antenna. Four metre amplifier. Phone 01-856 4123.

● **TRIO TS515** Transceiver £200 Hammarlund SP600 Receiver £70 Mizuho 2M SSB Transceiver SB2M with 10 watt linear £70 or exchange for Datong PC1 Converter. N Evans, 56 Homerton Road, Pallister Park, Middlesbrough, Cleveland. TS3 8LX. Tel: 0642 211685.

● **FOR SALE: MMT432/144R** Transverter £115. Daiwa CN630 SWR meter £60. Kenwood PS30 power supply £80. Dualband 70m/2m Colinear £20. Mr. A Kelly, 8 Greenslade Crescent, Marlbrook, Bromsgrove. B60 1DS. Tel: 021 445 2088.

● **WANTED** Codar AT5 plus Receiver and power supply; ceramic bases for 4CX250's. 4m Transverter - anything considered. Mr. A Kelly, 8 Greenslade Crescent, Marlbrook, Bromsgrove. B60 1DS. Tel: 021 445 2088.

● **QSL CARDS WANTED:** especially any showing Mickey Mouse, Felix Cat, Bonzo, Concorde, Olympic Games, or cards from any part of Antarctic. I pay fair prices for nice clean cards. G3BDQ, QTHR. Mr J D Heys, 'Whitefriars', Friars Hill, Guestling, near Hastings, Sussex. Tel: Pett 2262.

● **FOR SALE:** National Panasonic DR31 general coverage receiver FM/MW/LW and Short Wave 1.6 to 30MHz double superhet phase locked loop synthesizer BFO mains, batteries. 10 months old. Cost £178 - Sell £100. John Rayner, 35 Greenlaw, West Denton, Newcastle-on-Tyne NE5 5DD. Tel: (0632) 673507.

● **WANTED URGENTLY:** Any paperwork, handbooks, etc for National Receiver NC-Z-40D made about 1946 any cost refunded also A.E. connections HRO type for above set. B Pollard, 3 Deepdene Mns, Rostreton Road, SW6. Tel: 736 6581.

● **WANTED:** Valve 1.6 MHz and 456 KCS 1F Transformers Electronic type other types acceptable. G J Fowle. Tel: Broadstone, Dorset 698142.

● **ZX81 +16K PROGRAMS.** 'Findqra'-input Lat. and Lon. to find your QRA Locator. 'QRA' for distance, bearing, points, etc. £3.50 inc. £1 for RAIBC - G8CE2 R Fuller, 35, Chichester Walk, Wimborne, Dorset. BH21 1SL. Tel: Wimborne 882269.

● **DATONG R.F.A.** wide band amplifier as new, will straight swop for 2 metre beam or for Q8/2M 8 element quad with cash adjustment. Telephone (0322) Dartford 77472/77457 (work) 7.30am to 5.30pm.

● **FOR SALE:** 5 band vertical trap antenna model 18AVT. 80, 40, 20, 15, 10 metre wave band with HS ground plane kit as new only 4 months old. £80 ono. Ring Worthing 691717.

● **WANTED** urgently MR100A (or similar) pocket 2m scanning receiver. Will pay carriage. All letters answered. Mark Cooper, 33 Park View, Royston, Bamstley, South Yorks. S71 4AA.

● **KW204** transmitter, 6 bands, 160-10m with Shure 201 mmil and spare 6146's KW202 receiver qmult, notch filter, speaker and manuals. Both mint £160 each. £300 the pair. G4KKG QTHR. Tel: Yeovil (0935) 25327.

● **WANTED** 3 element TRI band antenna 10.15.20 mtrs. D. Lowe, G6EFA, Oakdale, Biddenden, Nr. Ashford, Kent. Tel: Biddenden 291303.

● **NRD515** and matching speaker £860. FRG7 internal dig. readout 2.155B and 5kHz AM filters £165. Regency 16 channel programmable air band receiver manual/scanner mains/battery, scan/search, scan delay. £175. Datong UC1 up converter £65. Wanted Redifon R408 receiver. K. Burton, 159 Redworth Road, Shildon, Co. Durham DL4 2JP. Tel: 0388 777398.

● **TRANSVERTER** 27-6.6MHz AM-SSB with RF gain, clarifier 12 volt £140. Ring Dawlish (0626) 86321.

● **COMMUNICATIONS** receiver Tandy DX302 10KHz to 30MHz quartz synthesised, digital frequency display. As new in original box. Cost £289. For sale £180 ono. M.S. Birkin, 2 St. Marys Close, Attenborough, Nottingham NG9 6AT. Tel: 0602-259359.

● **WANTED** HRO preferably in clean and serviceable condition, ideally with range of general coverage and band spread coils, alternatively BC 342 (or BC 312) unmodified and in good condition. Telephone GW3 FSW on Dyserth (0745) 570538.

● **SALE** S.A.E. components, valves. Wanted Vibroplex bug key, information graph oscilloscope type 303C. All expenses paid. G2HKU. Hamlyn Saxon Avenue, Minster Sheerness, Kent, Tel: (0795) 873100.

● **HELP!!** need 2 metre multi-mode, student leaving home will swap for excellent condition camera equipment, value £300. Any offers. Please phone Royston (0763) 71406 evenings only to Chris G4 5NJ.

● **EXCHANGE** portable B & W TV, 5 inch screen with build in AM & FM radio, runs on mains battery or cigarette lighter in car, for ZX Spectrum computer or Sony ICF 2001, SW radio, or FC 902 ATU. Will sell for cash, offers. Tel: Malvern 64327.

● **SUPERSTAR** 360FM AM/FM /USB/LSB/KW/KC shift. Build in SWR meter, standard mike, plus turner JM/ZU power mike as new and boxed £135. Tel: 01-958 6400 after 7pm.

● **BADGES** of call signs in brilliant copper. Lapel or tiepin mounted on solid brass badge pin 90p including delivery within 10 days. Griffiths, 6 Stanway Close, Alkrington, Middleton, Manchester M24 1HP. G6CVW. Tel: 061-643 6944.

● **LINER** 2 2 metre S.S.B. 10 watts frequency coverage 144.10 to 144.33 mobile mount and manual. Good condition, ideal starter rig £80 including postage, Frank G8TIG. Tel: Clitheroe, Lancs. (0200) 26137.

● **MIDLAND** 2001 CB transceiver with 1/2 wave antenna, will swop for general coverage receiver or 2 meter receiver or w.h.y. Tel: Cambridge 834263 evenings or weekends.

● **YAESU FT707, FC707 A.T.U., FP707 P.S.V. YM35 Mic,** all Warc bands A.1. condition £575. Also midland 3001 FM. CB & Mic & SWR/ATU & 5-7 amp. Power supply and 'Wotpole' antenna £50 or swap the lot and FRG7 RX and cash adjustment for Icom 720A & PSU. Tel: Fillongley (0676) 41012 (after 11 am).

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appears on May 26th, 1983**

FOR SALE: Eddystone 770R MKII V.H.F. radio with manual, crystal calibrator not working £180 or exchange for 2 meter synthesized hand held with accessories or EA12 or w.h.y. P. Newton. Phone Glenrothes (0592) 745056 evenings.

● **KW ATLANTA 80-10M** transceiver, PSU/SPKR, ext-VFO, shure mic, 500W p.e.p., 350W CW, two speed tuning, v.g.c. £200, carriage extra. Paul Lockley, 52 Bunkers Hill Lane, Bilston, West Midlands WV14 6JR.

● **R.C.A. AR88D.** Good order with sports and literature. Buyer collects please. £40. Tel: Mr. Fred Galpin, 23 Upper Highway, Hunton Bridge, Kings Langley, Herts.

● **CALLSIGNS** in brilliant copper tiepins label rally badges 90p. Station car plaques with holders £1.50p. Delivery included within 10 days. W.E. Griffiths, 6 Stanway Close, Alkington, Middleton, Manchester M24 1HP. 66CVW. Tel: 061-643 6944.

● **SANYO RP8880** communications RX FM (88-108MHz) LW, MW, SW, (1.6-30MHz) in 6 bands, double conversion system, tuned R.F. amplifier, 1MHz, 100kHz 10kHz, Xtal marker, antenna trimmer, wide/narrow selectivity B.F.O. £110. C.J. Graham, 8 Oaktree Drive, Ecclefechan, Dumfriesshire. Tel: 057 63 364.

● **WANTED:** very high frequency techniques (McGraw-Hill book) also old "junk" using lighthouse tubes. A. Emmerson, G8PTH, 4 Mount Pleasant, Blean Common, Canterbury, Kent, CT2 9EU.

● **SRX30D DIGITAL** communication receiver for sale. Five months old. £165. H. I. Humphreys, 31 Upper River Bank, Bagillt, Clwyd, CH6 6JL. Tel: Holywell (0352) 713708.

● **HAVE ALBA CBHZ 40** channel C.B. walkie-talkie with rubber duck antenna. Wish to exchange for ham band receiver, E.G. Yaesu FR101 or FR50B. Ring Southampton 819333 (ask for Andy King).

● **SOMMERKAMP FT307DMS.** Absolutely immaculate condition. Still under guarantee used on reception only. First offer over £700 secures. Contact 62, Rosemount Crescent, Carstairs, Lanarkshire ML11 8QW.

● **PANASONIC DR28** receiver FM/MW/LW & 3.2-30MHz SW, double superhet, digital, BFO, mains/battery £125. Vega 250 nine bands including VHF £20. Wanted DR49 or Panasonic 32 band Rx. Tel: 01-959 7715.

● **WANTED:** KW2000 Transceiver A or B. Good condition please. Have no car, will use public transport. Bournemouth/Salisbury/Southampton areas to collect. Part exchange 28/144 Transverter brand new, or sell. £80 on. Phone Ringwood 5717, Charles G8YKC. If prefer please write: C Collins-Hooper, Come-wood, 63 Sandy Lane, St. Ives, Ringwood, Hants.

B40 ADMIRALTY communications receiver, excellent condition, ideal for the shack. Modes R/T CW FSK SSB, 500Kc/s-30MHz £70. Heathkit SW717 factory tuned £70. Buyers collect. Askwith, Leeds O532 682682.

● **REALISTIC DX-100L** gen/cov receiver 150KHz-30MHz - SSB/CW/AM S meter, coarse/fine tune ferriterod built-in telescopic whip provision for external antenna. Mains or 12v neg-ground mint condition, little used. Original packing and handbook. £50 ono. Tel: Bristol 602402 Code O272.

● **COMPLETE 2M** base/mobile VHF station. Trio 7010 2M SSB/CW rig plus 65 watt linear 4 ele quad 5 ele Yagi 2m whip magnetic mount. SWR meter, rotator. All good condition. £220. Buyer inspects and collects. G41NV QTHR. Tel: 051-724 3998.

● **FOR SALE:** Yaesu FT480R 2m Transceiver guaranteed until Nov 1983, £285, Tono 2m 100w linear guaranteed until Dec 1983 £75, SEM Iambic keyer fitted in case with paddle cost £65, accept £25. Model YW3 SWR power meter £5. A F Sephton, 16 Bloemfontein Avenue, Shepherds Bush, London W12 7BL. Tel: 01-749 1454.

● **WANTED:** Mutek front end board for FT221/225. Also required Fix Unit Xtals, Repeater and FM Simplex channels for FT225. Phone 0224 643131 after 6pm.

● **FOR SALE:** Heathkit RA1 QPM16 "Q" multiplier matching loudspeaker recently re-aligned and serviced. Factory built £40 buyer collects. G3RKC. WJ Bryan, 20 Thirlmere Court, Felixstowe Suffolk. IP11 9SN. Tel: 277208.

● **EXCHANGE:** Yaesu FTV250 2m Transverter designed for FT101/FR101 or FT201 for good receiver Casa adjustment if necessary also one pair of 7MHz Unadill Traps, Trio MC35S mike, AEC, SWR meter all as new £20. P Haughey G3JXR, 7 Pulborough Close, Dovecote, Bletchley. Tel: 0908 642398.

● **FOR SALE:** Bolex C8S Cine Camera and matching Projector with five voltage settings dated 1958. Also Editor Dual 8 and Splicer, all mint condition or exchange for Multimode Transceiver. Tel: Tamworth 51591.

● **WANTED:** Pyrex or ceramic insulators plus Tee insulator for homebrew Rx Dipole. Will pay cash. Also SWL to correspond and exchange information ideas etc. Phone anytime or write with details RS54142 QTHR. John Griffiths, 8 Morawelon Road, Holyhead LL65 2ED, Gwynedd. Tel: (0407) 50291.

● **ZX81 COMPUTER** power-pack instruction books etc boxed plus 16K RAM and software £55 ono or swap for Gen. coverage receiver or good CB SSB/AM rig. Tel: Tony (0582) 425365.

● **NORDEMEDE** Globetrotter AM/FM/LW/MW/CB amateur 5 metre BFO 8 spread bands 3 SW bands. AGC.MGC Battery mains portable. Mint. Interested in R2000, made in West Germany. Offers. Phone Bradford, W Yorks, 676556 after 6pm.

● **BRAND** new Icom IC740. One week old £600. Unused. Listed at £725. Also PSU IC-PS15 £75. Unused. Listed £115. Sell together £650. For more information Ring 0293 515711.

● **WANTED:** Single side band adaptor for Grundig Satellit 2100. H Gillott, 40 Wellington St., Heanor, Derby. Tel: Langley Mill 67138.

● **WANTED:** Stolle Automatic Rotator with or without control box. 4 element, 2 metre quad KW. 107 or 109 ATU. Matched pair 6JS6C as BY7A valves for FT101B. Please full details, cash waiting QTHR. Roy Andreang G4CMT, 6 Beech Avenue, Bilton Hull, Humberside. Tel: 0482 812115.

● **G2DYM** Trap Dipole 40/10 inc. complete with 50ft twin feeder superb performance length 55ft £45. G2DYM balance to unbalance unit, switched option £12.50. Antenna and unit £55. Contact John G3OAZ QTHR, Basingstoke 65126.

● **FOR SALE:** Yaesu FT902DM all mode as new £725. Sony 2001 little used £90. Datong Auto Speech Processor little used £60. Trio 2300 with Nicads etc, little used £110. A E Chivers G3YFQ, 1 Sycamore Close, Bushey, Herts. Tel: 41461.

● **JAPAN RADIO** company's preselector NFG505 .5MHz-30MHz. Quality unit as used with their NRD505 commercial grade communications receiver. Brand new, unused, boxed. £45 collected, £48 posted. W H Gregg, 2 Park Road, Granborough, Buckingham MK18 3NS.

● **FOR SALE:** Yaesu FT102 as new not used since mid February with 26 and 27 megs. Offers around £680. Dave PO Box 3 Egham, Surrey. TW20 0SG.

● **WANTED:** PF1 Pocket phone Tx/Rx in working order Xtalled to RB2. Phone Newcastle-under-Lyme 612868.

● **FOR SALE:** SRX30D Digital communications receiver £160. Now have G8. H I Humphreys, 31 Upper River Bank, Bagillt, Clwyd CH6 6JL. Tel: Holywell (0352) 713708.

● **SALE OR EXCHANGE** Halli-crafter S38D AM & CW receiver £25. Would exchange for good up down key or a morse reader. Mr. D. Clifford, G6UFV, 160 Goldsworthy Way, Slough, Berks, Tel: Burnham 64567.

● **WANTED** handbook or circuit diagram for Lafayette HE-30. General coverage receiver willing to buy or hire to copy. All expenses paid. Urgent need. John C. Bowditch, 21 East Wyld, Weymouth, Dorset. Tel: Weymouth 75353.

● **WANTED** VHF-UHF R.X. 770R or similar. Hallicrafters etc. Swap for medals, die-cast, scale military vehicles, or cash wanted. Hi-gain 18AVT vertical antenna. H.R.O. £60 and BC348 £50 for sale. Phone Dave - office hours 0908 566222 ex. 35.

● **SELL OR** exchange Trio R 1000HF receiver with manual. Excellent £200. Scanning receiver Pro 2002 60MHz-512MHz, 50 channel memory bank, 20,480 frequencies, 2 months old £200. Exchange one or either for CW-RTTY decoder. T.V. monitor or what have you. Ring 051-638 5554.

● **REALISTIC DX302** HF receiver. All HF bands, digital frequency readout. SSB/AM/EV BFO ECT, Swap for 2 mtr rig in good working order. Must be able to deliver. Ring Mr. Rolls on 01-568 0844 (West London).

● **ORIC 1** and BBC programs. Rtty £7.50 morse tutor £4.50. Distance £3.50 70cm 8 el XY Yagi £20. 2A 13v PSU £7.50. 15W 144MHz linear £20. Datong FL1 £40. GBKMV QTHR. Tel: 0438 54689.

● **SCANNER** required, will pay up to £150 evenings, up to 9.00 pm. Colin on Eastbourne 0323 57769.

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In May a new design for a 50W h.f. transceiver will appear in Radio Communications. While it is a departure from our normal policy of marketing only our own designs we were so impressed by George Fare's (G30GQ) write up that we have offered to back the project with component kits. This will include PCB's and all components per our normal policy. Full price details are not yet available but a full kit should market for approximately £250 Inc. VAT. Some provisional technical details are available, please ask.

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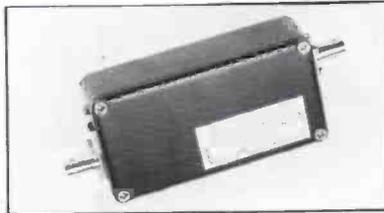
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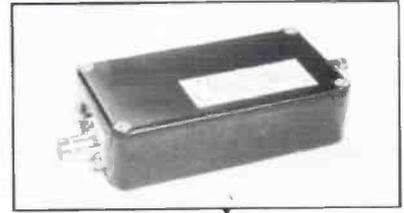
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This all-mode linear transverter allows your 28MHz transceiver to operate on the popular 70cm band. Providing an output of 10 watts RMS, and incorporating a low-noise receive converter, this product represents a cost-effective means of moving up to one of the few peaceful amateur bands. A frequency shift, allowing coverage of 432-434 MHz and 434-436 MHz, both from 28-30MHz equipment means that the simplex, repeater and satellite portions of 70cm can be utilised.

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MMC50/28

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Input frequency range : 50-52MHz
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Overall gain : 30dB typ.
Noise figure : 2.5dB or better

Price: £29.90 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)

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)

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)

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)

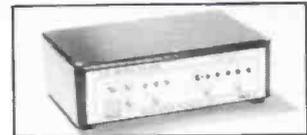
MMC144/28

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)

MORSE TUTORS



MMS1 pictured

MMS1 - £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.

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)

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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