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Amateur RADIO

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CURRENT·COMMENT

Greetings, each and every one and hopefully you've been enjoying your wireless lately. We've been aware for a while that we've needed to complement our equipment reviews by explaining exactly how we do tests on amateur gear and what we look for and why – so we're delighted to say that in this issue you'll find the first of a multi-part series covering all aspects of testing which is being written especially for us by The Man With The Golden Spectrum Analyser, Angus McKenzie, G3OSS.

How a spectrum analyser works

So if you've ever wondered about third-order intercepts, RFIM, noise figure and all the other magic words, look no further – it'll all be here. If you've never heard of a spectrum analyser, let alone don't know what it's for, worry not because it'll all be explained as we go. Should be great stuff.

Introducing you to this month's issue

Dont think, though, that from here on all our tests will be highly technical and contain no word less than seventeen syllables long. We have the rank beginner just as much in mind as the C.Eng. The letters that fall onto the editorial desk seem to suggest that the tack we're taking with reviews and technical things generally are about right, so we'll bash on an see how it goes. We have a typical Bicester review in this issue, to wit the **Microwave Modules 28-432MHz transverter,** so it might be good to read that in conjunction with what Angus has discussed and see whether it all makes sense. If it doesn't we'll fire the Technical Editor (what? me? I'm on a contract, aren't I? Oh).

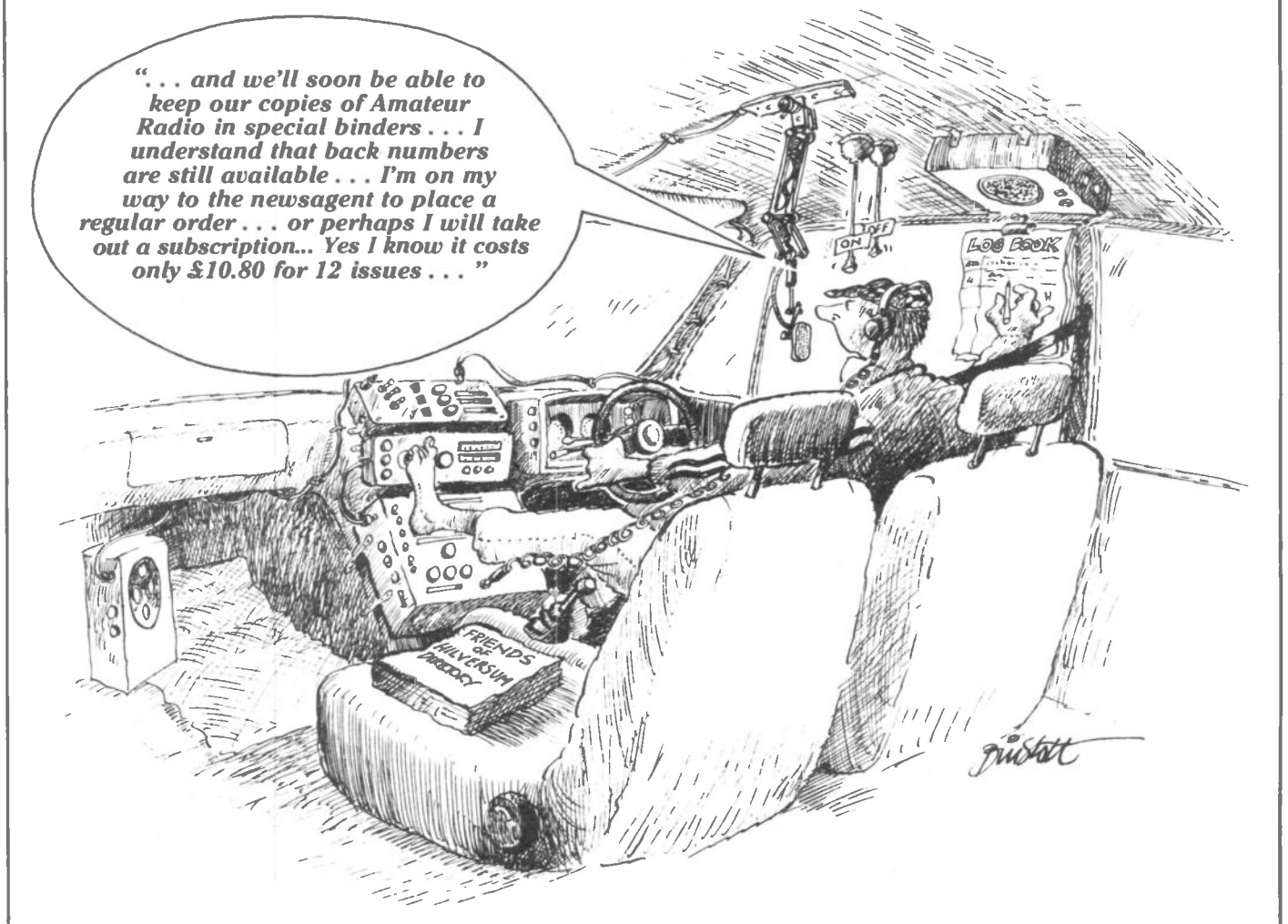
We have some interesting reviews coming up in the next few months as well, so you'll have plenty to go at. As we've said elsewhere in this issue, we've been looking at the **Icom 251E** with and without the **Mutek** board – very tasty indeed. We're also getting some time on an antenna test range in order to look at some **144** and **432MHz** antennas in depth, which ought to be fascinating considering the blue haze that seems to surround most antenna spex we see. We've been pondering ways and means of doing some meaningful tests on HF antennas as well but we haven't got too far with that yet. Oh yes, and our homebrew HB linear design is coming on well and that's scheduled for a couple of month's time.

Again, the RAE is under fire

To judge from what we read in some other radio-oriented publications, the Radio Amateur's Exam is under fire again for what many claim are silly and irrelevent questions, inconsistent scoring and a general attack of bureaucratitis. We haven't seen any recent papers ourselves, apart from the specimen things which we've been using and mulling over for our course on how to pass the RAE, so we'd be most interested to hear from our loyal and happy band of bretheren out there about their feelings concerning the RAE.

"The blue haze that seems to surround most antenna spex we see"

It isn't that we want to come over all militant and start laying about us left, right and centre but if there are some problems we'd love to hear about them so that we can go to the right places and get some answers. Any offers? Are you all up in arms about the RAE, or are the media making a mountain out of a molehill? Let us know and we'll stick an oar in.



L·E·T·T·E·R·S

Experiences of a serviceman

First of all let me introduce myself. I'm known to friends as Con Foley (no, the 'con' is the shortened version of the old Roman name of Cornelius). Next, to set the background; I'm bashing away on my old typewriter in the living room, got my Sony 2000I tuned to 500kHz, time is 11.27 GMT. So immediately this is an indication of my first love.

Yes, I'm an ex-Marine R/O and after almost 30 years ashore my Morse is as good as ever. A cup of strong coffee at my side plus the odd fag, so here goes for the first letter I have ever sent to any newspaper or magazine.

Before I continue, I have just received my April copy of *Amateur Radio*, the first issue being found on a magazine rack of a local supermarket; I'm hooked, sincere congratulations on a first class effort. So help me I cannot find fault with editorial content and the technical articles are excellent, and a pleasure to read.

My main reason for writing could be rather a long story and as you are no doubt a busy person I will try and keep to matters of interest. Being born in the old city of Cork and having on several occasions kissed that famous stone, I must try and restrain a natural tendency to ramble on.

During my late teens I was employed in what may be termed a dead end job, when an ex R/O with a wide experience of both ship/coast station equipments opened a radio college. Naturally along with several friends we managed to scrape together the entrance fees. For the next two years we worked solid, week in, week out, to obtain our tickets. Personally I think our standard of success was mainly due to group study – to college for the necessary technical lectures, and practical work on Marconi gear, then back to one of our homes for telegraphy. We built our own Morse oscillators complete with key/phone jacks and by the time we sat our examination(s) we'd no problems.

That year in Cork, the pass rate was over 90% and believe me the Irish GPO examiners pulled no punches. The oral test alone lasted over 1½ hours and it covered everything. In each case the examiner had a copy of your written tech. paper to refer to, then to cap matters the same bloke was in charge for the practical fault-finding test. The hard work proved worthwhile. In all my years at sea I never failed to clear my traffic; what's more I'm proud of the fact that my station was never off the air. I obeyed a very simple rule so far as receivers went: MF/HF Auto Alarm. On joining a ship my first job was to inspect the radio shack, check everything, then all RXs were switched on, and remained on apart from periods when batteries were being replaced or battery compartments overhauled.

Some of the old hands will remember EQZ, Abadan Radio. At the time I was on the old Burmah oil tanker the Masimpuri, c/s MAUT. Ye gods, the gear! An old Marconi TRF RX and a TX that you prayed over each time one started up, no aerial relay – just a hand switch, then during the monsoon period the deck head was like a garden sprinkler. Then the big day arrived. A sister ship, Badapure, was fitted with an Oceanspan. Regret to say I forget the RO's name, but that bloke saved the day on many an occasion, pse. QSP tfc. EQZ.

As time went on, things including equipment improved. God bless Xtal-controlled TXs and receivers that didn't start to howl immediately you went HF. One other matter; I must pay full thanks to the old Area AF system GKL: ZLW: VIS.

Time comes when the big decision has to be made, stay at sea or swallow the marriage hook. However as luck would have it I obtained a job with Pye of Cambridge, Survey Engineer. Those were the days of the Pye Reporter range of VHF fixed mobile equipments. Operational area was the UK and it required several trips abroad. For instance I was fortunate to be involved in the first International Radar Conference, held in Genoa. I'm sure this conference was the result of the Stockholm/ Andrea Doria incident. Very interesting work. Thank goodness the outcome of this conference proved that marine VHF is an essential aid to radar.

As you are no doubt well aware, the land mobile communication business has grown rapidly since the late 1960s. Again I was fortunate to join STC/ITT when the Star range of UHF/VHF equipment came on the market. The range eventually included link equipments, and the wonderful Star hand portable obtained the necessary I.S. Cert. 2E. For those interested, the ITT M5 mobile is probably the best UHF RX/TX ever designed. Pity all this ITT business is now water under the bridge; I will not go into details as to what happened . . .

For a number of years now I've been out of the communications industry. After the ITT business closed I decided that it was time to close the book. One day the story will be told in full; sufficient to comment that the staff and equipment were the cream of the cream.

This brings me to the Sony 2000I, a gift from a member of my family. Considering its general spec. and facilities it's a good little receiver. Unfortunately I am unable to copy all amateur R/T traffic, CW no problem, so in the near future I hope to invest in a receiver that meets my immediate requirements.

With regard to the RAE, it will of course be necessary for me to get cracking again. Must admit I am just a little behind with the latest specs; this month's copy of *AR* will be of great help. If I may; one bit of advice to those who wish to become key bashers, copy all the Morse you can listen to. It may be too fast to get down on paper, do not let it worry you. Listen on 500kHz, to ships' traffic. The most important factor is DO NOT TOUCH A KEY TILL YOUR RECEIVING SPEED IS AT LEAST 16wpm. Once you start on a key, get a good unit, screw it down to desk or bench, adjust gaps to ensure that each letter/figure is sent with max. accuracy. No good in sending Morse if the other chap has to guess what you're sending. . .

A.C. Foley, R405626,
Burnholme,
York

Page the Oracle?

I thought you might be interested in an answer to a letter I sent to Oracle Teletext Ltd., of London, recently.

"The decision to remove the amateur radio pages (from Oracle) was an editorial one, based on lack of demand. The editor felt that we had a limited number of pages and that there was far more demand for other subject areas. Sorry. It is unlikely that the pages will be reinstated unless there is far more demand than has been evident to date.

"At present all the ITV companies support Oracle financially, although of course, we hope to be self-supporting very soon through advertising revenue."

I hope this helps inform people of the facts, and let them know what they must do to try and reinstate the Oracle page. Their address is Craven House, 25-32 Marshall Street, London, W1V 1LL.

Ian Abel, G3ZHI,
Rotherham, Yorks.

Invisible wire

I was reading my April issue of *Amateur Radio*, when without warning, a seemingly harmless article about "invisible wires" jumped up and gave me an idea. Painful though it was, I endeavoured to make it a reality.

I am a SWL and have very little space to erect a decent wire, and not the money to buy a pre-amp so I got hold of some old coil and unraveled it while running (and tripping) along the back space between the gardens and the embankment leading to the road, and have now got myself a half-mile plus wire!

Gareth Davies,
Aberdeen

L·E·T·T·E·R·S

Two good signals

Congratulations to John D. Heys G3BDQ for his excellent article on end-fed wire aerials (April issue). As an SWL (at present) I have received on my Trio R1000 two excellent signals on only approximately 60ft of copper wire at about 20ft above ground level. And I have considered angling the wire as he has stated. Thank you, for your information.

I shall most certainly now consider this application. Thank goodness I have an XYL (can I use this term for my dear husband or is this strictly meant for the female?) who is very practical – dare I say that due to study I have some knowledge on the more academic side, and could not possibly handle a soldering iron as he does!

After reading this article in your magazine I can see why (well, I hope I can!) I have received two good signals from far afield – details as follows if you can stand it. I do have an ATU in line:

March 2nd. 2200-2300hrs

14.284MHz received from PY2-C1Z, Sao Paulo, Brazil to DLI-RBL, West Germany, RS-43, a distance of about 5,800 miles across the Atlantic Ocean to South East England; no chirp was received from the German station so I assumed he was using a directional beam antenna.

14.303MHz received from 5N-SKD, in Jos, Nigeria, RS-55, a distance of about 3,200 miles to JA-50PT, Japan; a slight chirp from Japan but no proper signal.

Both of the received stations were high up, the Brazilian station about 2000-3000ft above sea level, so you can see I have studied the maps. I have obtained information on these stations from the RSGB and now have their names and addresses, intending to write to them in the near future.

So, if I can receive these signals on my set up, just think what I can do with the amendments suggested by G3BDQ, also the money problem is a large factor, since I am early retired (not young any more fellas!) but genuinely interested in persuing a hobby which will give me great interest and I hope, keep my brain active for many more years to come.

Sorry this epistle is so long, but please bear with me!

Iris F. Osborne,
Hornchurch, Essex.

If you lengthen that 60ft wire and get it higher, you will then hear many distant amateur stations. Try listening for DX at different times of the day. It is not always necessary to burn the midnight oil to hear interesting stations that are thousands of miles away on the 14MHz band. After breakfast sometime, give your dusting and vacuuming a miss (very liberated we are . . .) and have a listening session on that R1000. At that time it is often possible to hear Australian and New Zealand amateurs at good strength. During the afternoon, particularly at weekends, you may pick up stations located in the Near and Far East.

Most amateurs are at work during their daytimes and this must be borne in mind when DXing. We hope you soon receive the QSL cards from the two stations mentioned, but feel that the fact they were both at such high altitudes was a coincidence. Height above sea level has very little effect upon the propagation of stations working on HF, and it is only at VHF that it becomes an important factor. Anyway, good luck, especially with your intention to become an operator. – Ed.

Antique radio

I am writing on behalf of my husband who has acquired a radio which is believed to be about 40 years old, or perhaps more. The make is Etronic, model No. ETA632, serial No. E05374.

We would be obliged if you could enlighten us if it has any value as we were told it could have. It is in good condition and perfect working order.

Mrs. H. Meikle,
11 Birks Hill,
North Bourtreehill,
Irvine, Ayrshire

Anyone know about the Etronic? – Ed.

Where are they now?

Congratulations on another excellent issue (March). The article by G3VA was especially interesting. I note the comments on the BC610 transmitter; I remember three serving as broadcasting transmitters with Forces Broadcasting Station, Nairobi in 1958. They were used on the 6mcs band and I had the job of relocating one to the Coldstream Guards' Camp at G1L G1L in the Rift Valley.

Fortunately I was able to commandeer the surplus excellent plug in PA HF coils for my own use! I wonder what other parts of the world these transmitters may have found themselves.

Stan Crabtree, GM3 0XC
Ex-VQ4GQ,
Aberdeen

That blue glow

Your April issue of *Amateur Radio*, certainly contained "something for everybody", and was very well produced. And I guess I was a cub reporter on a local weekly long before Chris Drake was born . . .

Now, regarding the query about the mysterious "blue glow" in a 4CX250B; this brought back memories of this appearing in mains output bottles long before the war.

It was always put down to the ionization of air molocules which had gained entry by wiggling up the pins or even through the glass (true!). The effect was never noticed in RF of low-power triodes, which ran much cooler, but affected power pentodes in particular. A little glow didn't seem to affect the performance of the valve, but a bright blue light meant too many molecules had crept into the crypt, the onset of dreaded grid current, and the quick demise of the valve – an expensive item to an impoverished schoolboy!

To try and save the valve, it would be left on all night, with heater on, but HT disconnected. Surprise, surprise, this often did the trick, and banished the dreaded blue glow – but goodness knows why!

The multi-pin double triodes used at VHF during and after the war were particularly prone to air leaking into them if left in store for any length of time. It was often possible to eliminate the air by running the heaters for seeveral days, or even up to a week . . . nowadays, they would all be junked, but then the amateurs of the eighties would appear to be made of money (to judge from the cost of gear!!!).

Douglas Byrne,
G3KPO/GB3WM,
National Wireless Museum,
Ryde, I.o.W.

Rotator circuit

I have a Sky King antenna rotator and am hoping that one of your readers will be able to pass on a circuit diagram for the same to me. The fault in the control box I believe, lies in the setting of the two variable resistors. At present I find that the motor will rotate from north to east only, and return as far as West.

This is unsatisfactory, so I hope that someone will be able to assist. Keep up the good work with the magazine.

Bruce Steel, 7 Nemphlat Hill, Lanark Ml11 7PN

Can anyone help? – Ed

Cable wanted

Your article on feeders was very interesting. In that article you write about good low loss coaxial cable, such as LDF-4 Heliax and manufacturers such as Andrews. Could you put me in touch with a firm who could supply me with this cable?

Norman Averill,
Magherafelt, Co.
Londonderry, N. Ireland

Well, Andrews are in Fife, Scotland, and Randam Electronics could also help; ring 0235 23080 – Ed

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

STRAIGHT·AND·LEVEL

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

Another Bicester mega-magazine, after a fairly quiet month on the wireless. We've been getting some reviews together, and indeed in an unprecedented act of generosity we're going to turn a paragraph or two of this learned column over to Technical Bod – he's been walking round the office muttering to himself and fuming gently for the past couple of weeks and pleading to be let loose to get something off his chest. So I said yes provided he didn't mention resonant frequencies . . .

"Sorry to butt in to the Editor's splendiferous prose *(you must be kidding, sunshine – MD)* but it really is time for a bit of a winge about the signal quality of some SSB users, especially on 144 and 432MHz. I'm not normally the wingeing type, far from it, but we've been doing some reviews on an Icom 251E with the Mutek board just lately and also messing about with some good front-ends for 432MHz for publication later on this year. The thing is, I'm really wondering if all this straining after good front-end performance is really worth it when so many transmissions are as wide as the Chilterns. Here we are trying to make good receivers to be plus and minus 10kHz, but the trouble is that some SSB signals are all that and more. It isn't just during contests either – we were listening round about for four evenings a couple of weeks ago, and the average signal when a black box was driving a linear was about plus and minus 6 or 7kHz.

Making life difficult

"It wasn't our receiver either, for anyone thinking uncharitable thoughts, and it wasn't just people with 400 watts from a pair of 4CX250s. The worst one we heard was a G4S-- station who was using a black box and a 100 watt solid-state amplifier, and he was spreading about 20kHz either side of his transmission. A couple of people mentioned it to him in a friendly way, but he said that he was on a second box and his third amplifier so he couldn't do anything about it. Another couple of guys were using the awful NAG amplifiers, with a hapless 4CX350FJ used in about as wrong a way as it's possible to use it and sounding – well – yuck. And so on and so on.

"The best bit was one station who, along with a group of three or four others, was keeping a sked with a Welsh station on 144MHz – he was working on 144.340MHz and making life very difficult for some chaps trying to copy a Scottish station calling CQ on decimal 3. When asked to do something about it, said gent said "Well, I am running about half the legal limit, you know" as though that in some way explained why his signal was taking up a fair chunk of the SSB allocation on 2 metres.

Narrow and clean

"There's no reason on the Lord's earth why someone running 400 watts shouldn't be as narrow and clean as someone running 4. It ought to be possible, assuming the receiver's halfway decent, to tune away from an SSB signal and find it disappearing completely within about 4kHz in either direction. There shouldn't be any little whiskers that keep going right out to 8 or 9 kHz away, although there often are – they are usually the result of either too much mic gain or general overdriving of amplifiers, and it's well worth bearing in mind that if a linear requires, say 10 watts of drive it isn't going to like it one little tiny bit if it gets more. Most black boxes of a nominal 10 watt rating give a lot more than that on SSB, and it's well worth experimenting with an injection of voltage into the ALC socket of the rig, if it's got one, and cutting the drive back so that the amp is comfortable.

"The other nasty, especially with valve amplifiers, is not enough loading. If you tune and load a VHF amplifier for maximum RF out, it's a safe bet that the loading isn't heavy enough for best intermod performance, and by far the best way of doing it is to look at the maker's data sheet and find out what current you should see when you shove a carrier in; you should then set up the loading for that figure. This is very much the case with 4CX250s and the like, and our guess is that 99 out of 100 amplifiers using these aren't giving anything like the performance they should. Remember that a 4CX250 or whatever should have better intermod performance than the average black box if you use it properly and load the thing in accordance with the ratings for it, and don't be afraid of the screen current being negative. It usually is if everything's working properly at VHF.

"The other horror we keep hearing is stations with so much speech processing in that they're about readability 2 even though they're strength 9. You don't need a compression level of more than about 15dB for best readability even at extreme range and extreme weakness of signal, and any more than that is likely to detract from the readability instead of improving it. Processing alone shouldn't affect the width of the signal, but a combination of too much processing, too much audio, too much RF drive and an amplifier that isn't really at it's best and you're in a prime position to ruin about 800 other people's entire day, ie anyone on the band within about 15kHz of you!

Well set up

"Sorry to preach a sermon, but now we're at a stage where really good receivers are getting easy to find it seems to us that the next really urgent thing to do it make sure that out SSB signals don't occupy any more bandwidth than they should. It *can* be done, you know. We were listening to G4OAE in Reading a couple of weeks back running a pair of 4CX250s at the full legal and putting a thunderous signal into our neck of the woods. Tuning around him, he was absolutely gone within minus 4 and plus 3kHz, and we

could have worked the weakest of weak DX at those figures away from him if there had been any there to work. It isn't magic – it's just setting up the amplifier properly and trying to squeeze the last watt out of it. With semiconductor amplifiers, the biggest evil seems to be overdriving – this really is nasty. Half the battle with both transistor and valve amplifiers seems to be the power supplies for them, and it looks as though we're going to have to see if we can't design some good things in this area and contribute to making the bands a better place to be than they sometimes are. End of Sermon."

Hmmm. We have to agree, actually – maybe we ought to start a prize for Good QRO Signal Of The Month. I might just add that our own 432MHz signal at 400 watts is slightly narrower than it is at 8 watts, because the black box performs better at the couple-of-watts-to-drive-the-linear level than it does at 8 and the 4CX250Rs have got about 10dB better intermod performance than that anyway. Net audible effect, or so we're told, is that the signal is about 2kHz narrower at 400 watts than at 8 watts!

Talking about this column, don't forget there's a year's free subscription to the man who finds another name for it! This column that is.

You'll see somewhere on this page, assuming that the Art Editor hasn't had a brainstorm and forgotten all about it, a letter from the Chairman of the RSGB's VHF Committee all about the dreaded SYLEDIS. There isn't a lot we can add, although we can't in all honesty say that 432MHz strikes us as the best frequency in the world for this kind of system and in the paper that came with G3ZNU's letter which gave the background (by one H. P. J. Edge, of Shell UK) there are some very interesting statements. The paper is too long to reproduce here – it runs to ten close-spaced pages – but it makes interesting reading as to the background of SYLEDIS and maybe we'll see if we can make copies available if anyone wants them.

Quite why this system was ever put out is beyond us – what's wrong with putting it about 30MHz lower? Also, we're wondering just how well MOLD and SYLEDIS are going to get on together? We used to operate 432MHz down on the South Coast a few years ago, and one of the things we gathered from talking to the company that runs SYLEDIS, or one of them at any rate, was that the system throws up its hands in horror if you bring any other RF anywhere near it. Oh well – no doubt someone, somewhere has it all worked out and calculated – or maybe that's what the Home Office and Co. would like us to believe. From out here in the sticks, it all looks sometimes like one great muddle, and the sad thing in this case is that the amateurs come off worst.

More and more people, it seems, are going for the RAE, and here at Bicester we're receiving more and more letters asking about courses, how much they cost, how long they take, and where you can go to learn about amateur radio. One of the several reputable schools we know about is the British National Radio and Electronics School of 55 Russell Street, Reading, Berkshire. Telephone 0734 51515.

This school has specialised in RAE courses for more than 30 years and their normal pattern is to cover the theory needed to deal with the exam, and then cover Morse and simple practical work in order to learn the necessary subjects. The BNRES course can be completed in two to six months, depending upon how much time you have to study, while if you want to include a programme of practical and experimental work on electronics, we suggest you take the BNRES "Lernakit" course, which covers the same RAE ground, but adds extra instruction on transmitters and operating procedures. The RAE-only course will cost you from £60, by the way.

Ah well, we're out of space for another month so better leave it at that. Sorry we've moaned this month rather than breezed our way along – don't know why it's turned out like that.

COMMITTEE MEMBERS CORRESPONDENCE

RADIO SOCIETY OF GREAT BRITAIN

Patron HRH The Prince Philip, Duke of Edinburgh, KG Member Society International Amateur Radio Union Founded 1913 Incorporated 1926

Please reply to :-

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0473-642065 (work)

45 Cedar Avenue
Kesgrave
Ipswich IP5 7HA
24th March 1983

The Editor,
Amateur Radio Magazine

Dear Sir,

The Syledis navigation system, used mainly in the North Sea by the oil exploration business, has caused problems to UK amateurs using the 432MHz band for some time. Initially Syledis chains were set up temporarily where and when required, but subsequently installations became permanently established. These permanent chains do not transmit continuously, but are switched on automatically by a mobile unit requiring a navigational fix.

Unfortunately for the amateur population, the 430 - 440MHz band is allocated on a primary basis in the UK to radio location, with amateurs having only secondary status. The amateur population has therefore no right to demand that interference from Syledis cease. What is also unfortunate is that the frequencies of operation chosen by the manufacturer of the equipment, and subsequently allocated by the Home Office, coincide with part of the "DX Communication" end of the 432MHz band.

A paper presented at the "Electronics in Oil" Conference held towards the end of last year in London gave some details of the system, and indicated the frequencies used by the service. The frequencies mentioned are 432.563MHz, 432.513MHz, and 432.463MHz for the Primary Group, and 432.383MHz, 432.303MHz and 432.144MHz for the Secondary Group.

Although the Home Office have been approached about the situation, at present they are not prepared to alter the status of amateurs on 432MHz. So for the time being, UK amateurs are, by the terms of their licences, obliged to avoid these frequencies, so as not to cause interference with the primary service. I would be grateful if you could convey this information to your readers so that they are aware of the situation, and realise which frequencies in the band they should avoid.

Yours sincerely,

Malcolm Appleby G3ZNU
Chairman, VHF Committee

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S·W·L

For the short wave listener

Those SWLs, and indeed licenced amateurs who needed some activity from Spratly Island will have heard the news of the trouble which struck some German visitors to the aforesaid place with more than a little dismay.

In case you *haven't* heard, what happened was that a group of five German amateurs and one woman chartered a yacht and set sail for Spratly – despite strong advice locally not to even think about going anywhere near the place, they arrived at 0652 on Sunday 10 April. Or rather, they didn't quite arrive. They were fired on by one or other of the factions who inhabit the island and apparently their yacht was set on fire. A SOS message was sent, but then all communication ceased and so far no-one seems to have heard a dicky-bird from them.

Spratly Island, which is actually a group of small islands about 200 miles north-west of west Malaysia, is an odd place. Ownership of the whole group is disputed by Vietnam, the Phillipines and Taiwan, and although they're in the middle of nowhere the theory goes that they're potentially rich in natural resources of one sort or another and that there's a vast amount of oil not a million miles away. What seems to happen is that small military units from each country live in and around the islands and take pot-shots at each other from time to time, so it isn't exactly a healthy place to approach on a yacht full of wireless. We gather that, as if this weren't enough to contend with, various pirates and similar malevolent folk inhabit some of the islands and occasionally sally forth to plunder a passing junk or similar.

All in all, then, not exactly the Isle of Wight and it isn't too surprising that although it counts as a separate country as far as DXCC is concerned, there hadn't been any radio-type activity from there for years and years. In fact Spratly Island is in the top five wanted DXCC countries around the world, according to the results of a survey we saw last year, and maybe it isn't surprising that people wanted to go there and activate it – think of the kudos, the glory you'd gain by it.

However, the cold fact is that in pursuit of such distinction it looks as though six people have lost their lives. We all enjoy our hobby, sure, and we'd all be delighted to work something as rare as Spratly, but there's something here about a sense of proportion that's worth looking at. The German group were strongly advised that Spratly wasn't exactly the place to go for a Sunday afternoon picnic, and everything we've heard about the place very strongly backs that up. So why did they go anyway? Maybe there's also a legitimate question here about the DXCC status of such places; does the fact that they're classed as a country as far as DXCC is concerned, act as a stimulus to some people who apparently put the interests of their hobby above things like life and safety?

To our knowledge, this is the first time that something like this has happened, and we sincerely hope that that it's the last.

Anyhow, what else is new? Propagation is definitely showing signs of summer conditions now, as we mentioned last month, and it's noticeable how much we're going down the slope of the last solar cycle. 28MHz has gone for days without producing anything much at all on east-west paths, as we forecast last month, and even 21MHz has been decidedly patchy at times. 14MHz looks set fair to be the main DX band and it'll be open to somewhere or other for almost all of the 24 hours except between about 2 and 4 in the morning local time. 21MHz looks likely to be at its best between about 11am and about 6pm, with the best times being around lunchtime, 1 to 2pm – on most days there'll be plenty to work and some long-haul paths should produce quite consistent signals.

All in all, however, 14MHz looks easily the best band on which to listen for the tasty morsels. Sporadic-E looks likely to provide lots of short-skip Europeans from about the time we hit the bookstands, and to a lesser extent the same is true of 21MHz – you can expect middle and eastern Europe to provide consistent S9 signals on both these bands.

Lower down, 7MHz gets more interesting every day although, as we've said so often before, you need to work for it! The same goes for 3.5MHz, and a good antenna and receiver on this band ought to produce some interesting long-haul stuff during the hours of darkness. Absorption shouldn't be as high as it was a while ago, and signal strengths on the band look like being better than they have been.

As a final-final for this month, it's interesting that the only part of this magazine we don't receive dozens of letters about is this column – since we've been monthly, we've only had two! So we don't really know whether SWLs are being properly catered for; we know that lots of you want to see reviews of receivers and have articles about antennas and tuning units, and we cater for these in the rest of the magazine, but this is essentially your column and we need to know about and what you think of it so far. Also, do you want us to cover broadcast station DXing, or do you get quite enough of this in the other mags? Let's hear from you!

HOW AMATEURS FOLLOWED THE SPRATLY ISLAND SAGA

Taken from the RSGB's "DX News" sheets.

Spratly Is. Operation by DJ3NG & DJ6SI as 1S3NG & 1S6SI from about March 22nd for 5 days. DJ3NG will concentrate on SSB & DJ6SI on CW. LF dipoles will be taken. QSL 1S6SI via DJ6SI, Baldur Drobnica, Zedernweg 6, D-5010 Bergheim, W. Germany. 1S3NG via DK9KD, PO Box 620260, 5000 Köln 60, W. Germany. In addition to this trip, rumours are still circulating about a DU group(inc. DU1CK) making a March visit with the call DX0--/1S.

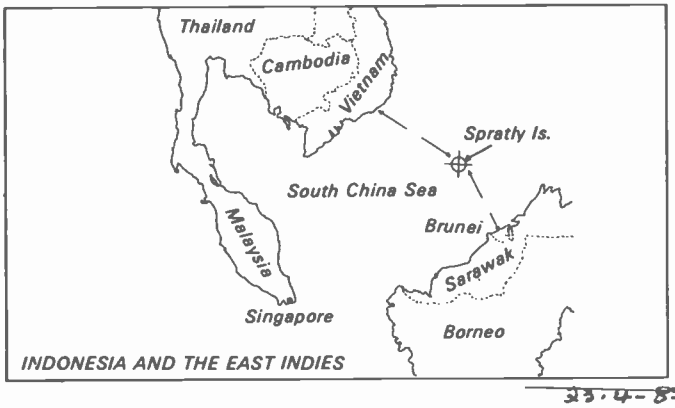
Rumours that the operation by DJ6SI & DJ3NG has been delayed 1 week.

A group of Philippine scientists will be going to Freedom Is in the Spratly Archipelago in late March. The group includes some amateurs who have applied to the Philippine government for permission to operate. If this is forthcoming they will be QRV with the call DX1IS.

The German DXpedition is now expected to reach Spratly (by hired catamaran) on April 7th or 8th. There will be 4 operators, 3 on SSB 1 on CW. SSB QSLs to DK9KD, CW to DJ6SI.

Last contact with the DL group was at 0652 on 10th April, when they gave their location as 8°08'N, 113°12'E (1 mile off Amboyna Cay) and said they had been hit by gunfire and were on fire. Aboard the 51' trimaran were the owner and his wife, together with DJ3NG DJ4EI DJ6SI and DK4FK. Don Search has confirmed that there are no immediate plans to delete Spratly from the countries list, but islands which are being controlled by one of the neighbouring countries will probably not count for Spratly. In view of this incident it might be better if Spratly was deleted as quickly as possible.

1S..The Daily Telegraph reported that a message had been received from the German group stating "two dead, four injured, short of water." No confirmation of this. The DU expedition is rumoured to depart April 16th. 1Z9B 21240 1610 53 wkg G3AWP.



18.4.83

YACHT'S CREW 'PICKED UP BY RUSSIANS'

By GRAHAM EARNSHAW in Bangkok

Mystery continues to surround the wheresbouts of a German yacht which has been adrift in the South China Sea for a week after being shelled by Vietnamese forces on a small coral island in the Spratley group.

A Malaysian radio operator reported over the weekend picking up a message indicating the yacht had been contacted by a Soviet nuclear submarine and its four surviving crew members transferred to a Russian cargo ship but there was no confirmation of this.

The yacht..the Siddharta, left Singapore on April 9 with five Germans and one Singapore girl on board. The Germans reportedly planned to set up a radio transmitter on the Spratley island

19-4-83

HUNT FOR YACHT CALLED OFF

By GRAHAM EARNSHAW in Bangkok

West German officials in Singapore yesterday called off a search for a German yacht lost in the South China Sea as speculation mounted that the crew might be dead or held by Vietnamese troops on an island in the Spratley group.

Officials said reports that the Siddharta's crew of six, missing since April 10, had been picked up by a Soviet ship were incorrect. Earlier reports said the yacht was fired on when approaching the Vietnamese-o

23.4.83

YACHT FOUR TELL OF ORDEAL

By GRAHAM EARNSHAW in Hongkong

FOUR emaciated survivors from a West German yacht shelled when it approached a Vietnamese-held island in the South China Sea arrived in Hongkong yesterday and were taken immediately to hospital.

Two German ham radio operators died in the attempt to set up a radio transmitter in the Spratley Island group, and the other four drifted in a dinghy for nine days without food or water before being picked up by the Panamian container ship, Linden, 15,510 tons.

The dingby was spotted off the coast of South Vietnam at dusk last Tuesday.

Three Germans and a Singaporean woman were taken to hospital for observation.

Their yacht, the Sidharta, set sail from Singapore on April 9, and the following day approached the Vietnamese-held island of Amboyna Cay in the Spratleys. They were fired on by uniformed men.

"The first shot fell into the water behind us, and we just thought they wanted to let us know in a very, very firm way that we were not welcome," said skipper Peter Marx. "They fired a second time and set the catamaran on fire."

Second man dies

One of the radio hams from Cologne, Diethelm MueHor, died immediately, and within 15 minutes the catamaran was a wreck.

The yacht's dinghy, their only hope of survival, started to drift away, but Herr Marx's Singaporean wife, Jenny Toh, recovered it.

"We were in a predicament," she said. "The others were injured or they could not get to the dinghy and bring it back. I jumped into the water on two (petrol) drums and rowed it back."

Herr Marx said they then drifted away in the dinghy with the attackers still firing at them. They had no food or water with them and a second German, Gero Band, died of dehydration on Monday, one day before they were picked up.

The survivors said a prayer and pushed his body out.

The West German government yesterday condemned the attack, saying it would make representations to the country responsible as soon as it was clear who had opened fire.

21-4-83

FOUR ARE SAVED FROM SHELLED YACHT

By GRAHAM EARNSHAW in Bangkok

Four survivors from a German yacht which was set on fire by Vietnamese gunfire were heading for Hongkong yesterday after being rescued by a Panamanian freighter. Two members of the yacht's crew were killed.

The survivors had spent 10 days in an open boat after being shelled as they approached Amboyna Cay in the Vietnamese-occupied Spratleys Islands, intending to set up an amateur radio station. They were picked up by the 15,500 ton Linden.

The Vietnamese apparently made no attempt to rescue them. The Spratley Islands are hotly-contested territory in the Souh China Sea between Southern Vietnam and the Philipoines. They are claimed by Vietnam, Malaysia, the Philippines, Taiwan and China

FALKLANDS MUSEUM

An exhibition of mementos from the Falklands conflict to open at the Imperial W: Museum on Monday.

Printed and published by 135, Fleet Street, London, EC4P 4BL. Registered as a news

Yacht four had 9 days without food

By GRAHAM EARNSHAW in Hongkong

FOUR survivors from a German yacht, shelled by Vietnamese forces on a South China Sea island, said yesterday they had no food or water for nine days before a passing freighter saved them on Tuesday.

Two of the crew died as a result of the attack when the vacht approached an islnd in the Spratleys group. It was planned to set up a radio transmitter to send messages to Ham operators around the world.

The co-owner of the Siddharta, Peter Weiss, contacted by radio-telephone, told reporters in Hongkong that one crew member was killed instantly on April 10 while the other died shortly before they were picked up by a Panamanian ship.

"I made a thorough check that he was no longer alive. We said a prayer, then we had to push him over the side. It was very sad.

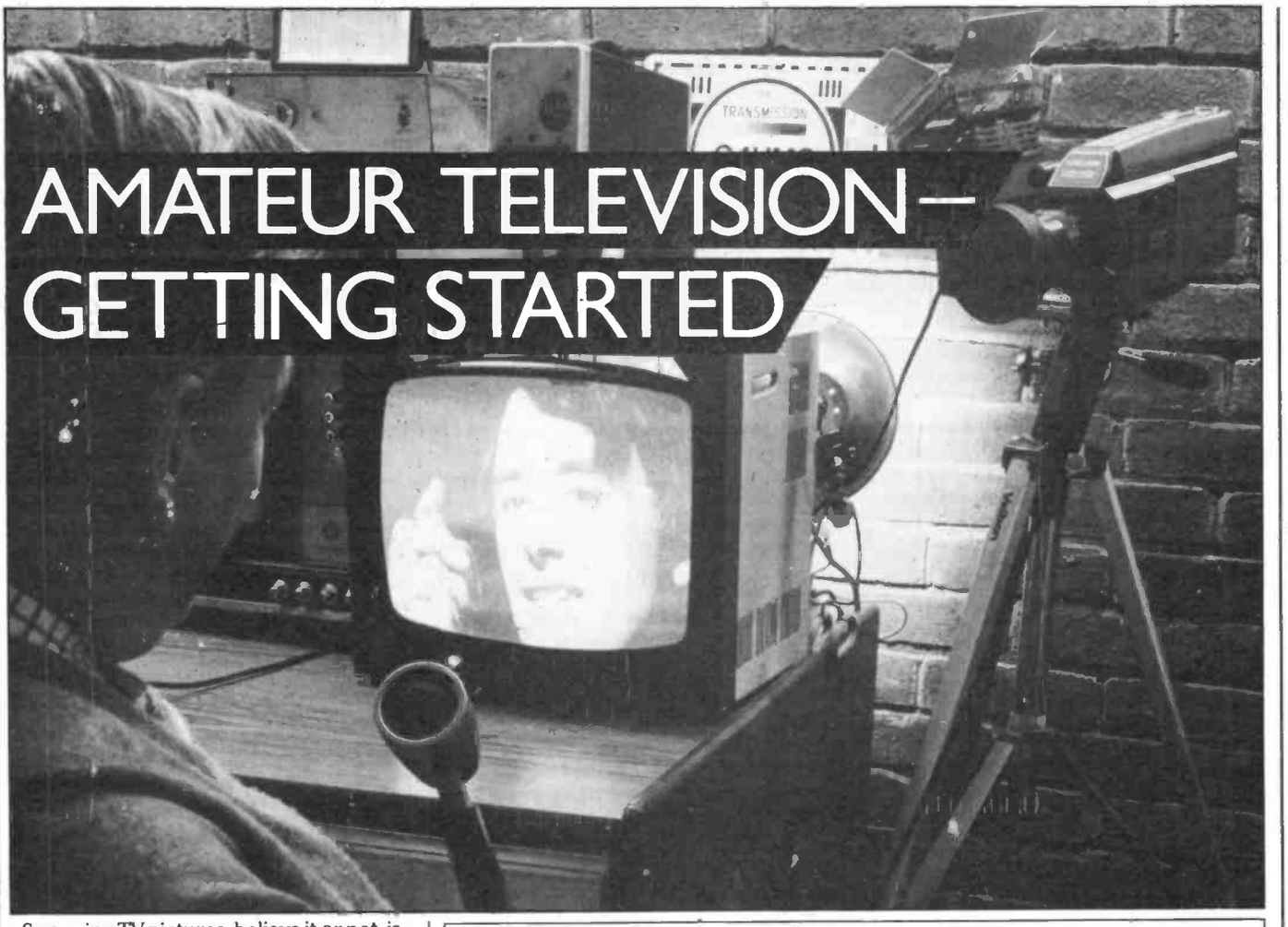
Caught fire

When the Vietnamese garrison on Aboyna Cay started firing on the Siddharta it caught fire, and the then five survivors, four Germans and one Singapore girl, escaped in a dinghy. It was fired on as well.

Mr Weiss declined to specically name his attackers. "They had no flag flying," he declared.

After the attack the dinghy drifted 200 miles west of the Spratleys into the busy sipping lanes off southern Vietnam where they were spotted on Tuesday.

AMATEUR TELEVISION— GETTING STARTED



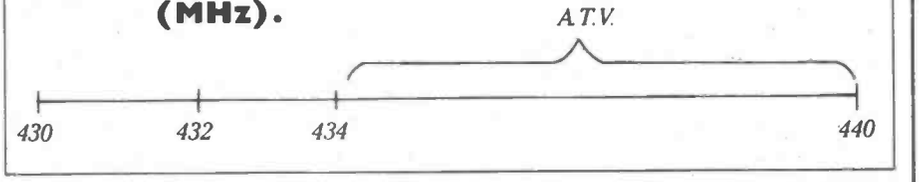
Swopping TV pictures, believe it or not, is one of the fastest growing areas of amateur communication. It is a spin-off from home video, partly, but it's also got a lot to do with the recent availability of transmitter kits and even ready-made 'black boxes'.

Ten years ago things were very different; then, the average TV amateur needed a separate licence (in the G6+3/T series) and also a great deal of know-how. Equipment had to be designed or modified at home and some of it necessitated a separate room complete with a garage-type hoist! Small wonder there was very little activity.

Today it's a lot easier; every licensed amateur (Class A or B) can transmit television without special authorisation. He or she can also get on the air with a basic monochrome set-up for little more than the cost of a medium-priced multi-mode sound-only rig. Best of all, however, amateur TV is FUN! Unlike most other aspects of the amateur radio business, the whole family can get involved. Children's artwork makes good visuals (captions) whilst wives, girlfriends and teenage daughters can make excellent models!

Nearly all amateur TV (ATV) takes place on the 70cm (432MHz) band, this being the lowest band permitted by the Home Office – study your licence for details. Although 70cm scarcely allows enough space for more than one TV channel at a time, it does offer the minimum of technical difficulties and the greatest range of available equipment.

70cm ATV allocation (MHz).



434-440MHz may seem an enormous chunk of band compared with the few hundreds of kHz allocated to various other modes of communication, but television is an inherently wideband mode and the allocation is actually perilously small, especially if you're contemplating colour. The reason is quite simple, namely that with conventional double sideband AM techniques, the transmission occupies twice the width of the maximum modulating frequency. Thus if the signal from a camera contains frequencies of, say, 3MHz (corresponding to the fine detail in reasonable quality mono), the transmission will be 6MHz wide – the whole of the band! There *are* clever ways of cramming in higher frequencies (such as the 4.43MHz colour subcarrier) but these are beyond the scope of simple equipment.

Picture sources

The simplest and cheapest video source is still undoubtedly the second-hand surveillance camera. One of the earliest and most readily available is the Pye Lynx, reasonable specimens of which can usually be bought for around £30-£50 complete with one-inch vidicon tube and lens. With a reasonable amount of normal domestic lighting and a fairly static subject, simple vidicon cameras can produce remarkably good quality mono pictures.

Going further up market, the choice at over £200 is between one of the so-called video cameras intended for use with home VCRs and ex-industrial or broadcast colour cameras. Of these two, the second-hand professional three-tube camera will obviously produce a better picture, but you'll need access to professional test equipment and spare tubes. It's not therefore an option recommended to beginners.

Other video sources in common use are electronic pattern generators of various types. These range from simple commercial dot and crosshatch units to personalised digital test-card generators of great complexity. Home computers are also widely used to generate graphics and captions. Useful, but not essential, is a video recorder. This can be used to store your own movie sequences, and also to record incoming pictures for re-transmission back to the sender. Flattery will get you everywhere!

Fig 2: Typical video signal (not to scale)

With separate receiver and transmitter, it means you can set up as receiving station without the equipment later becoming redundant. First get your standard TV, ATV converter, and 70cm aerial.

Video standards

In the UK nearly all amateur transmissions conform to the broadcast 625-line standard. This means that cameras, VCRs, monitors and receivers must run with a line (horizontal) scanning frequency of 15,625kHz and a frame (vertical) scanning frequency of 50Hz. To keep all these pieces of equipment running in step, or 'synchronised', all transmitted vision signals must be accompanied by so-called 'sync pulses'. Fig. 2 shows the electrical waveform corresponding to a few lines of this composite video signal. The sync pulses shown are line syncs; frame sincs occur every 312½ lines and look rather different.

Most domestic video equipment generates its own internal sync pulses and can therefore be fed straight into a suitable ATV transmitter without any further processing.

Receiving equipment

In many other areas of amateur radio the 'transceiver' is the norm; with ATV, however, most operators still use separate transmitters and receivers. This has the advantage that you can set up a receiving station without the equipment later becoming redundant. All you need to begin with is an ordinary domestic telly (colour or b/w), an ATV converter and a suitable 70cm aerial and rotator.

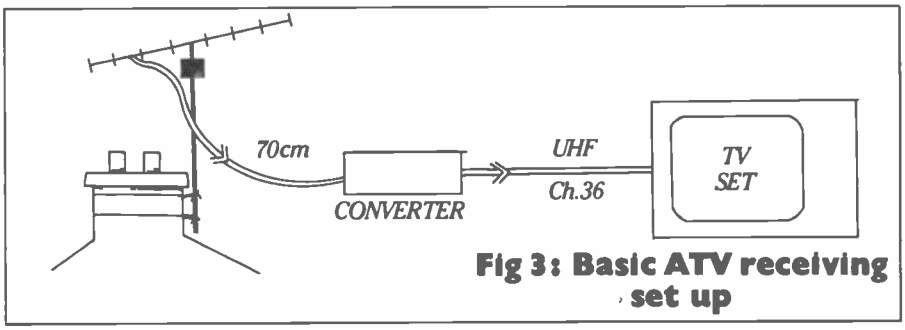


Fig 3: Basic ATV receiving set up

Many ATV converters (such as the Microwave Modules MMC435/600) are available ready-made for less than £30 and will convert a 430-440MHz amateur signal to the ubiquitous UHF channel 36, beloved of all computing and TV games enthusiasts.

A good aerial system with a rotator is a 'must' since ATV signals are rarely as strong as broadcast ones and come from all points of the compass. An aerial specially designed for wideband signals (Tonna 21 el. ATV, Jaybeam MBM48/70) should be connected to the converter using good quality connectors and the shortest possible length of low-loss 50 coax (UR67 etc). Horizontal polarisation is standard, so all aerials should be mounted with the rods horizontal.

Transmitting equipment

Once you've got the receiving set-up working properly, it's a relatively simple matter to start transmitting. The following block diagram shows the various extra ingredients, all of which can easily be obtained ready-made or in easy-to-build kits.

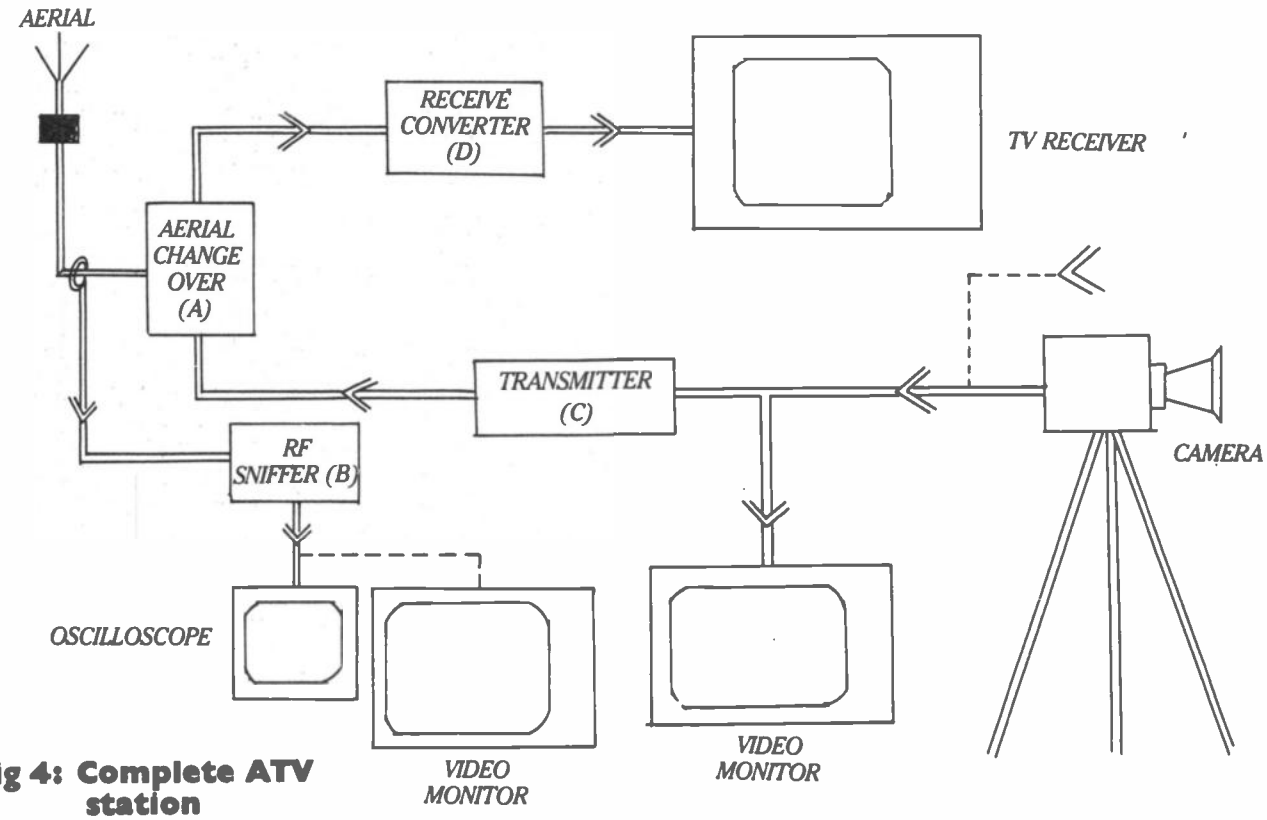
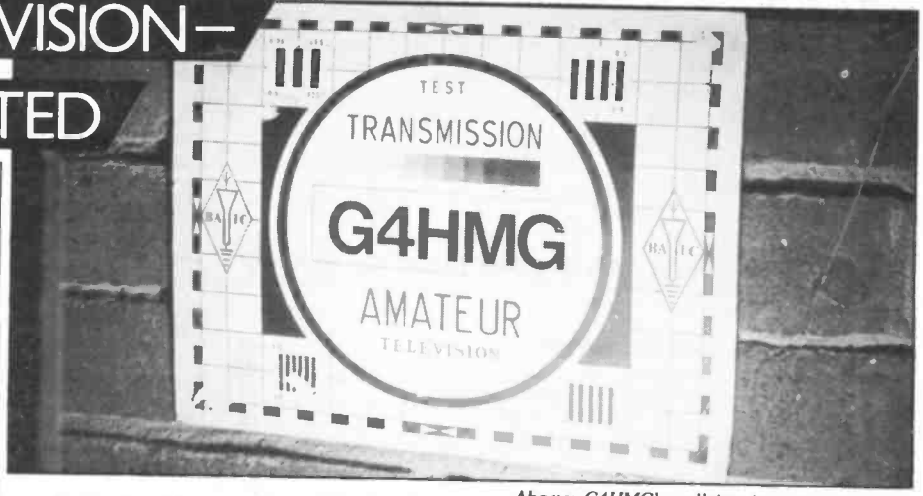


Fig 4: Complete ATV station

AMATEUR TELEVISION – GETTING STARTED



Above: G4HMG's callsign incorporated into British Amateur Television Club test card, stuck to the wall, with the camera set up to transmit same to person receiving. Below: G8KIS transmitting to G8MNY in the front room. Note the neat set up.

Nearly all transmitters on the market include the aerial changeover circuitry (block A) in addition to block C. A typical example is the Microwave Modules MTV435 which offers 20 watts output, a choice of two frequencies and a built-in test generator. A similar model from Fortop Ltd, the TVT435, offers negative or positive modulation (useful if you're planning continental DX).

A component that probably isn't familiar is the RF 'sniffer'. What this does is to extract a small sample of the transmitted signal and demodulate it back into video. this can then be fed either to a monitor or to an oscilloscope to check that there's no distortion (sync pulse crushing is a common fault that can cause severe picture locking problems at the far end). When the transmitter is working properly, the oscilloscope should show a waveform like that of Fig 2.

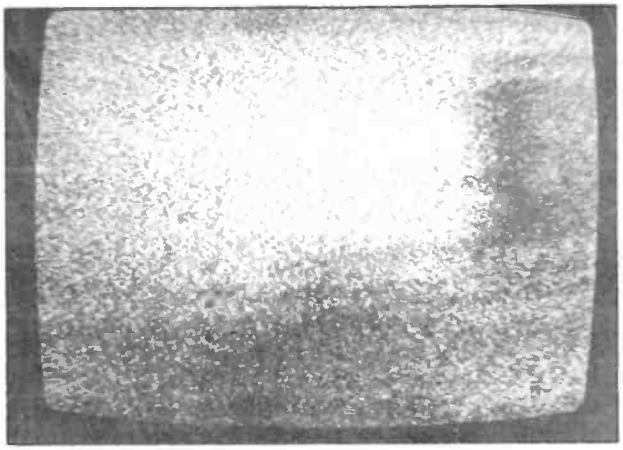
In practice an RF sniffer is nothing more than a diode and a small buffer amplifier loosely coupled to the aerial feeder. A suitable design can be found in the Amateur Television Handbook No.1 published by the British Amateur Television Club. There is now on the market a transmitter that includes an RF sniffer, and an optional receive converter. Called the Sirkit ATV system it comes as near as anything to being a complete ATV transceiver. It's available ready-made or – for those with some construction experience – as a complete kit of parts.

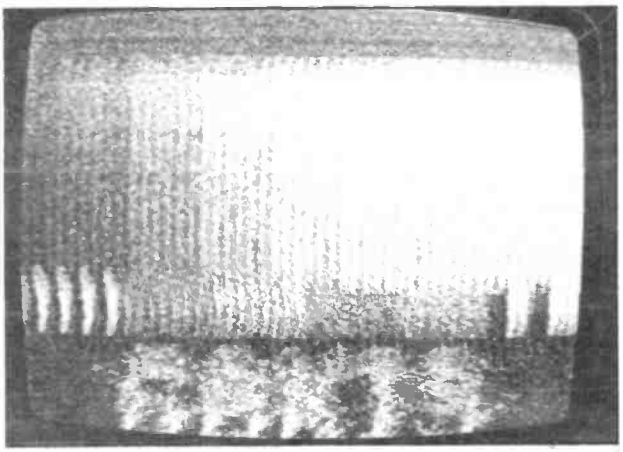
As for the video monitors shown in Fig 4, these can either be separate small-screen units of the sort intended for computers or surveillance purposes or else converted domestic TV sets (beware the live chassis). Needless to say, you don't actually need a separate monitor for each of the positions shown; one unit can be switched between several different monitoring points.

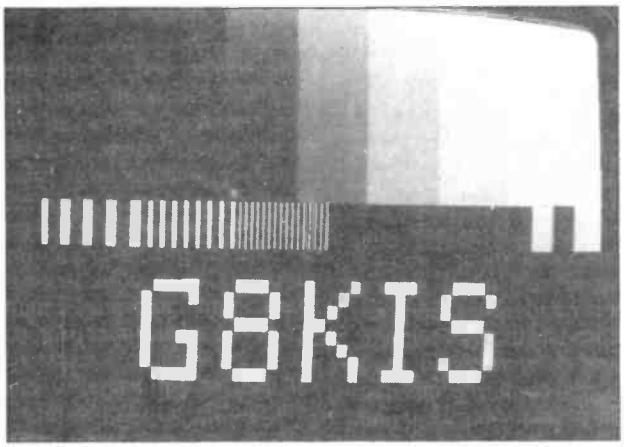
Operation

Amateur television isn't yet widespread enough to make it worthwhile sitting in front of a camera holding a placard proclaiming "CQ, CQ, CQ, TV" – or even "The end of the world is nigh!" Contacts are normally established via the 2m (144MHz) band using the nationally agreed talkback frequency of 144.750MHz. (144.17MHz SSB is often quoted as an alternative talkback frequency but is rarely used as such). A 2m FM rig is therefore an essential part of any ATV station. As a general rule, if you can get a noise-free sound contact using one watt of power on 2m, you can also expect to get a good picture with 10 watts of peak sync power. TV transmitters are rated in 'peak sync power' because with negative modulation the tips of the sync pulses represent the peaks of transmitted power. Sound is rarely ever transmitted on 70cm as an adjunct to the picture. Using the broadcast style 6MHz, sound/vision spacing is technically difficult and also uses too much band space.

How far you get in terms of range is as much a matter of geography, luck, trans-







Top left: No picture visible. Top right: Very weak picture. Above left: Fair detail visible. Above: Strong picture. Left: Strong picture with visible noise.

AMATEUR TELEVISION— GETTING STARTED

USEFUL ADDRESSES

Microwave Modules Ltd., Brookfield Drive, Aintree, Liverpool L9 7AN.
Fortop Ltd., 13 Cotehill Road, Werrington, Stoke-on-Trent, Staffs.
Sirkit Projects, 'Benbow', Widecroft Road, Iver, Bucks.
British Amateur Television Club, (membership enq's) Brian Summers, 13 Church Street, Gainsborough, Lincs.
Tonna antennas can be purchased from: Arrow, 7 Coptfold Road, Brentwood, Essex CM14 4BN.
J-Beam antennas from: Waters & Stanton Electronics, 18-20 Main Road, Hockley, Essex.

mitter power and operating skill as it is on any other amateur mode. Suffice to say that 100 miles is not uncommon, nor is continental DX, at least for those living in the South of England.

Signal reporting

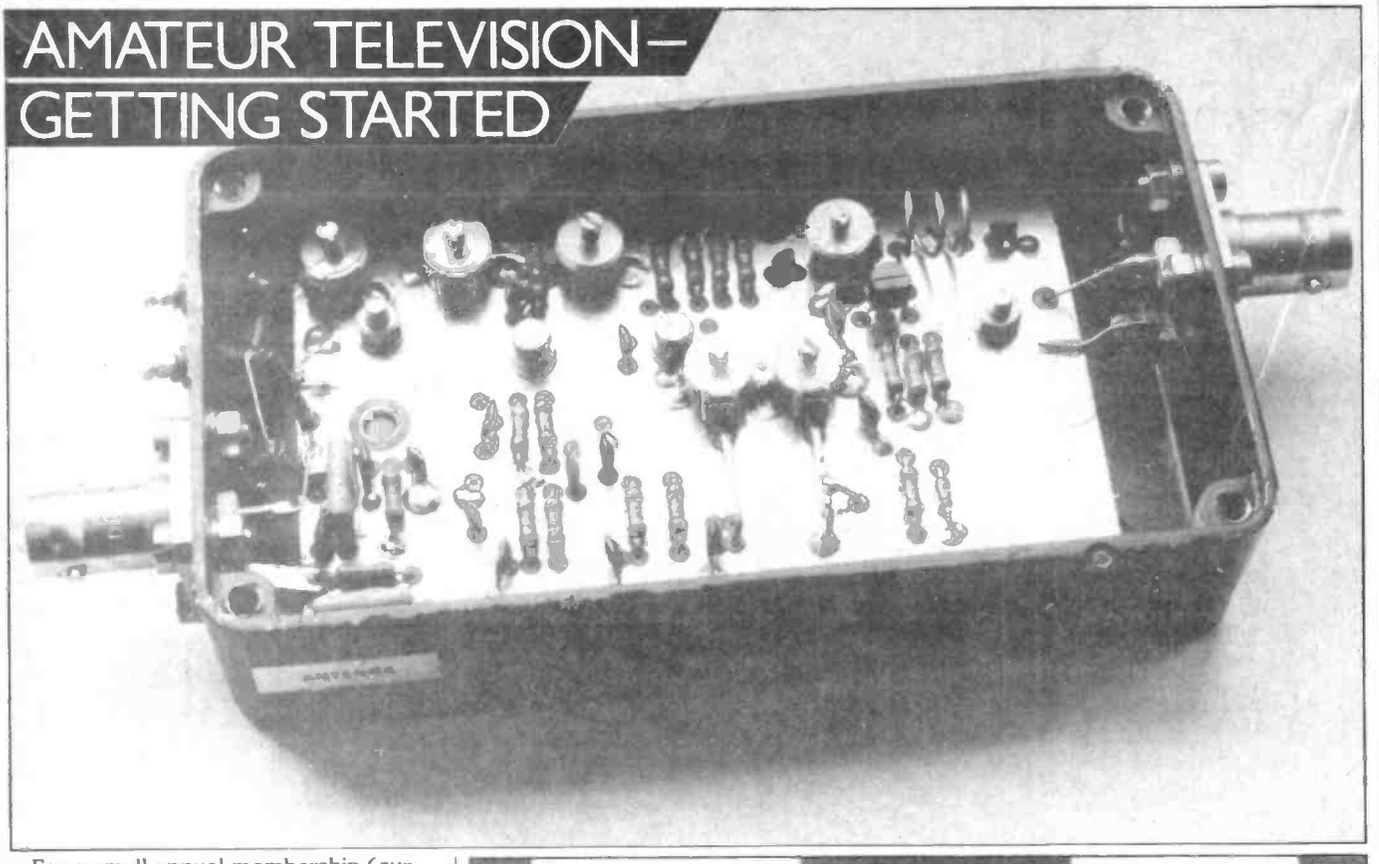
'5 and 9 OM' may be OK for normal amateur sound contacts, but it's not much use for ATV. A reporting system has therefore been developed which uses a six point scale from P0 – P5. The divisions, very roughly, are as follows:

P0 – Total noise or patterning; no picture visible.
P1 – Very weak picture with considerable noise.
P2 – Noisy picture but fair detail visible.
P3 – Strong picture with some noise.
P4 – Very strong picture with noise only just visible.
P5 – Picture equivalent to closed-circuit quality.

The term 'noise' may seem a rather stange one to use in connection with television but it has exactly the same technical meaning as with sound. On the screen a high level of noise produces the well-known snowstorm effect associated with weak signals.

Picture far left: John Betts speaking into the camera and mike, to John Wilson, who happened to be on the air at the time! Picture by Tony Large.

AMATEUR TELEVISION – GETTING STARTED



For a small annual membership (currently £4), the best organisation to belong to is the British Amateur Television Club. The BATC was founded in 1949 to 'inform', instruct and co-ordinate the activities of amateur radio enthusiasts experimenting with television transmission. The club is affiliated to the Radio Society of Great Britain and publishes an excellent quarterly magazine called *CQ-TV*. This includes operating news, constructional articles and lots of small ads for television equipment. The BATC also provides a service to its members by operating a sales division for hard-to-get items like camera tubes, focus coils, printed test-cards and circuit boards. For those with a competitive streak, there are award schemes, contests and regular details of ATV achievements.

The future

ATV activity is undoubtedly going to mushroom and no time could be better than now for getting started. Apart from the greatly increased activity on 70cm, there's also exploratory work going on on the higher frequency bands, especially 24cm (1.3GHz) and 3cm (10GHz). The 24cm band promises to be particularly interesting because of the space it provides for extra channels. Firm proposals have already been submitted for a number of possible ATV repeater stations which would receive signals on one frequency and re-transmit them on another. In this way the range of transmissions could be increased considerably. Again, following on the technniques already employed for sound radio, there have been suggestions for an ATV satellite that would permit regular intercontinental working.

Whether such an amateur version of Telstar ever gets off the ground is obviously a matter of some speculation but it does indicate the sort of exciting prospects that lie in store for those equipped to work ATV. At the more mundane level, opportunities also exist for those with a technical rather operational bent. Computer-generated video special effects are now becoming more widespread, as are electronically-generated patterns and captions. A typical all-electronic test card is the one shown (over the page) as received from amateur station G8LAM. In this case the call sign was programmed into an Electronically Progammable Read-Only Memory chip (EPROM).

Top: The Microwave Modules receive converter, type MMC 435/600, mentioned in the text. Above: Picture taken at G8MNY's station – this shows the sort of picture you can send over a distance of about 35 miles.

Another subject of experimentation is the use of FM for vision transmission. Although the AM versus FM controversy has been raging for a long time in connection with sound transmissions (amateur, CB, and broadcast), it's not one that's affected TV very much until recently. At the moment nearly all amateur and broadcast television transmission are AM. In the future, however, we'll be seeing a move towards FM, especially in connection with Direct Broadcast Satellites (DBS). FM uses much more bandspace (15MHz minimum) but offers advantages in terms of quality. As for amateur transmissions, it will be interesting to see whether the extra space on the higher frequency bands will cause a general move in the direction of FM.

Unlike some modes, amateur television is limited only by your own skill, imagination and ingenuity. See you on the air!

Thanks to John Betts G4HMG, and Richard Lambley G8LAM, for their help in the preparation of this article.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PASS THE R.A.E.

VOLTAGE AND CURRENT

Nigel Gresley continues his "theory and practice" theme and here, discusses what's meant by voltage and current. He also explains what happens when an electric current flows.

Part 3

Here we are again. You remember that last month we had a look in simple terms at what goes on inside the atom, and we discovered something about the nature of an electric current. We noted that it flows in something called a **conductor**, and doesn't in another something called an **insulator**, and we saw why these two things have different properties.

This month, let's take a closer look at what's meant by **voltage** and **current**. It's also a good time to examine what's meant by some of the other ways of describing what happens when an electric current flows. So, without more ado, let's get started.

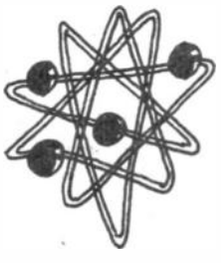
Two sorts of electricity

One way of looking at these things is that there are two different sorts of electricity. You'll remember last time that we said that the atom itself was electrically neutral – ie that the nucleus is positively charged and that this positive charge is neutralised by the negatively charged electrons. By "charge", we can say at this stage of the proceedings that this simply means possessing a surplus of one or other types of electricity, positive or negative.

Now one thing about the atom is that it's pretty easy to dislodge an electron or two from it – we saw one way of doing it last time, and another way, believe it or not, is by rubbing! "Uh?" you say "has he gone out of his skull?" Well, no. Do you remember those experiments you may have done at school when you rubbed a glass rod with a silk cloth? No? Oh well, try it, or if you don't happen to have a silk cloth handy try running a comb through your hair in a dry room, or stroke the family moggie when it's lying in front of the fire and its fur is nice and dry.

What will happen is that the glass rod, after you've rubbed it, will be capable of picking up small bits of paper and so will the comb, if your hair is reasonably dry and clean, and you many even hear a crackling sound as you comb it. As you stroke the cat, you may well see some tiny sparks pass between you and it – puss might not like it too much, so I'd go easy on the animal-type experiments!

In the case of the glass rod, what happens is that some of the electrons which belong to the atoms of glass get left on the silk. Now this doesn't in any way change the physical properties of either substance – the glass is still glass and the silk is still silk – but you can say that the surplus of electrons on the silk is a **negative charge** and the lack of electrons, if you like, on the glass (remember it's short of a few because they're on the silk) is called a positive charge. Remember that if you remove electrons from a nucleus, you end up with the positive charge of the nucleus having no electrons knocking around to neutralise it, so you're down to a situation whereby a deficiency of electrons is tantamount to a positive charge.



It's all a bit confusing, to be sure, put like that because you tend to feel intuitively that a surplus of anything ought, somehow, to be positive. Unfortunately, the early pioneers in this field didn't know too much about what was going on and we rather feel that if they'd known just a teensy bit more they'd have referred to electrons as having a positive charge and saved all of us a good deal of hassle about remembering what goes on. However, it's too late to change it all now and we just have to bite the bullet and remember that a **deficit** of electrons implies a **positive** charge and put up with the boredom. It can get extremely tiresome, especially when we get to semiconductors, because by convention the direction a current flows in is said to be from **positive** to **negative** but if you'll think about it for a minute you'll realise that the drift of electrons we discussed last time has to be from negative to positive because the electron itself has a negative charge. Got it? No? Ah well, grab another coffee and mull over it – you'll twig it by and by.

So we can see that both positive and negative charge are possible, and that the first implies a deficit of electrons and the second implies a surplus. This is what we meant, by the way, when we said that there were two sorts of electricity; we meant positive and negative.

A drift of electrons

Now as we saw last time, any unequal distribution of electrons, such as you might create by connecting the two poles of a battery to a piece of wire, creates a somewhat stressful condition in which something has to happen; in the case of copper wire, copper being a conductor of course, the "something" is a drift of electrons which we call an electric current. The idea is that having created a surplus or a deficit of electrons, whether with batteries or rubbing or what-have-you, the electrons want to restore the balance in some way, whether it's drifting in the wire or flashing over as little sparks between you and puss.

In fact, as in the case of the glass rod being able to pick up pieces of paper, you get an attraction between the two things themselves, and this is why it is said that opposite charges attract each other – the idea, don't forget, is that the electrons want to get back to some sort of normality, ie back to their parent atom.

Now the space between the two opposing bodies – between you and the cat, if you like, or between the rod and the silk cloth – is said to be subject to an **electric field**, which is a posh way of saying that an electric field exists between two things which have an opposite charge on them. And, as you might somehow expect, the more the charge the more intense the field – there's a very strong electric field between a thundercloud and the earth during a thunderstorm, for example, and a flash of lightning is just the net result of the

electrons correcting the difference in charge between cloud and ground.

So, the thing to remember at this stage is that if there is a difference in what you might call the "electrical pressure" between two points, whether it's due to a battery or the mains or a thunderstorm or you stroking the cat or whatever it happens to be, there's going to be a tendency for electrons to move from the point of lower, or most negative, potential to the point of highest, or most positive potential.

We've used the word "potential" quite deliberately here because this difference in electrical pressure, which is a bit like the amount of water pressure behind the kitchen tap, is known as a **potential difference**, usually abbreviated to pd. As we'll see in a while, pd is measured in units called volts, and these will be familiar to you from the battery in your trannie or torch or whatever. If your battery has "9 volts" written on it, this means that a potential difference of 9 volts is present between the positive and negative poles of the battery, or at least when the battery's new it does! When it's dud, there's a pd. of about 0 volts present, as we saw last time.

Electrons flow in some materials

Don't forget at this stage that some materials will allow electrons to flow if you subject them to an electric field, whereas some won't. And what do we call these two? Jolly good.

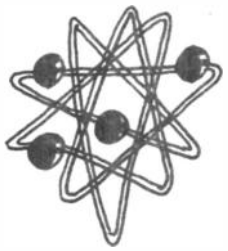
Okay, on we go. Actually, the volt isn't just the unit of potential difference, and indeed in some ways to say that it is missing the point. Things like batteries and generators are important because they can cause electrons to flow from point A to point B, and as you might intuitively expect, a little battery has less of this ability than a high-voltage power supply might have, for example. The quality of being able to make electrons move in this way is called **electro-motive force**, usually abbreviated to emf and again its units are volts. In fact, this usage of the volt is more important than that of pd, and you won't usually find yourself thinking about pd until you come to considering things like capacitors, so we'll use volts to indicate emf for now.

"Remember that a deficit of electrons implies a positive charge"

While we're on this tack, let's think about some other basic units. Now since an electron is an electron is an electron – ie it doesn't matter in the least whether it's an electron from an atom of glass, copper, oxygen, uranium or what – they're all the same and the amount of electric charge associated with each and every electron is the same. So you could use this amount of electricity as a unit if you wanted, except that because the electron is incredibly tiny the amount of electricity associated with one electron is also amazingly small and it's somewhat impractical to be able to use as unit of measurement. So the basic unit of electrical quantity is that amount of electricity associated with something like 6×10^{18} electrons (if you're not sure about that sort of notation, by the way, see our article on indexes in the April 1983 issue, page 36) and this amount is called the **coulomb**. The symbol for an amount of charge in coulombs is the letter Q.

Now if you remember, we can think of the **flow** of electrons in an electric current – meaning that they seem to flow from a negative point to a positive one. If you like, you can think of the amount of the current flow in coulombs per second and it would be true to do it that way, but in fact there is a unit for this; a current which amounts to one coulomb per second is called a current of one **ampere**, generally referred to as an amp (Mr Ampere was a Frenchman, so you have to remember to say ampere in a heavy Left Bank French accent, and maybe we ought to call them omps instead of amps. Oh well, no-one ever understands my jokes!). So if we say that a current of one amp is flowing in a wire, that implies that every second 6 times 10^{18} electrons flow past one point in the wire every second – truly amazing, especially when you remember we said last time that it wasn't a flow, it was more like a drift as far as current flow in a conductor was concerned and that if they managed an inch a minute they were doing well. There are a hell of a lot of electrons in one piece of copper wire . . .

So to sum up so far, we've got an electromotive force, measured in volts, which is making a current flow through a conductor or whatever; the current is measured in amps, and the amp is derived from the basic amount of electricity associated with the electron. Just to top off so far, the symbol for volts is V and for current in amps it's I: The abbreviation for the amp itself is A. In fact, the symbol for electro-motive force itself is E but you'll only use that once in a blue moon.



Okay, so that's charge, electromotive force, current, volts and amps sorted out. The last item on the menu for today is something called resistance, and we'll discover shortly that voltage, current and resistance are intimately related. What's resistance when it's at home? Well, we've looked at conductors and we know that a conductor is something that permits the flow of electric current. However, some conductors are better at being conductors than others. Pure copper is one of the best conductors known to mankind insofar as current will flow through it at the drop of a hat and it offers no obstacles to the electrons doing their thing.

If you take something like carbon, it does conduct and does permit a current to flow, only it's a bit grudging about it and it puts up a bit of opposition to the flow of electric current. Different materials put up more or less opposition, and the amount of

opposition they do put up is called the **resistance** of the said material. One foot of copper wire has a very low resistance, assuming it isn't half the thickness of a hair (resistance also depends on the size of a conductor as well as its physical properties, you understand) but one foot of certain alloys like Nichrome (the stuff you use for electric fire elements) has quite a lot of resistance.

In fact, if you like, you can say that the thing about an insulator is that it has pretty well infinite resistance! The symbol for resistance is R, and the unit of resistance is the **ohm** – it's named after one Georg Simon Ohm, who was a brilliant German pioneer in these matters and who also had the longest and grandest beard you ever saw, according to a photo (or should it be a daguerreotype) I saw a couple of weeks ago!

An insulator has infinite resistance

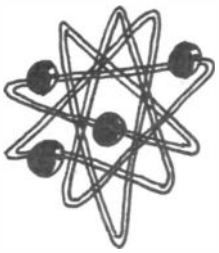
Now then. The definition of an amount of resistance totalling one ohm is that which permits a current of one amp to flow if you connect an emf of one volt across it. This is highly important, and indeed it's a fundamental law of anything remotely to do with anything electric or electronic – not surprisingly it's known as Ohm's Law and formally stated it goes like this:

"The current flowing in a conductor is directly proportional to the potential difference existing across it, provided that the temperature and other physical factors remain constant".

That little lot is worth permanently imprinting on your brain, chaps, because although it might not sound very grand it's the answer to volts, current, resistance and everything else to do with current flow. How come? Well, if you think about it, volts, current and resistance form a sort of inter-related triangle in which, if you know what values two of them have, you can suss the third. Remember we said that a current of one amp flowing in a conductor which had an electro-motive force of one volt across it suggested a resistance of one ohm? Well, it works the other way round as well. Suppose we have a known amount of resistance, say 100 ohms, and we apply an electro-motive force of 10 volts to it. Now because of Ohm's Law we can tell straight away how much current will flow when we connect it all up. If we remember out symbols, we can construct three little equations which we can always use:

$$V = I \times R$$
$$I = V/R$$
$$R = V/I$$

Those three are directly derived from Ohm's Law, and they describe the ways in which volts, amps and ohms are inter-related. In our example, we wished to know how much current would flow when we connected 100 ohms across an emf of 10 volts – well, the equation says that $I = V/R$, or in other words the amount of current in amps is represented by the electro-motive force in volts divided by the amount of resistance in ohms. In this case that's 10/100, which is 0.1. So therefore we know that a current of 0.1 amp will flow. Handy.



You may think we're making a great and noisy fuss about nothing in particular at this stage, but in the course of your amateur radio career we can promise you that Ohm's Law will be one of the things you use most of all. The reason is that voltage, current and resistance are fundamental quantities and whatever you do you simply can't get away from them. Also, various other delights follow from Ohm's Law which we'll get to in a later article; either way, it's well worth learning the little equations off by heart for now and maybe doing a bit of practice.

"Ohms Law is fundamental to anything to do with electric or electronic matters"

Just to finish with, here are some little questions for you to test yourself – we'll give the answers next time.

1. You have a resistance of 30 ohms and you are able to establish by devious means that we haven't dealt with yet that 3 amps flow in it when you connect a certain voltage battery across it. What is the voltage of said battery?

2. You have a piece of wire whose resistance you wish to establish for some reason or other; you have a 10 volt power supply and you are told by your friend who has a suitably clever way of measuring it that when you connect this supply across the wire, a current of 2 amps flows. What is the resistance of the wire in ohms?

3. You have been given some unmarked batteries by your mate who went to the rally and he tells you that when he connects a resistance of 100 ohms across one of them he notes that a current of 0.09 amps flows (actually, your mate would probably express this as 9 milliamps, since the amp is a bit big for many radio-type things and the milliamp, which is a thousandth of an amp, is more commonly used). What voltage are said batteries?

4. You have a 12 volt car battery, and in a moment of absent-mindedness you connect a piece of copper wire with a resistance of 0.01 of an ohm across the terminals. What current will flow? Supplementary question – why do you think the wire glowed white-hot and then melted?

We'll look at that, and other goodies, next time.

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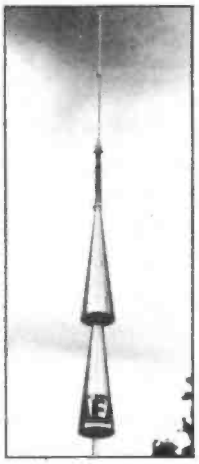

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•PROCEDURES• 2

Second part of Nigel Gresley's series on basic operating procedures, and how to make the best of your contact with another amateur station.

You'll remember that last month we started analysing an SSB contact on 144MHz between a station in Wales and another in Kent, and we left our heroes at the point where they'd exchanged reports with each other.

You'll remember that we also had a look at what the RST code is really all about and how to use (and abuse) it! Let's carry on with looking at this contact. The chaps involved are GW4ABC in Swansea and G6ZZZ in Sevenoaks, and in last month's cliffhanger GW4ABC had said what rig he was using and also given details of his antenna – to save you thumbing through last month's epic issue again, the last bit went:

"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"

What we might hear next could be:

"GW4ABC from G6ZZZ – all copied. Would you like to QSY, break?"

"From GW4ABC – roger, QSY 144.230, decimal two three zero, go ahead"

"G6ZZZ QSY 144.230 – see you down there, I'll call you"

What's all this then? Basically, operation on VHF SSB is a bit different from HF band operations because for most of the time, excluding when there's a contest or a monumental opening of some sort, people call CQ on one specific frequency and then move off to a clear frequency away from there within the SSB allocation. The 144MHz calling frequency is 144.300MHz and the SSB allocation on this band runs anywhere from 144.150 up to 144.500MHz, so there's plenty of room. On the 432MHz band the bandplan calling frequency is 432.300MHz, with the SSB allocation again running from 432.150MHz to 432.500MHz – however, for some reason most people seem to use 432.200MHz as the calling frequency instead on this band.

Anyway, G6ZZZ has suggested that both of them QSY (here again, this is using a CW Q-code on voice, and almost everyone does as far as QSY is concerned), and one point to notice is that he's been a good chap and suggested a frequency that's well away from the calling frequency. We don't know why but it's a fact that many people seem reluctant to move more than about 10 or 20kHz away from 144.300MHz and the inevitable result is that you get too many contacts going on here and interfering with each other whilst vast tracts of the spectrum go unused.

It was rather funny, actually, having a contact with a G3T--station on 144MHz last week – we suggested moving to 144.390MHz and there was a distinct amount of "erm, well, I'm not too sure about that" in his voice, almost as though he wasn't sure that his wireless would work on such a peculiar frequency! It's always a good idea to move well away from the calling frequency, folks, because the chances of some twerp descending on you without listening first and clobbering your tasty morsel of DX are considerably lessened if you do.

. . . because he's beaming a completely different way . . .

Anyway, on we go. We spin the dial down to 144.230MHz and await events:

"Is this frequency in use please? from G6ZZZ"

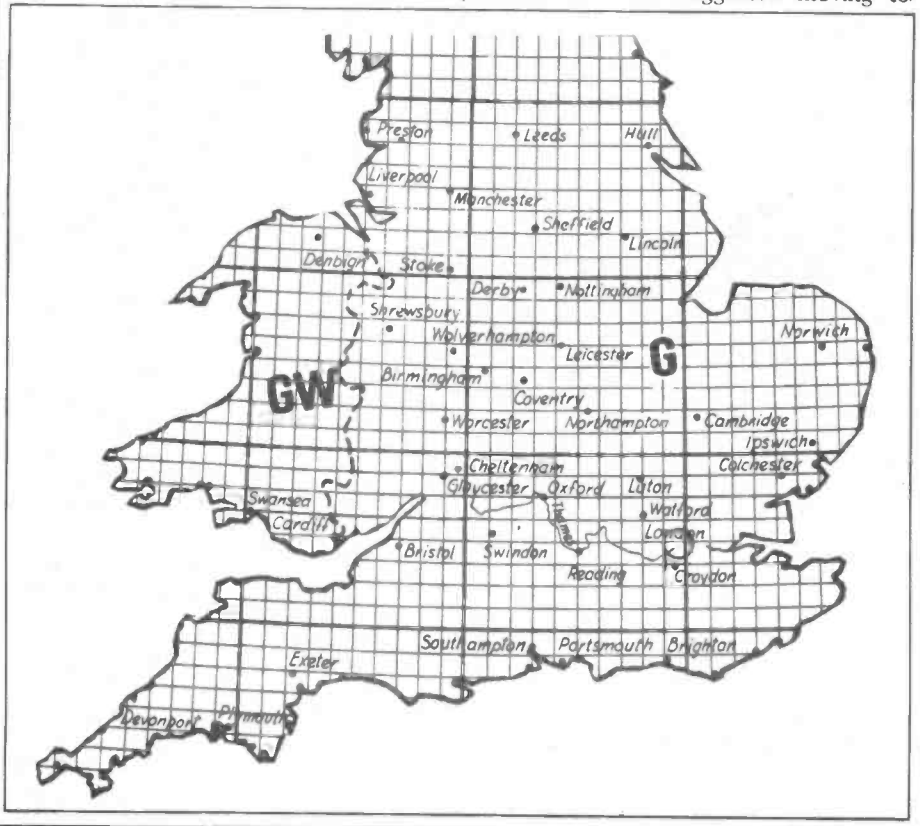
Silence

"Thankyou – GW4ABC, Golf Whisky Four Alfa Bravo Charlie, this is Golf Six Zulu Zulu Zulu, G6ZZZ calling and by"

"Golf Six Zulu Zulu Zulu, this is Golf Whisky Four Alfa Bravo Charlie, OK, nice signal from you, go ahead"

"GW4ABC from G6ZZZ, fine – you're a bit stronger now, about 5 and 2 with some fading and flutter, perfectly Q5 though. The name here is Jim, Juliet India Mike, and we're running 300 watts from a pair of 4CX250s driven by a TS-700. The antenna is a 16-element Tonna at 65 feet above the ground, and the QTH is 480 feet above sea level. Let's see how you copy. GW4ABC in Swansea, this is G6ZZZ in Sevenoaks, over"

Let's look at some things here. G6ZZZ is a very good chap because, before he starts waving kilowatts around on 144.230MHz he asks whether the frequency is in use. For all he knows there might be someone local to him already having a contact on this frequency with someone he can't hear because he's beaming a completely different way – one of his locals might be talking to a Scottish or Dutch station, for instance while G6ZZZ is beaming west and off the side or back of his beam. If the distant station was having his over at the time. it'd be infuriating if someone suddenly descended on to the ferquency the local had picked five minutes ago as being clear for his QSO and demolished the DX at S9+++. It happens, and leads to all sorts of lost tempers and aggravation, so do spend a second or two asking whether the frequency is in use or not before powering away and banging a hole in the troposphere with your immense ERP!



How England and Wales are laid out as QTH locator squares. This map is part of the QTH locator of Western Europe, available from the RSGB.

STARTING FROM SCRATCH

So having been a Good Chap and established that no one else was using the frequency, G6ZZZ proceeds to call the Welsh station and establish that they are still in contact despite having QSY'd a whole 70kHz away from the calling frequency! (Gasp, shock, horror, sarky so-and-so) Sure enough, they're still able to make contact and so G6ZZZ gives his details to GW4ABC. This is usually the first procedure in a contact, to establish what sort of gear you're both using, whereabouts you are and what your name is, and indeed we could criticise GW4ABC for doing that on his first over, ie before they left the calling frequency.

Your blood pressure hits the ceiling!

It's best, and most courteous, to leave the calling frequency as quickly as you can, for two main reasons – one is that you don't monopolise it for longer than absolutely necessary, to the detriment of other folks who might want to make contacts, and the other is that the sooner you move off the less your chances of the contact being clobbered by A. N. Other who maybe can't hear the station you can and doesn't know that you're in the throes of setting up a contact with a nice bit of DX. A. N. Other then proceeds to call CQ right on top of you and your blood-pressure immediately hits the ceiling!

It's no-one's fault really, although too many chaps blaze away and call CQ without listening for a minute or so to make sure they're not about to splurge their dulcet tones all over someone else. Good operators tend to listen on a frequency for at least thirty seconds before calling CQ, and if everyone decided they'd do just that we'd all probably live longer. Can we all try? Please? Gosh, thank you, I knew our readers were all good chaps and I promise I'll ask the 9H1 to listen for you next time there's a Sporadic E opening and I've just worked him (har har, joke, I *still* haven't worked 9H1 on 144MHz).

Don't be a "lid"

Actually, whilst we're in a beefing mood there's another thing we would criticise about Jim, G6ZZZ, if we really were feeling highly pernickety. Notice he said"... we're running 300 watts...". My first Fleet Street editor once said to me that the pronoun "we" is used by or about, queens, editors and pregnant women, and we've often felt like coming on an amateur contact and asking which category the man would choose to put himself in. I don't know whether amateurs think they're royal or whether they mean "my transmitter and I" but you wouldn't say it in the bar so why the hell say it on the wireless?

If you say "we" it stamps you as a lid of the highest order, and if you don't know what a lid is in the amateur world it means a lousy operator (actually, we've often wondered where that word comes from but we musn't digress or I'll get my knuckles rapped) None of us want to be lids, do we, so shall we all stop saying "we" on the wireless? It must confuse casual listeners and new SWLs no end – they must think that there's a small army of amateurs clustered round the mic and all speaking at once.

It's a bit like that other fatuosity, "the handle" or, even worse, "the personal". If anyone asks me what my handle is I say that it's chrome-plated and on the side of my FT221, and as for the "personal" – well, I've nothing against ex-CBers, nothing at all. They've passed the same exam as me but I wish to God that one had stayed on 27MHz. Or am I just paranoid? (Don't worry, calm down old boy, you've just been working a bit hard. Look, here's a nice wireless, take the rest of the afternoon off and work some DX, there's a good chap!)

Sorry about that. Right, where were we? Actually, talking about handles, I heard a beauty on top band a few weeks back. Station A was in the throes of establishing contact with Station B, and one nice bit of dialogue went;

Station B: **Sorry, old man, I didn't quite catch the handle".**

Station A: **"Oh, well, actually, it's quite firmly bolted to the rig and I didn't throw it at you"**

Station B: **"Sorry? Oh yes, it is a silly thing to say, isn't it."**

"Probably learned the hard way that it's important to listen before transmitting"

Anyway, let's get back to our lads on 144MHz. G6ZZZ is running quite high power from what sounds like a good site, so he's probably learned the hard way that it's important to listen on frequencies before transmitting on them because he could gunge up a lot of other operators if he wasn't careful. He's given the height of his site above sea level, which is usually interesting to the other operator in a contact, so it's all shaping up quite nicely so far. Let's keep listening.

"G6ZZZ, this is GW4ABC – all copied and you're a good signal most of the time here averaging about 5 and 5 with some rapid QSB. Conditions seem quite good to the east from here but you're the best DX I've worked so far – the Wrotham beacon is coming in about 5 and 1 and I've heard a Dutch station but didn't work him. The QTH square this end is X-ray Lima, by the way and I guess you must be in Alfa-Lima – that's a new one for me. Hope you're still copying OK, back to you. G6ZZZ from GW4ABC".

So Mike in Swansea is getting really quite a nice signal from Jim – G6ZZZ is running a lot more power than GW4ABC so that isn't too surprising, and maybe Mike has done some mods to his IC-211 or put the Mutek board in or something, to make it even better. Note that GW4ABC has mentioned the Wrotham beacon – this is GB3VHF on 144.925MHz, which is one of several that serious operators on VHF and UHF use to gauge how well propagation is working in a particular direction. If GW4ABC can't usually hear GB3VHF but today he's getting it at 5 and 1, this suggests that conditions are up on normal in the direction of Wrotham, which isn't a million miles away from G6ZZZ.

Mike has also given his QTH locator square as XL, which is nice for G6ZZZ if he likes to work different squares as we mentioned last month. He's said that AL square is a new one for him, so we can guess that he likes to work different ones and it's odds-on that he'll ask for G6ZZZ to confirm the contact. But we'll see that shortly – let's keep our ears on the wireless and see what happens.

"GW4ABC, Golf Whisky Four Alfa Bravo Charlie from G6ZZZ – I'm sorry but I didn't get the QTH square – you went right down into the noise and I lost you, I guess conditions are a bit up and down and you're only about 5 and 2 at best. Can you say again the QTH locator? Please repeat the locator, go ahead"

A bit on the deaf side

This often happens on VHF and UHF – conditions aren't very stable and with the fairly low power that our man in Wales is using, G6ZZZ is missing some things. It's worth making the point here that if you're running high power it's as well to make sure that you have a good receive side to go with it, otherwise you stand the chance of being heard by more stations than you can actually work because you can't hear them.

This is particularly the case if you're using an ordinary run-of-the-mill black box and then you build or buy an amplifier – you may find it doesn't help all that much because the black box probably won't have a particularly brilliant receiver and you'd be well advised to upgrade the front-end of it if you're going to run any sort of power. Maybe his TS-700 is a bit on the deaf side – it certainly will be if he hasn't done any work on it or added a high-grade preamp at the top of the mast, for example, since like many black boxes that's why he isn't getting quite as good a signal as he might from Swansea. Let's see.

•PROCEDURES• 2

IARU 144MHz Band Plan with UK usage

144.000		
CW only	144·000–144·015	Moonbounce
	144·050	CW calling frequency
	144·100	CW ms reference frequency
144.150		
SSB and cw only	144·250	Used for GB2RS and slow morse transmissions
	144·260 ±	Used by Raynet
	144·300	SSB calling frequency
	144·400	SSB ms reference frequency
144.500		
All modes non-channelized	144·500	SSTV calling frequency
	144·600	RTTY calling frequency
	144·600 ±	RTTY working (fsk)
	144·675	Data transmission calling
	144·700	FAX calling frequency
	144·750	ATV calling and talkback
	144·775	Raynet
	144·800	Raynet
	144·825	Raynet
144.845		
Beacons only		
145.000		
FM repeater inputs	145·000 R0	
	145·025 R1	
	145·050 R2	
	145·075 R3	
	145·100 R4	
	145·125 R5	
	145·150 R6	
	145·175 R7	
145.200		
FM simplex channels	145·200 S8	Raynet
	145·225 S9	Used by Raynet
	145·250 S10	Used for slow morse *tone modulated transmissions
	145·275 S11	
	145·300 S12	RTTY-afsk
	145·325 S13	
	145·350 S14	
	145·375 S15	
	145·400 S16	
	145·425 S17	
	145·450 S18	
	145·475 S19	
	145·500 S20	FM calling channel
	145·525 S21	Used for GB2RS fm newscasts
	145·550 S22	Used for rally/ exhibition talk-in
	145·575 S23	
145.600		
FM repeater outputs	145·600 R0	
	145·625 R1	
	145·650 R2	
	145·675 R3	
	145·700 R4	
	145·725 R5	
	145·750 R6	
	145·775 R7	
145.800		
	Satellite service	
146.000		

UK 430-440MHz Band Plan

430.000		
All modes, low-power hand-held (431–432MHz is withdrawn from service within an area up to 100km from London)		
432.000		
CW only	432·000–432·015	Moonbounce
	432·100	CW random ms
	432·150	CW calling frequency
432.150		
SSB and cw only	432·200	UK ssb calling frequency
	432·300	IARU ssb calling frequency
432.500		
All modes non-channelized	432·500	SSTV calling frequency
	432·525–432·575	1·3GHz/432MHz linear transponder output
	432·600 ±	RTTY working (fsk)
	432·600	RTTY calling frequency
	432·675	Data transmission calling
	432·700	FAX calling frequency
432.800		
	Beacon sub-band	
433.000		
FM repeater outputs in UK only	433·000 RB0	
	433·025 RB1	
	433·050 RB2	
	433·075 RB3	
	433·100 RB4	
	433·125 RB5	
	433·150 RB6	
	433·175 RB7	
	433·200 RB8/SU8	Used by Raynet
	433·225 RB9	
	433·250 RB10	
	433·275 RB11	
	433·300 RB12/SU12	RTTY repeater and rtty afsk working
	433·325 RB13	
	433·350 RB14	
	433·375 RB15	
433.375		
FM simplex channels	433·400 SU16	
	433·425 SU17	
	433·450 SU18	
	433·475 SU19	
	433·500 SU20	FM calling channel
434.600		
FM repeater inputs in UK only	434·600 RB0	
	434·625 RB1	
	434·650 RB2	
	434·675 RB3	
	434·700 RB4	
	434·725 RB5	
	434·750 RB6	
	434·775 RB7	
	434·800 RB8	
	434·825 RB9	
	434·850 RB10	
	434·875 RB11	
	434·900 RB12	RTTY repeater-afsk
	434·925 RB13	
	434·950 RB14	
	434·975 RB15	
435.000		
Satellite service		
438.000		
	434–440	Sub-band devoted to UK atv-frequencies chosen so as to avoid interference to other band users and, in particular, the amateur satellite service
440.000		

"From Golf Whisky 4 Alfa Bravo Charlie – the QTH square is X-ray Lima, X-ray Lima, X-ray Lima square. Did you get that, go ahead?

"Roger, roger, from G6ZZZ – yes, fine, you were back up to about 5 and 2 that time. I'm not using a preamp here, and in fact I've only been using the amplifier for a couple of weeks and I think I'll have to do something about the receive side now. Running a pair of 4CX250Bs, about 300 watts peak envelope at the moment – I haven't got quite enough EHT to get to 400, the transformer isn't big enough, but it seems to be working well. Yes, we're located in Alfa Lima square here (oh you bad boy – pregnant again? – Ed) **and I haven't worked X-ray Lima so I'd appreciate a card via the bureau. Hope the signal's holding up, back to you. GW4ABC from G6ZZZ"**

So all is revealed, and G6ZZZ is going to have to do something about his receiver; he'll probably try a preamp, and then maybe mess about with the front-end of the rig itself to help the show along. The TS-700 isn't a very easy rig to work on from that point of view, so he's got some hard graft in front of him, but maybe he enjoys that side of the hobby and he'll learn a lot about his wireless if he sets about it.

As predicted, he's asked for a QSL card via the bureau – this is, of course, the RSGB's QSL Bureau, which is available to members and which takes some of the pain out of getting QSL cards and sending them.

But what happens now?

"Break, from G6YYY"

'Hello, Fred, go ahead"

"Sorry to break in, Jim, but did you know you're something like plus and minus 15kHz with me, G6ZZZ from G6YYY?"

"Oh dear, hang on a sec . . . . . ."

And on that cliffhanging note we'll leave it for this time – read on next month and find out what the problem is! See you then.

·B·O·O·K·S·

It's been a while since we looked at books for amateurs, and indeed our heavy hints in the last few issues have been heard in High Places and we've actually been sent some review books! The first to land on The Desk was the new edition of the RSGB's ***VHF-UHF Manual***, which we mentioned last time – it's written by George Jessop, G6JP and runs to about 500 pages in 11 chapters. There's also an appendix with all sorts of useful data in it.

Much detail on propagation

We spent the best part of a weekend reading through it, and although we liked some of it we got a sort of impression of unevenness and I-don't-know-quite-what-market-to-go-for out of it. The chapter on propagation, for example, is very detailed and full of all sorts of highbrow goodies which are very interesting in themselves but which don't look very likely to help the average run-of-the-mill chap who's interested in VHF and UHF make much of auroras and tropo. It's all good scientific stuff (in other words) but it seems a bit disconnected from actual wireless, if you know what we mean. The same goes for the chapter on antennas. There's a good amount of theoretical stuff but nothing to help you choose which antenna to use and how to put it up when you've got it home, and in fact much of it is exactly the same material as in the ***Rad Com Handbook***.

The transmitters and receivers material is interesting enough, but here again it all seems a bit removed from the general practice on VHF and UHF. Some of the material is decidedly out of date as well, and our guess is that some of the stuff is that there just isn't enough data on how to get things going; there's a promising amplifier design on page 5.94, for instance, but there are no details whatsoever on power supplies for it, how to get it going and what sort of performance to expect from it at the end of the day.

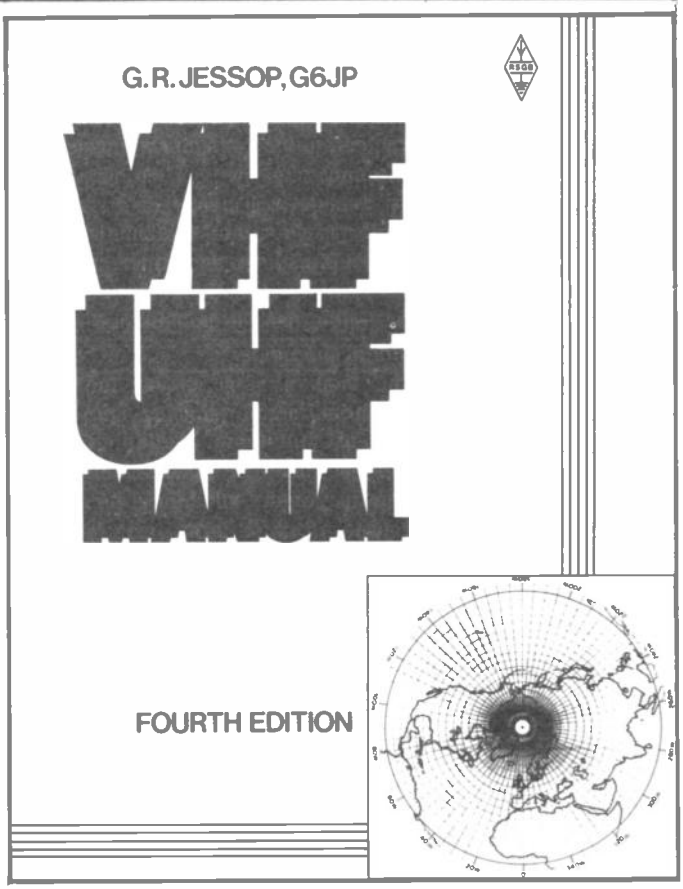
If you knew about amplifiers, of course, you'd know all that – but what's the point in publishing half the story? It would have been nice to see some fundamental considerations of things like why it's worth having good strong-signal performance in a 144MHz receiver written in nice simple prose instead of the rather stately style of the book as well.

Sorry to be negative about it, but we still don't think that the RSGB have got their treatment of VHF and UHF right. They insist on writing in the style of a learned textbook, but it's a bit like their house magazine – they haven't yet learned that we live in 1983 and that to unbend and write in a slightly less formal and dignified style doesn't immediately invalidate everything they've said. To be honest, it irritates us a bit sometimes to read things like "It is well-known that . . ." and "Consider random noise in the receiver. Interactions between random noise voltages and the carrier . . ." and so on.

Guide to co-ax fittings

Anyhow, there are some good things in the book, and we particularly liked the Appendix and the pictorial guide to putting plugs on coax. We had to laugh at being instructed to "Cut end of cable even and remove 8.73mm (11/32in) of outer sheath" – now we know why we have problems with N-types here a Bicester, because we certainly don't measure the outer sheath to two decimal places of millimetres or even to thirty-seconds of an inch!

We'd still buy it though, because there are things in it which are worth remembering and thinking about even though you have to wade through several layers of solemn prose to get at them.



Above: Front cover of G6JP's VHF UHF Manual, plus one of the drawings to be found inside. The cover is coloured, although it doesn't look too colourful in black and white!

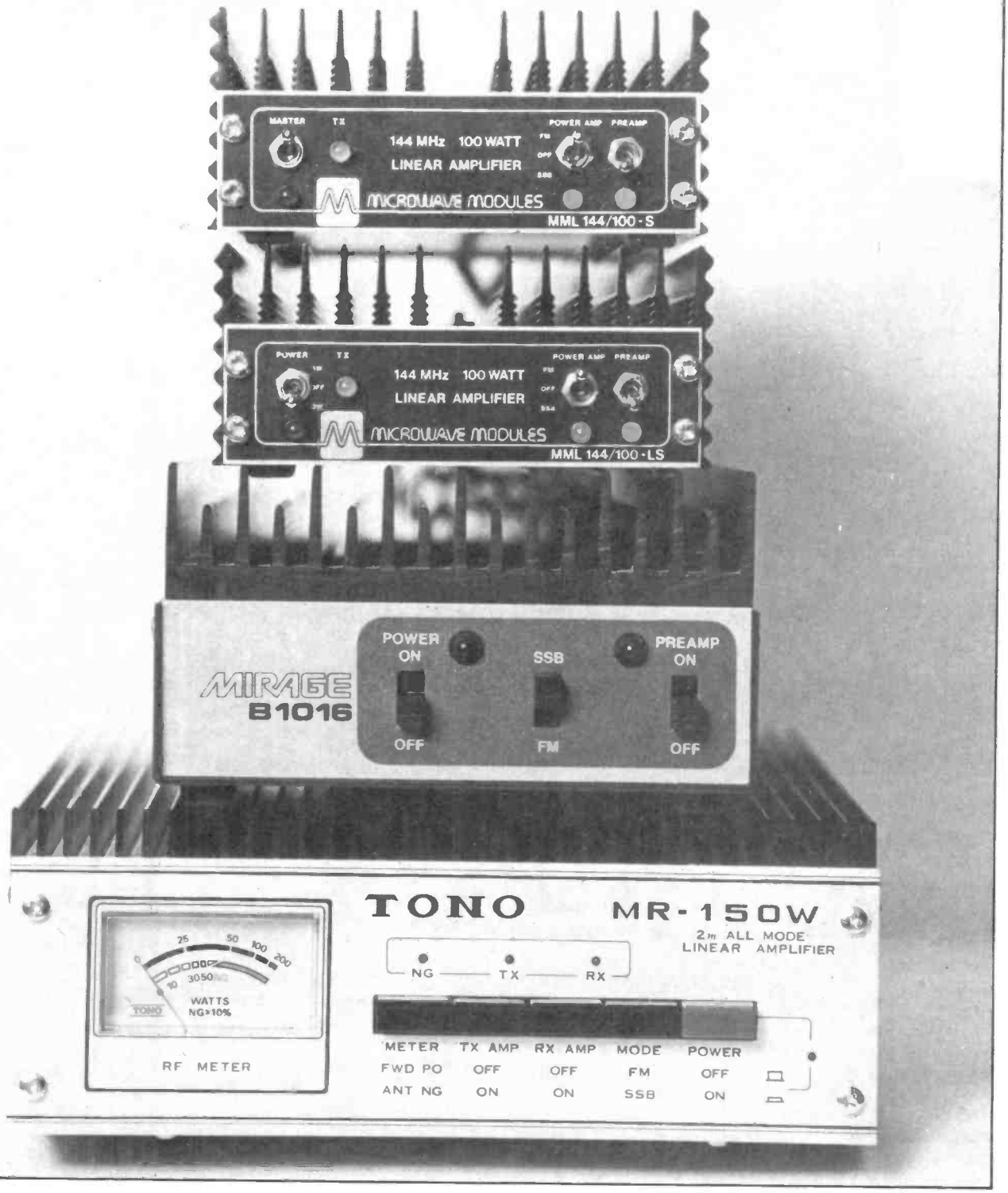
It'll rush you £9.29 if you're a member or £10.31 if you're not, inc p&p.

If Mr Jessop, or whoever it is at the RSGB that writes in this way would like to see how to write technical stuff in a readable way, we'd refer him to ***A Practical Introduction to Electronic Circuits*** by one Martin Hartley Jones. This is a truly excellent book which, if you have the barest technical knowledge, takes you through all sorts of hair-raising things like semiconductor theory, FETs and whatnot in such a gentle way that you barely realise the high-tech of it all.

Directory

He reminds us a bit of M.G. Scroggie in that lovely book ***Foundations of Wireless***, which really ought to be on every amateur's shelf, in that knack of writing in a down-to-earth way that takes you with him instead of making you work for it like Rush Job publications do. ***APITEC*** is published by the Cambridge University Press, and all we can say is "buy it – you'll like it". No, Brian, they ***aren't*** giving us 10% on every copy they sell.

Last on the list this time is that hardy perennial ***World Radio and TV Handbook 1983***, which is about as authoritative directory of radio and television broadcasting on every wavelength from miles to millimetres as you'll get. There are some excellent receiver tests as well, plus some good feature articles on things like Latin American DXing, frequency allocations and a jolly good item on propagation predictions for 1983. It's probably of greater interest to our SWL readers than to licenced amateurs, but if you're a listener or a world-wide traveller you shouldn't be without it. It's £10.95 from most good bookshops, and published by Billboard Limited.



AMPLIFIER ANALYSIS

Angus McKenzie, G3OSS, puts four well-known linear amplifiers for the 145MHz band through their paces. Do they come up to expectations? Reviewed here are the Microwave Modules' 144/100LS and 144/100S, Tono MR-150, and Mirage B1016

There is a well known adage used in computer circles, affectionately known as GIGO, which stands for "Garbage In – Garbage Out". In the context of single side band transmissions on VHF, and their amplification by so-called linear amplifiers, it is important that the basic original transmission is reasonably clean, before attempting to increase power. Maladjusted Liner 2s or Multi 2000s are bad enough in my opinion, but when amplified with a big hairy linear, they can virtually put everybody off the air within a 15-mile radius!

Effective heatsinks cope with build-up

This is because the original transmission would have had bad intermodulation products either side of the main transmission, thus causing what should be a transmission of around 2.5kHz bandwidth, with steep skirts, to widen (horrifically) to perhaps 50kHz! If this ghastly transmission is amplified by a poor linear, one can imagine that all the locals are going to get very upset, and it is here that tact and help is required to put matters right.

FM transmissions are nowhere near so demanding in the design of the linear, other than the fact that because the RF carrier is at full level all the time the transmission is taking place, the duty cycle on the output transistors or valves is 100% for maybe several minutes at a time. The heat sinks must be effective in preventing undue heat build-up around the PA transistors, and most high power valves used in PAs must be efficiently blown. SSB demands that the PA should give an output which is always proportional to the input, no matter how complex the input wave form within the ratings of the system. This will mean that the amplification factor of the linear should be constant, whether it is amplifing 100mW or 10w.

A linear with a power gain of 10 times, ie 10dB, should give an output accordingly of 1w or 100w. Such is not the case with almost all transistor linears, if one considers the full ratings claimed by their manufacturers. Transistor linears are usually adequate up to fairly high levels, above which they tend to become worse with output compression becoming more and more marked. At low levels some linears begin to lose gain, usually because the standing current is insufficient.

Ask yourself: why do you need a linear? And what's the maximum power you will want?

Before embarking on the choice of a linear, you should ask yourself *why* you need one, and what is the maximum power you are likely to want? And, whether you are interested mostly in FM operating, or whether the facility for working well on SSB is of prime importance.

If you are interested only in FM, then a class C transistorised power amplifier may suit you. They should be slightly more efficient, and thus not get quite so hot for the same size of heat sink. The average multimode mobile rig operating from 13 volts DC should give 10w both on FM and SSB (PEP). Unfortunately, many give several watts more than spec, which can cause serious linear over-driving. As we see later, it would be better for everybody if the SSB PEP was set up by the manufacturer for around half the power that can be given by FM. The average amateur who wants to put out a stronger signal from his 10w rig will choose an amplifier rated at 10w input and 100 output, or so, without any clear specification of limitations for SSB.

The sad story is that most typical linears have too much gain on SSB, and require only 5w drive for almost full power on the output to be reached, and are non-linear above half the nominal input drive level. Some linears are rated at 25w in, for perhaps 160w output, and these should work very well, and linearly, with 10w input, but often do not. A few years ago few stations used high power on FM, but recently more amateurs have added high power PAs to extend their range. Unfortunately, whilst it is useful to acquire a louder megaphone for shouting with, it is not much use unless you also acquire an improved ear trumpet, unless you just want to shout at the troops!

"People have a habit of shouting in a contest, making others cower"

Too many black boxes have very insensitive receiver front ends, and there is nothing more frustrating than to hear somebody calling "CQ", who does not respond to one return call after another. Once a station has a good receiving system, then he can use high power more effectively.

One good reason for buying an amplifier for a mobile installation is to keep the signal strength up at the other end when driving behind hills or under bridges, etc. It is always annoying to hear a mobile continually dropping in and out of a repeater – but carrying on his attempted QSO because he can hear the repeater satisfactorily. Running high power then, makes it easier for others to hear you when you are mobile. But if you are fixed, running high power constantly monopolises an FM channel for miles around, whereas running barefoot means that somebody else a fair distance away can use the channel without receiving interference from you. It is a pity that more FM stations do not use beams; it is useful to call "CQ" with the linear on, and having established contact and beamed up on each other, turn the power down thus allowing someone else to use the channel independently in some other direction.

The same situation exists, of course, with SSB. Many amateurs have tried and discarded SSB because of an apparent lack of contacts. This has often been due to either using too low a transmitted power, or to not using the correct polorisation. SSB mobile on 2m can be excellent if you use a good linear (having a good pre-amp in it for receive), and a properly set up omnidirectional antenna such as a halo.

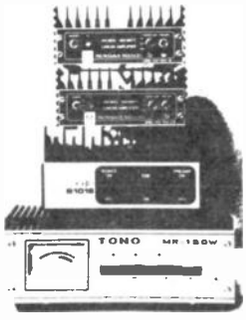
The home base can also benefit

Running 10w PEP into a vertical can be near useless as you will be up to 30dB down on the chap with 100w into a halo, the difference representing an awful lot of S points! The home station can also benefit by having a linear at hand, but since the effective ERP is always much greater if an average beam antenna is used, bot transmitted and received signal strengths will be much higher than those noted by mobiles in the vicinity. A spreading transmission caused by a bad linear (or a misused good one) will, in this case cause more offence to others from a fixed location. Matters are worse if the fixed station is in a highly populated urban area, or at the top of an enormous pimple out in the sticks, in the middle of a portable contest. People have a habit of shouting in such a contest, almost invariably through an overdriven linear, and stations within even a 50-mile radius will note the spreading, and start cowering.

Let's take a look at how we tested the linears, and some of the typical problems you'll find on most makes. Valve machines don't apply of course.

Testing procedures

The most difficult part of testing linears is, in fact, generating a signal clean enough to act reliably as a reasonable source for checking amplification capabilities. Three of the four linears tested were specified at 10w input for a specified output. We felt it desirable to have the facility of having a clean 15w PEP available. Our test set-up involved the use of two Marconi 2019 programmable signal generators (see page 56) whose outputs were programmed to be in the 2m band, and spaced 100kHz apart. The two sources were combined in a 50 hybrid transformer and then through a Marconi precision 50 UHF attenuator switching in 1dB steps. The output from this fed directly into the input of a Boonton 230a valve power amplifier, using three 2C39 valves in cascade, the first having an accurate 50 input impedance and being untuned, whereas the second and third valves are tunable from 10MHz to 500MHz. This amplifier could give a clean output drive up to a few hundred mW, sufficient to drive my 4CX250R valve to give an output of at least 20w, which was again clean. This output was attenuated 3dB to give a very stable 10w, feeding through a Bird through-line watt meter to a coaxial switch. One output of this fed a precision high power



50ohm load whilst the other output fed the linear under test. The output from the linear fed a Bird PEP meter, which could also be used for reading average power, and thence a Rohde Schawz 50ohm power attenuator with an output of -30dB. This was then interconnected either with a Racal programmable power meter, a high frequency HP oscilloscope, or spectrum analyser (see page 56). The current drawn by the linear was monitored, and the voltage applied to the end of the supplied power leads was always 13.8vdc.

For testing the received pre-amplifier sections, we fed the attenuated output of a signal generator through the linear and out to a Yaesu FT290R, fitted with a Mutek front end. The output from the speaker jack fed into an external load bridged by an HP8903 audio analyser, the sinad function being selected. 400Hz and 30kHz filters were used.

The receive pre-amplifiers were also checked with two tones, in order to measure the -40dB and -20dB input intermodulation distortion points. I thought it desirable to look at pre-amp gain and bandwidth as well as noise and IM performance. We also thought it desirable to check the hold-off time of the RF sensed vox circuits, for there is nothing more annoying than a vox which is clattering in and out all the time, instead of in between sentences.

The tests

Each power amplifier was checked with a single carrier input of half the nominal rated input level, as a check on the system. 5w for example was set up as a drive level into the Bird dummy load, and then switched through to the linear. The input SWR was then checked, in addition to the power output and the DC current drawn. Full drive was then applied by taking 3dB attenuation out of the Marconi attenuator. We previously determined, of course, that attenuation was linear. This, in the example given, increased the drive power to 10w, and once again the output power and DC current were checked. We then checked gain for 1w input. We also checked to see if the FM/SSB switch affected linearity.

The two-carrier, or two-tone tests, were then started; we decided to try an initial two tone level of 5w PEP, or its equivalent. If two carriers on other than the same frequency are sent through a power meter to a load, they will develop a peak envelope power which is double the average power, if the system is linear. Thus, two carriers, each of 1¼w will develop 2½w average power, but 5w would be read on a PEP meter. We adopted this procedure throughout to give a predictable PEP drive source, having determined that it was linear. We measured the 3rd, 5th, 7th and 9th order products on either side of the two tone output from the linear, but only the average of the lower and upper side bands is quoted in the table, unless they are very different. Note that two frequencies, respectively f1 and f2 will develop odd order intermodulation products of 2(f1)-f2, 2(f2)-f1, 3(f1)-2(f2), 3(f2)-2(f1), etc. It will thus be seen that an enormous family of IM products is produced either side of the two tones, and what is important to the user is how rapidly the higher order harmonics reduce to significantly lower levels. We checked the IM products for full, half, and tenth-rated inputs, as well as checking output PEP. We noted any difference between the FM and SSB.switched positions, and the time taken for the relays to drop out of Tx. We also checked to see that full power was available at both 144.3, and 145.5MHz.

"It is obvious that a two-tone test . . . is an exceptionally cruel one"

The pre-amp gains were checked at a fairly low level using a spectrum analyser, and the Racal power meter. Great care was taken to ensure the consistency of results. We used the spectrum analyser to check gain at band edges, -3dB points, and the frequencies where unity gain was given. We measured the level required of each of two carriers held at the same level relatively, which would create a 3rd order IM product of -40dB and -20dB. All the pre-amplifiers were at least good, but the problem was, they would cause severe deterioration of the IM performance of any rig following them, but that is another story! Possibly for a future issue . . .

" . . .if they are driven too hard, they could cause offence if used with a speech processor"

If you peruse the IM figures in the table, they will probably scare the pants off you, and they certainly did worry me, particularly since I consider myself a perfectionist. As a reviewer, though, I must be a realist, and in the subjective trials, the apparent degree of spreading as reported by others, and as I noted on other peoples transmissions, using the same gear, was somewhat less than that which might have been expected. I have had to think long and hard about this, and my conclusions as a result might be quite important. As an audio consultant in the hi-fi and sound recording field, I have frequently had to perform analysis of the human voice, but not quite in the direct field of power density within a 3kHz bandwidth.

It is obvious that a two tone test, where the two tones are at the same level, is an excepetionally cruel one, being the limiting or worst case for the production of the highest IM products. Whilst two tone testing can give an excellent ranking order of products, the results might not be completely typical of the subjective performance. I suspect that only exceptionally rarely do any two widely spaced components of a voice reach an equal amplitude which is near the average peak level of the voice. Vowel sounds are low pitched, and thus their harmonics are fairly close in frequency, whilst consonants and sibilants have much energy above the pass band of a typical SSB system, and so can be ignored.

The worst case would be produced by an instantaneous appearance of a high level, low frequency vowel, with a high frequency high level sound which must be within the pass band of the system. Components of 500Hz and 2.5kHz at equal high levels surely must be very rare, but the voice does nevertheless produce many frequencies at the same time, but with individual component amplitudes instantaneously many dBs apart in level. The IM products are therefore typically 10 to 30dBs below what they would be on two tone testing, allowing for a reasonable microphone, an average modulator with fairly low distortion, and an ALC which is reasonably designed.

Worst possible IM products

Once a compressor/clipper is used, however, the average power intensity of all components will tend to increase and fill up the carrier/bandwidth very noticeably, thus having the tendency to do the very thing that can cause the worst possible IM products, namely, creating two components of near equal amplitude well apart in frequency. The 9th order IM product of two tones spaced 2kHz apart is plus and minus 8kHz of the two tones themselves, but if the frequency spacing is decreased then the 9th order product position will cause the apparent transmission to be much narrower. Put the clipper in, and the transmission immediately widens out causing the ceremony by the natives of much teeth gnashing and throwing hands up in the air!

The moral of all this is that whilst the transistorised linears reviewed may be acceptable (although not as good as valve linears) if they are driven not too hard, they could cause offence if used with any speech processor or clipper. These add energy within the SSB passband at a wider frequency difference than would be added with a simple but effective compressor, which would hold instantaneous relative levels of various frequencies. If you must use a clipper, then make sure you either considerably underdrive your transistor linear, or use a valve one with very low IM products.

Microwave Modules MML 144/100-LS

This linear is surprisingly compact and weighs a mere 1.5kg. The manufacturers now supply two heavy duty captive 13v input leads of approximately one metre length. On the front panel is the basic switching to give full rated output from a rig giving just 1w or 3w, a three-position switch having a centre-off position. Another three-position switch selects the operating mode for the RF vox circuitry, centre position switching the power amplifier off, the others FM and SSB. A two-position switch turns the RX pre-amp on/off. LEDs indicate power on/off, TX/RX, linear on/off, and RX pre-amp on/off. On the back panel, input and output RF sockets are now normally S0239s, although other types can be supplied to special order. A 15a heavy duty fuse holder is on the back, and a phono type socket is fitted which, when short circuited externally, causes the linear to change to the TX mode, even in the absence of RF.Excellent for SSB operation. The FM/SSB front panel switch causes the transfer from TX to RX to be either almost instantaneous, or about 0.25 sec in the absence of RF. Microwave Modules have informed us, just before going to press, that they will be adding a pre-set to vary the hold on time up to one second, almost immediately, as we suggested. The latter is much too short, and I would have preferred a delay of about one second for SSB. Many rigs (such as the Yaesu FT290) do not have a socket on the back which is short on TX and open on RX. The use of the front panel switch on SSB is therefore essential, and thus the requirement for the longer delay time.

This model accepts either 1w or 3w input for the full rated output, the linear incorporating a driver transistor bringing the level up to 10w or so, followed by a single transistor amplifying up to the 100w level.

Included are two PL259 plugs and a phono plug for interconnections, together with a brief description of the unit, a circuit diagram and a guide to transceiver interconnections. I would have liked more comprehensive instructions which could have told a purchaser how to increase vox delay, for example, and more detailed specifications.

Lab test results

We first selected the 3w nominal input position for single tone tests. The VSWR was acceptable, but not good. Somewhat surprisingly, half the rated input level gave only 0.5dB below full output, showing considerable compression near the nominal 100w output level, not reached after the amplifier had warmed up. Two tone tests were carried out on the 1w input position, which was a far better match. At the half and 1w input levels, output corresponded better but IM products I thought were too high, and considerable asymmetry was also noted at 1w. At 100mW asymmetry was again noted, and high order products seemed worse than they should have been, 17th order for example measuring approximately -62dB. At lower input levels there was a tendency for the linear's output to be too low, ie the gain dropped off slightly at lower levels.

The power bandwidth was excellent, no difference being noted at the two frequencies tested. The DC current consumption was quite reasonable, efficiency at full output being 55%. We checked the TX/RX switching characteristics, and vox sensitivity, indicating that whilst the linear dropped out of TX at 125mW, it required 300mW input for FM, and a surprising 500mW for SSB to bring up TX again.

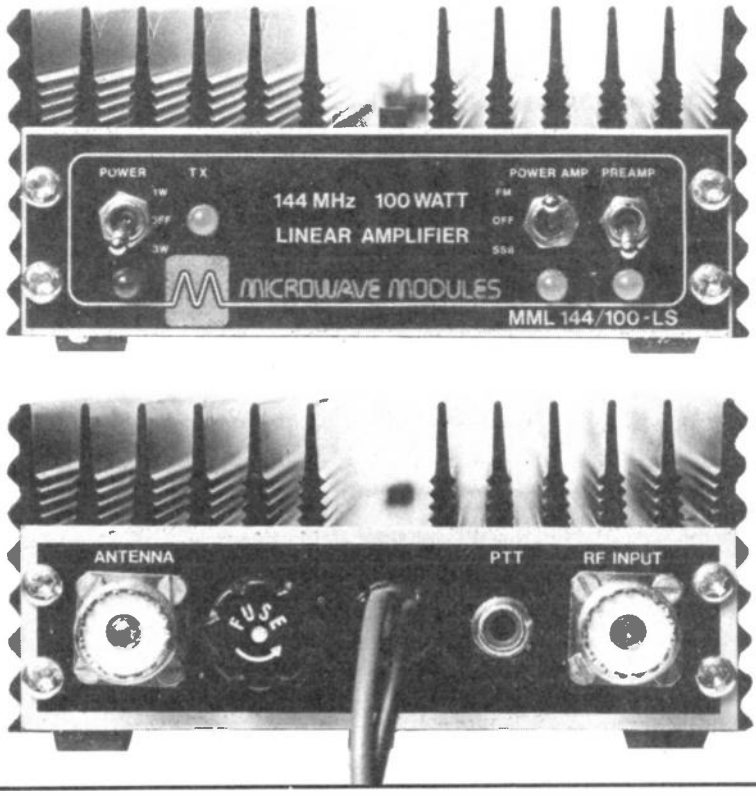
Whilst this linear has affective vox circuits for FM, the vox is totally unsuitable for SSB as it stands, unless you use the external PTT socket. The manufacturers have recently designed a modification to increase the vox input sensitivity; the hold-on time was only 0.25sec, and MM have promised to lengthen this by changing the time constant components around.

The RF pre-amplifier had quite a high gain at band centre, only marginally varying across the band. Unity gain measurements showed the bandwidth to be rather wide, and a higher Q would have been desirable. The input noise performance of the pre-amp was fairly good, but the combination degraded the FT290/Mutek system by 1.25dB. This pre-amplifier would improve the sensitivity of many systems, however. The intermod performance of the RX pre-amp was adequate, but would have been better with less gain. The through loss of the system with pre-amp switched out was less than 0.4dB, the lowest loss in the survey.

Operational comments

I found that when I was using SSB, the linear would not stay on transmit properly, tending to jump on and off rapidly unless I spoke very close to the mike or raised my voice, or used external PTT. On FM RF sensing worked excellently, and so it was clear that (especially from a 1w rig) there was insufficient sensitivity in the RF sensing circuit to allow low level SSB to hold the linear on TX. This emphasises the manufacturer's recommendation that is worthwhile to go to considerable lengths to use the external PTT socket for SSB, even if this means a small modification to the transceiver.

The built in pre-amplifier improved the measured signal to noise of an average black box, but actually degraded the apparent sensitivity of the FT290 fitted with the Mutek front end. When driving an MM 28/144 transverter to 4.8w, and attenuating by 3dB to 2.4w into the linear, IM products were none too good, and some complaints were received, but when the rig level was attenuated to 1½w drive, results were significantly better, the output only slightly decreasing (confirmed in lab tests). G4MVR obtaining a 5 and 9 + 10 signal at 20 miles, found the transmission around 17kHz wide above RX noise, and this was considered too wide (2.4w drive).



Microwave Modules MML 144/100-S

The back panel is identical to that of the MML144/100LS. The only difference on the front panel is that the main power on switch is just on/off, the rig being intended for 10w in and 100w output. The receive pre-amplifier is identical to that in the other model.

This model works extremely well on FM, giving a good 100w output from the average 10w FM rig, but I most strongly recommend that you do not exceed 5w input on SSB if you want to avoid a certain amount of spreading. Pushing 10w in increases the output by less than 1dB. The RF sensing circuit was far more effective from a 10w source, and only very rarely dropped out on SSB, because of the greater relative sensitivity of the RF sensing circuits referred to a typical input level, although the delay time was again much too short on the vox circuitry.

When driving the rig from 5w input, spreading was thought adequate, but at 10w input there were a few comments about spreading from local stations. At a distance, stations using this linear with a well controlled 10w input seemed only slightly wider than they should be, but cleaned up immensely when the user moved back from the microphone. At 4.8w drive, G4MVR (20 miles away, receiving 5 and 9 + 10dB) noted a 14.5kHz overall transmission bandwidth down to the noise. Accessory plugs and literature are as with the MML 144-100LS.

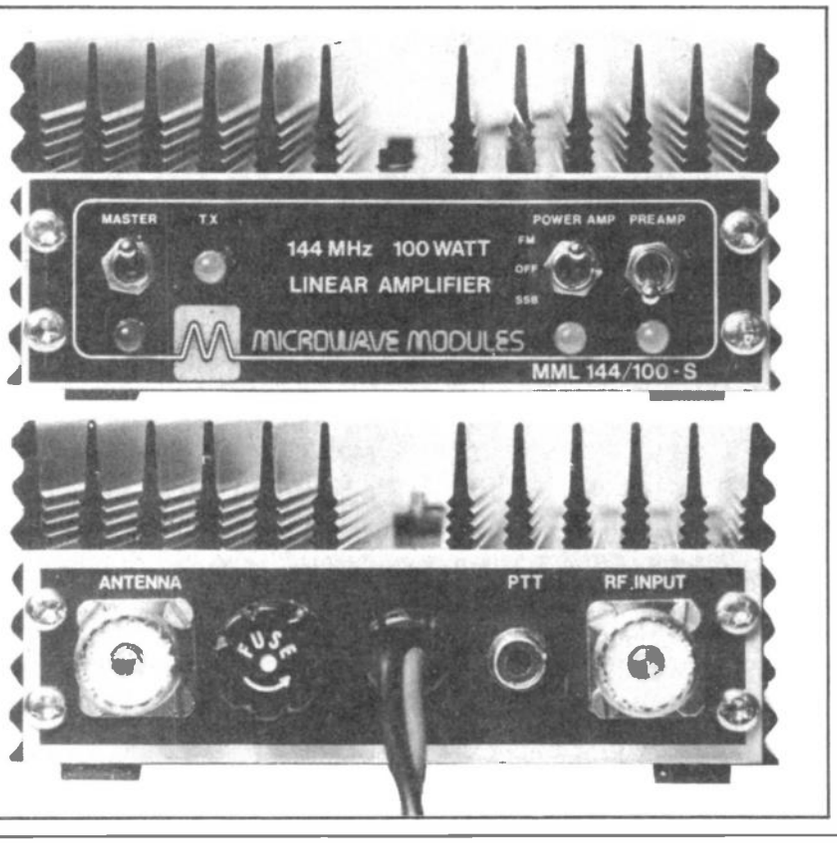
The MML 144/100S works well on FM, giving a good 100W output from the average FM rig.

Lab test results

When driven at the 5w input level, the input SWR was adequate. No trouble should be experienced driving this linear with average rigs. At 5w input just 1dB below full output was reached, doubling the input to 10w, ie +3dB, showed 2dB compression for 100w output. Efficiency at maximum output was 58%, which is excellent. 1w input, single tone, gave 25w output, showing rather higher gain at lower levels. 5w PEP input (two tones) gave 75w PEP output, the IM products being rather asymmetrical for low orders, the worst being 3rd order.

At the full rated input of 10w, one 3rd order product reached -12dB, although high order products were not too bad, but again asymmetrical. At the 1w level, IM performance was much better, high order products measuring quite well.

The TX hold time on SSB was again short and requires lengthening. Power bandwidth was excellent and no problems were actually experienced in use. It is again obvious that this MM linear is suitable for 10w input on FM, and it gave the full rated output, but on SSB it would be more accurate to specify it at 5w input for around 80w output. Even so, I have heard many used carefully with well set up 10w rigs, and the spreading could not be said to be severe, although stations local to the user would benefit from the drive level being reduced to a maximum of 5w PEP. The RX pre-amplifier is identical to the one in the other MM linear reviewed, although the sensitivity was marginally worse.



Mirage B1016

Far more chunky than the MM models, the Mirage weighs 2.3gk and has a ginormous heat sink. Front panel controls switch the receive pre-amp on/off, FM or SSB (affecting the vox TX hold-on time only) and main power on/off. This linear is fitted with two extremely thick 13v leads to carry up to a massive 25a on TX, a 35a fuse being internally mounted. Input and output RF connectors are S0239, and a PTT phono jack allows external overriding of the transmit switching circuitry, normally switching with the internal RF sensing circuit. In the FM mode, TX/RX switching is almost instantaneous, but on SSB the hold on time can be varied over quite a wide range, which is excellent, the trimmer being easily accessible through a hole on the side.

The amplifier has a thermal cut-out, which when operating, stops the TX light from coming on in addition to turning the power stage off. Usefully, a six-pin socket on the rear is provided for interconnection with an optional accessory, the RC-1 remote head, which allows the linear's switched functions to be remotely controlled, thus allowing the linear to be put away in the boot or in the engine compartment in a mobile installation.

Tono MR-150W

Although this linear is larger than the others, it is not too heavy, weighing 2.5kg. I was immediately impressed when I saw that the RF input and output sockets were N type. The thick 13v power leads are just over 1½m long, and a 20a heavy duty fuse is provided on the back panel, together with a remote control socket, which enables the PTT to be controlled from the transceiver in the usual way. One pin provides a change-over facility with an external DC voltage applied from 5-13.8v.

A row of five neat push buttons on the front panel select main power on/off, FM/SSB (this changes transistor bias but not vox delay), RX pre-amp on/off, TX amp on/off, and meter switch, selecting forward output power, or ant, NG. On looking at the instruction book we found what NG meant "When the NG (no good) lamp is lit . . .". There is nothing like plain language for labelling! But perhaps it would have been more obvious with a B inserted in the

The receive preamplifier seemed a little deaf, but otherwise worked well. On transmit, the amazing power on FM was really rather shattering, as it allowed me to run 100w at the radiator of my veritical 8/8 J-Beam, giving me my favourite "we have ways of making you listen" syndrome! Under mobile conditions, you would of course be exceeding your licence regulations on FM, and you might end up damaging an aerial transformer!

On SSB the operation was much liked, but as with the other linears, the IM products were rather poor at 10w PEP input. Decreasing the drive power to 5w dramatically improved these to a tolerable level. A small but competent instruction book is supplied, but you will need a good pair of specs to see the circuit diagram.

Lab test results

On a single carrier, 5w input drive gave the very high power of 160w output which increased by only 0.5dB for a 3dB increase of input level. The gain of the linear was just under 1.5dB greater at 1w than it had been at 5w, showing some compression even at 5w. The power was well maintained across the 2m band. In the two tone tests at the 5w level, higher order components were only fair, whilst at 10w input the lower order IM components became worse, although higher orders did not seem much different. At the 1w level the components did not drop as much as I would have expected. Input VSWR measured extremely well, and no trouble should be experienced here. The maximum current drawn was very high at 24.5a, so don't use the linear static mobile on FM with your engine switched off!

I carefully set up a Microwave Modules 2m transverter with my Trio TS830 for a maximum power output level of 5w PEP, and used this to drive the Mirage for an evening. Several stations said that the transmission was rather wider than my normal valve amplified one, when the latter was running over twice the power output, although the Mirage was not considered to be spreading badly. There were no immediate locals on, however. The Mirage was a delight to use; the SSB hold-on time was exactly right for me. The RX pre-amp, when switched in, degraded the performance of the transverter signal to noise ratio.

The receive pre-amp had about the right gain to work with a reasonable rig front end, but its noise was about 2dB worse than that of the FT290/Mutek system. The system had a slight through loss, but this was not serious. The RX bandwidth was a little wide, but typically so. The IM performance was considered excellent, and in practice it will always be the main rig that will determine the overall system IM levels. When G4MVR (20 miles away) brought the received signal to 5 and 9 + 10dB, as before, by aerial rotation, he reported that the overall bandwidth to noise was around 12kHz, which is good for a transistor linear.

The Mirage was a delight to use; the SSB hold-on time was exactly right for G3OSS.

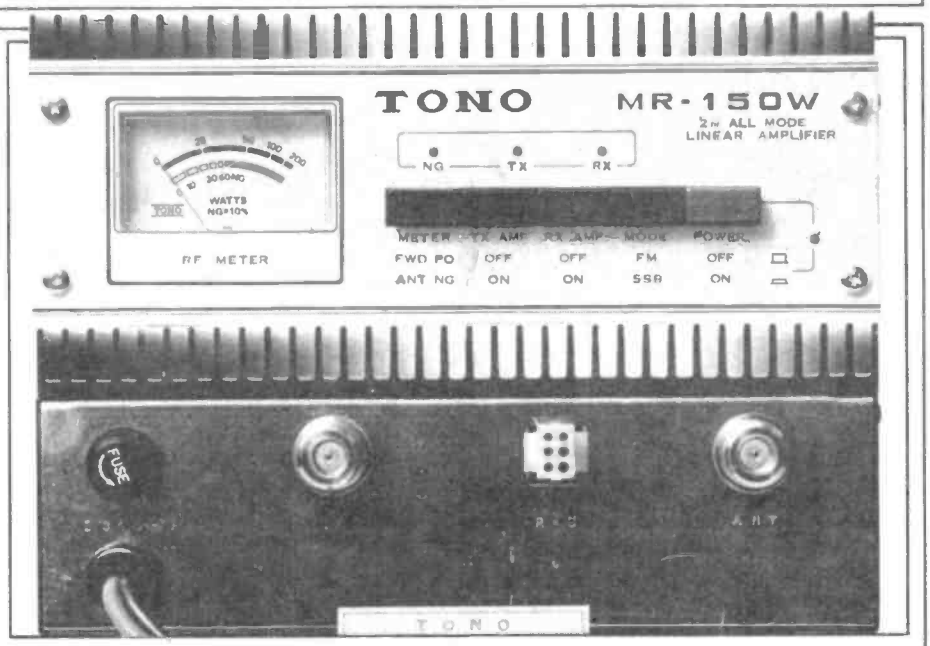
Below: The Tono is the largest of the linears reviewed here.

middle! The power meter, incidentally, indicates 200w FSD, which perhaps is incredibly optimistic (the other scale is NV x 10%). Two right-angled brackets are supplied to help car fitting. A remote control plug and screws are also supplied, but no N plugs. LEDs across the front panel indicate NG, TX, RX and power on/off.

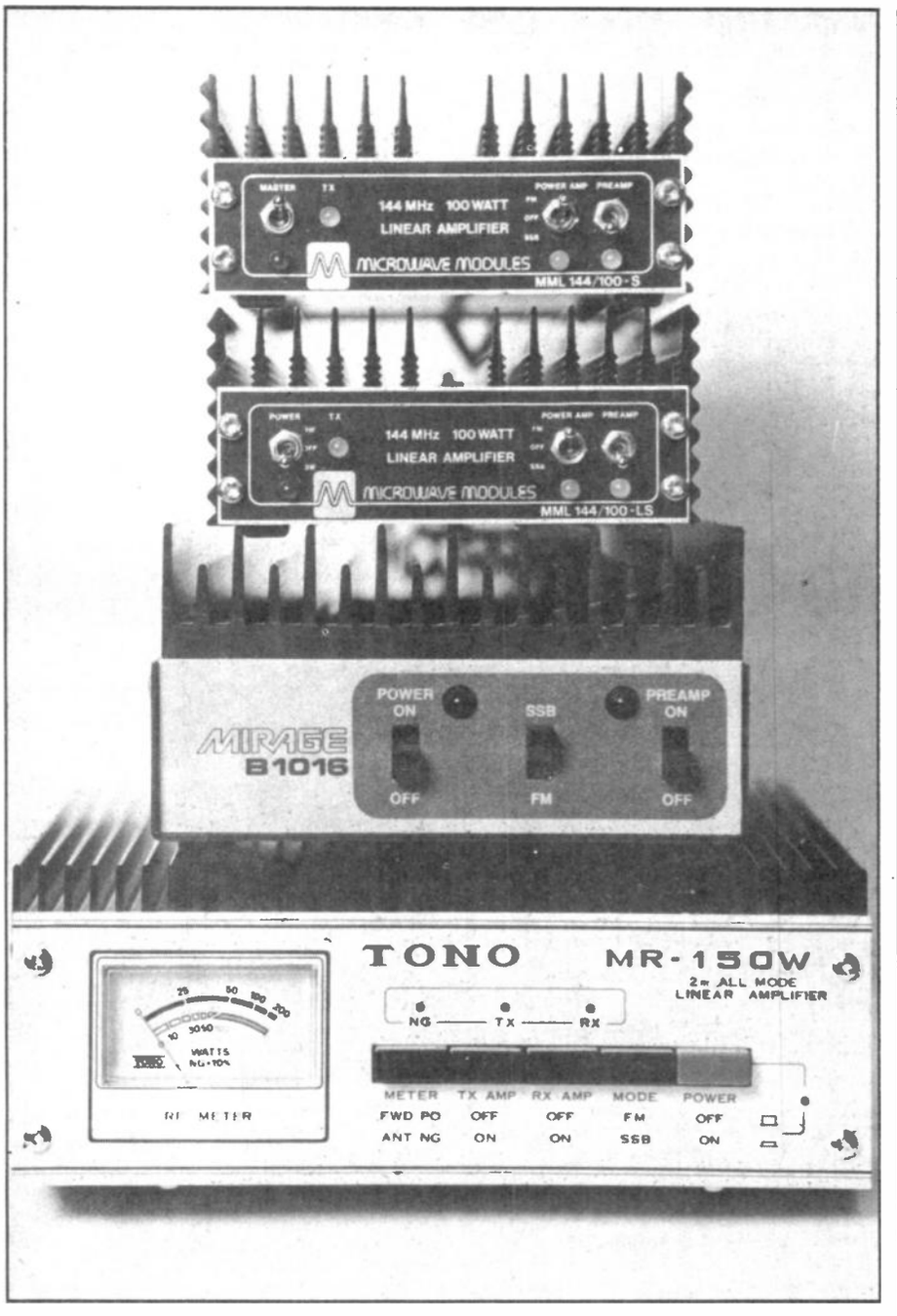
Lab test results

At 5w single tone input, slightly more output was given in the SSB position than on FM, whilst at 10w drive the output levels were equal. We noted a saving of only one amp on FM at full power, which did not seem worthwhile for the extra circuitry involved. At 1w input there was a major difference in output, FM being almost half the output of SSB. The remarkable efficiency of 65% was reached on SSB at 125w output, FM being slightly better. The input SWR measured very well indeed. The TX/RX vox delay was virtaully non-existent. Since the specification states that input is 10w to 15w nominal max, we checked an output of 140w for 15w input on FM, and this is quite enough for normal use.

We noted that the gain at 145.5MHz was somewhat lower than at 144.3MHz, 10w input on FM giving just 95w output, for example, at the higher frequency. 5w input PEP with two tones produced 100w PEP output, with IM products falling quite fast, 9th order being surprisingly good. At 1w input IM products were at surprisingly low levels for a transistor linear, which is commendable. IM products, though, rose very steeply indeed above 5w input, the maximum input level that I recommend for SSB with this linear.



The RX pre-amplifier had its maximum gain well below the bottom of the 2m band, gain falling appreciably at 146BMHz and width was again fairly wide, which is a pity. Input noise did not measure well; the noise performance was 3dB worse into the FT 290/Mutek with the pre-amp in. A rather high through loss was noted of 0.7dB. The IM performance was quite good, but the Mirage's was better.



G3OSS intends to follow up this review of linear amplifiers with some more in a future issue. So keep watching this space.

Conclusions

It should be borne in mind that when evaluating any products, we must take price into consideration. You may have to look around a bit to find Microwave Modules products discounted, but even at their "recommended retail price" they are good value for money. They have the most sensitive pre-amps surveyed here, but they did not quite come up to the performance I anticipated.

The MM linears worked very well on FM and I have no reservations on their performance in this mode, but for SSB I most strongly recommend you to keep drive levels to 5w max and be content with 80w out (or half power input for the higher gain model). If you wish to use the 1-3w input version on SSB you'll probably have to use the PTT line facility rather than RF sensing, until MM increase gain – which they are now doing in their latest linears.

Unfortunately, many low power rigs (Yaesu FT290, Standard C58, and IC202S, for example) do not have appropriate external relay control sockets, but it should not be too difficult to modify the rigs accordingly. One of the strengths of Microwave Modules is their suitability for use under mobile conditions, the load on the battery being reasonable, and the size very compact.

The Mirage is expensive, but the power output capability is amazing. If you want a really high power mobile set up, you'll need a big battery, but the Mirage should work wonders on FM! On SSB, once again, I earnestly suggest that you keep drive down to 5w max. The pre-amplifier was 1dB better than the Tono, whilst the MM one was the best. I particularly liked the vox sensing facilities, and how much better this linear is than the old KLM, which had the same rating, but seemed to almost square off almost all SSB signals!

The Tono linear had the best transmit performance at low levels, and some excellent facilities, but the pre-amp was very poor. If you are prepared to ignore the latter, of fix it, then the Tono too can be recommended, although you only get around 1dB more output for the extra £30.

I am not trying to evade a direct recommendation for a best buy, for all the linears surveyed are useful in their own area. If you want to put out a good, clean and thoroughly healthy signal, I must recommend you to use a valve linear. These linears are expensive, though, unless you "roll your own". Transistor linears are obviously excellent for FM, and SSB mobile, but I think there is still research to be done to design high power amplifiers with lower IM products when transistors are used. In comparing all the above linears with earlier models, improvements are quite marked. I am surprised, though, that their built-in pre-amps were not as good as they should be.

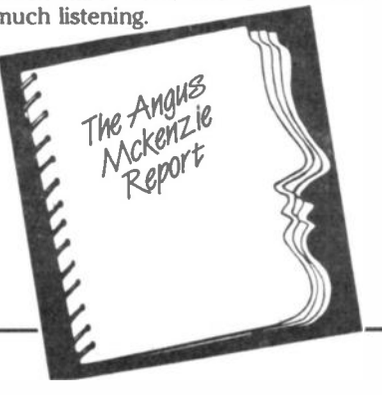
Superb speech quality

I feel quite strongly that all manufacturers should incorporate a DC sensing circuit on the transceiver input line which could activate the TX relay, thus obviating in particular the MML 144/100LS vox sensitivity problem. The FT290 and Standard C58 multimode rigs are so popular, and both have DC on the output on TX, so why not use this facility!

Finally, G4MVR, who very kindly helped with the receive comments, said that the MM transverter (barefoot) gave a superb speech quality, deteriorating only slightly with the Mirage, slightly more with the MML 144/100S. The Tono was fairly good but compressed at high level, but the MML 144/100LS was poor with rather scratchy speech.

Unfortunately the Tono went faulty during the final subjective tests, which were not completed. Input VSWR went crazy, and output dropped by around 8dB. Note that the Tono must be used with external PTT for SSB.

The author wishes to thank Microwave Modules Ltd, SMC Ltd, and Thanet Electronics Ltd for the loan of review equipment, his colleague G8UQX Simon for much hard work, and G4MVR John for much listening.



LINEAR AMPLIFIER MEASUREMENTS

Frequency for single tone measurements: *144.3MHz unless otherwise stated.*
Frequencies for two tone measurements: *144.3 and 144.4MHz.*
Supply: *13.8vdc*

	Tono MR-150W	Mirage B1016	MML 144/100S	MML144/100 LS	NOTES
Output for 10w input (single tone) (w)	125	180	100	95 (3w i/p)	
Current drawn from 13.8v supply at this output (a)	14 (FM) 15 (SSB)	24.5	12.5	12.5	
Efficiency (RF power out/DC power in) x 100%	65	53	58	55	
Output for 5w input (single tone) (w)	82 (FM) 86 (SSB)	160	80	85 (1.5w i/p)	
Output for 1w input (single tone) (w)	14.5 (FM) 27.5 (SSB)	43	25	15 (300mW i/p)	
Input VSWR	1.15:1	1.2:1	1.4:1	1.4:1 (3w pos) 1.2:1 (1w pos)	
Output for 10w single tone i/p = 145.5MHz (w)	95 (FM) 100 (SSB)	180	100	90 (1w i/p, 1w pos)	
Output for 10w PEP two tone input (w PEP)	130	180	90	90 (1w i/p 1w pos)	
Av. 3rd/5th/7th/9th order intermod at this output (dBc)	-16/-24/ -25/-29	-14/-32/ -40/-41	-16/-29/ -35/-44	-17/-26/ -37/-38	Average of upper & lower products
Output for 5w PEP two tone input (w PEP)	100	160	75	45 (0.5w i/p, 1w pos)	
Av. 3rd/5th/7th/9th order intermod at this o/p (dBc)	-23/-33/ -38/-65	-22/-35/ -39/-40	-22/-30/ -40/-47	-26/-36/ -36/-38	
Output for 1w PEP two tone i/p (w PEP)	25	50	25	6 (100mW i/p, 1w pos)	
Av. 3rd/5th/7th/9th order intermod at this o/p (dBc)	-29/-37/ -46/-54	-25/-36/ -42/-43	-24/-34/ -45/-48	-28/-31/ -36/-43	
Worst 3rd/5th/7th/9th order intermod with 10w i/p (dBc)	-16/-24/ -25/-29	-14/-32/ -40/-41	-12/-23/ -34/-36	-13/-25/ -29/-35	Worst of upper & lower products
Preamp gain @ 144.000/ 145.000 / 146.000MHz (dB)	10.7/10.0/ 9.0	9.8/10.2/ 9.8	14.2/14.0/ 13.8	As other MML model	
-3dB (rel. to max gain) points MHz	128/148	141.5/148.5	138.5/150.0	,,	
Unity gain points (MHz)	123/153	132/161	119/175	,,	
RF level for -20dB 3rd order intermod (mV pd)	112	141	56	,,	
RF level for -40dB 3rd order intermod (mV pd)	45	50	25	,,	
Through loss (dB)	0.7	0.5	0.4	,,	
12dB sinad FM test (uV pd)	0.15	0.13	0.125	0.12	
SSB TX/RX hold time (secs)	None	Variable	0.25	0.25	
RF sensing for SSB	Bad	Excellent	Fair	V. poor	
Overall quality FM	Good	V. good	Excellent	Excellent	
Overall quality SSB	TX fairly good. RX poor.	TX good. RX fairly good.	TX fairly good. RX good.	TX poor. RX good.	

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 Issue 3.
Trio TS530S	£520	Very good rig for the newcomer; reliable
Trio TS830S	£645	We love this one – see our review in Issue 2.
TS930S	£1000 approx	We don't know anyone who has one
Trio TS430S	£736	Very new
Yaesu FT102	£785	Nice – see review in Issue 3.
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
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.
Yaesu FT77	£?	Replaces FT7B.

VHF transceivers

Trio TS780	£799	Covers 2m and 70cm; good reputation; bit deaf!
Yaesu FT290R	£265	Base-cum-portable 2m rig; see review in May 1983 issue.
Yaesu FT790R	£325	Ditto for 432MHz see review in May 1983 issue.
Trio TR9130	£395	Very nice 144MHz multimode – reliable and solid
Icom IC251E	£559	Good 144MHz multimode, see review in next issue.
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. Review in April 1983 issue.
Icom IC4E	£199	We loved this – Review in April 1983 issue.
FDK Palm II	£109	144MHz 6-channel FM hand-held
FDK Palm IV	£109	Ditto for 432MHz
Azden PCS300	£179	144MHz

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.

		handheld; good Rx synthesised
Trio TR2300	£144	Big portable FM 144MHz box
Trio TR2500	£220	Keypad-synthesised 144MHz handheld; review in April 1983 issue.
Trio TR3500	£250	As above; review in May 1983 issue.
Icom IC202	£209	SSB 144MHz "portable", still going strong
Icom IC402	£245	ditto for 432MHz
Yaesu FT208R	£209	2.5w FM 144MHz hand-held – review in April 1983 issue.
Yaesu FT708R	£230	1w FM 432MHz hand-held – review in April 1983 issue.

VHF and UHF mobiles

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

FDK M700AX	£180	144MHz 25watt FM – nice audio and good Rx
FDK M750AX	£269	144MHz multimode, 10 watts
Trio TR7730	£268	25watt 144MHz mobile, nice to use
Trio TR7800	£257	Much as above only bigger!
Trio TR8400	£299	A mobile 432MHz FM machine, good Rx, apparently
Trio TR9500	£428	Multimode mobile 10watt 432MHz
Yaesu FT230R	£239	25watts on 144MHz mobile/base station (FM)
Yaesu FT730R	£285	Ditto on 432MHz – 10watts. Rx a bit deaf
Yaesu 480R	£369	Multimode 144MHz rig; some have had problems
Yaesu FT780R	£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 in March 1983 issue.
Yaesu FRG7	£199	The old "Frog"
Yaesu FRG7700	£330	Reputedly rather good.
NRD515	£985	Very nice, although not without its faults

In-Circuit testing

How to make up a simple in-line circuit tester, and use it properly. Check for open and short circuits, front to back ratios, and circuit continuity (switches, fuses, etc) and detecting high resistance soldered joints – most important for home building!

By Brian Kendal,G3GDU.

The author came across this circuit in an old RCA Information Letter dated some 8 years ago, whilst cleaning out an accumulation of old papers.

In the best tradition of do-it-yourself he then proceeded to his radio workshop where a 'breadboard' model was constructed within a few minutes. An hour later, after using the tester on a number of old PCBs, he was fully convinced that the unit has all the advantages claimed. He now intends to fit such a tester permanently within his oscilloscope.

Traditionally, fault finding on de-energised PCB boards has required the desoldering of all but one of the connections to the components under test and then making one or more resistance measurements. This is not only time consuming but also involves application of heat which can cause lifting of PC tracks or perhaps inadvertent destruction of heat-sensitive components before or even after test. As the component packing density of modern equipment increases, so inadvertent damage can also occur to physically adjacent components. Furthermore, an Ohmmeter cannot detect a short-circuit inductor or an open-circuit capacitor and some generate sufficient power, even on their lowest range, to destroy some semi-conductor junctions.

The circuit described is, when used in conjunction with a standard oscilloscope, capable of testing components for short and open-circuit, checking front-to-back ratios on semi-conductors and, by utilising Lissajous and combination patterns on the oscilloscope display, will check reactive components which defy Ohmmeter analysis. The circuit is also useful for checking circuit continuity, (switches, fuses etc) and detecting high resistance soldered joints.

Construction

As may be seen from the circuit diagram the few components are all common items and since all are non critical they may be replaced by whatever suitable parts are immediately available. The transformer is only called upon to supply 10 mA thus may be as small as convenient. Should a transformer be selected whose secondary winding delivers more than 6 volts RMS, then the 560 Ohm resistor should be replaced by a component of somewhat higher value to ensure that the voltage drop across the 100 Ohm resistor remains at 1 volt.

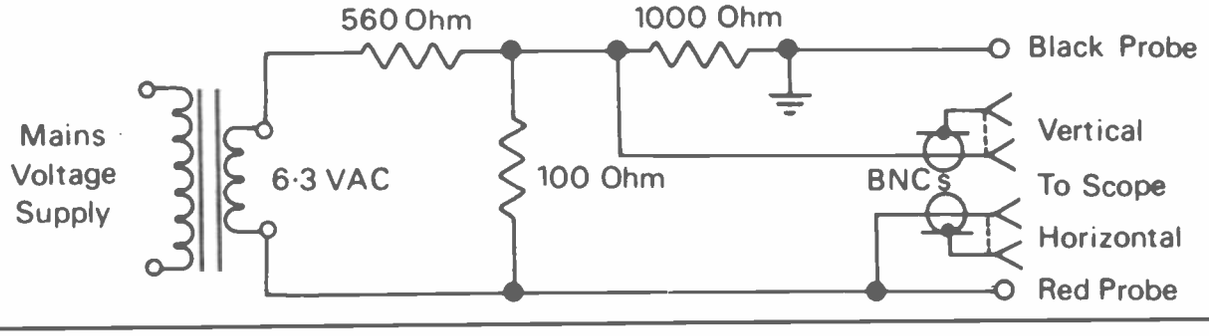
Operation

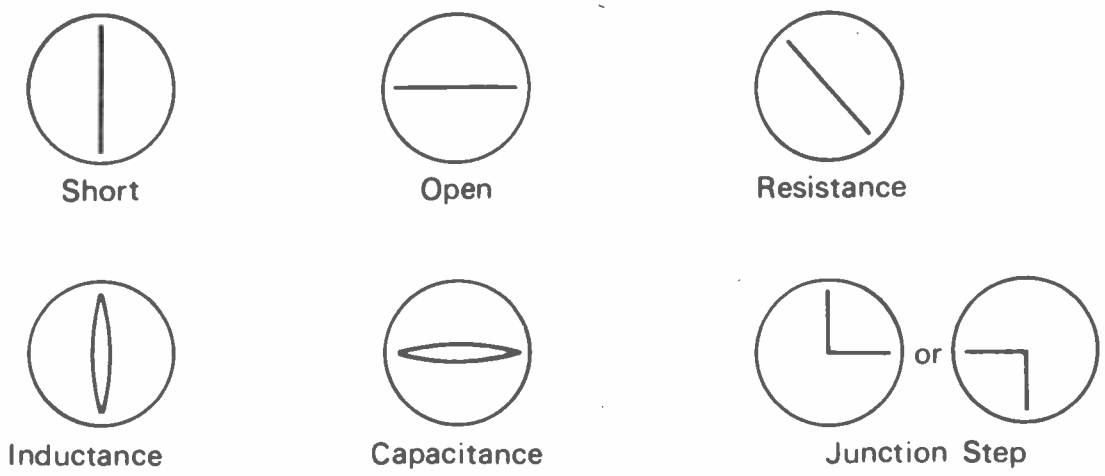
The oscilloscope leads should be connected to a suitable instrument, and with the test leads short circuited the oscilloscope vertical gain should be adjusted until the trace is almost full scale. Separate the leads and adjust the horizontal gain until the trace is almost full scale. The unit is now ready for operation.

As the diagrams indicate, the tester can clearly indicate a number of different circuit elements including: resistance, semi-conductor junctions, capacitive or inductive reactance. It would therefore be wise for the technician to familiarise himself with the various displays by testing a number of know good and faulty components singly and in various combinations.

When testing transistors, check from base to emitter and to collector separately as a collector to emitter test, being through two back-to-back junctions, would not produce a

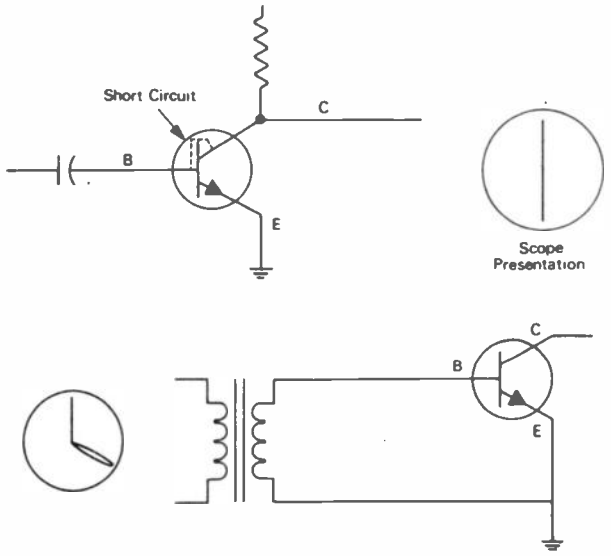
The tester's circuit diagram





Oscilloscope presentations for various circuit conditions

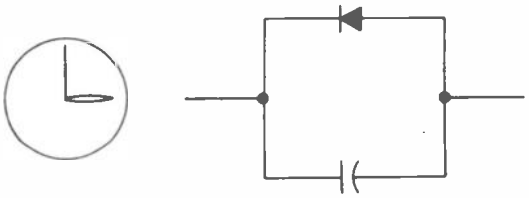
usable display. A single junction will produce a 90° step display whilst a more obtuse angle indicates a reverse DC path across the junction. If the transistor is out of circuit, this indicates a less than perfect junction, but when in circuit



Above: Presentation for a short-circuit junction
Below: The display indicates the junction step associated with a Lissajous due to the inductance of the transformer winding. The d.c. resistance causes the junction step to exceed 90 degrees

would indicate the alternative of a parallel resistance element. The presence of capacitance or inductance across the junction will cause one leg of the step wave form to show a Lissajous loop. Thus, if a diode and a capacitor in parallel were under test, the oscilloscope would display both a 90° junction step and a Lissajous, indicating that neither a short nor open circuit were present. However, in the case of a transformer in the base-emitter circuit of a transistor, a similar display would appear but with a more obtuse angle junction indicating the presence of the DC resistance of the transformer winding in addition to the reactance of the transformer and the junction step.

Should it seem desirable during in circuit testing to unsolder a component to determine its condition, this may often be avoided by comparison with a known good board.

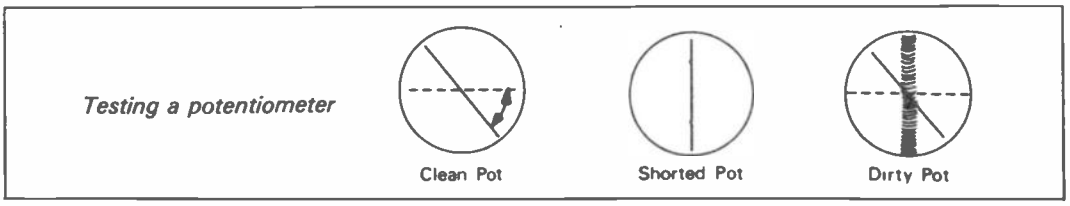


Display for a diode and capacitor in parallel

Two other useful checks can be performed with this tester:

(1) in the instance of an unmarked transistor, place the red probe on the base connection and the black probe on either emitter or collector. A step pattern opening downwards indicates that the transistor is NPN. The same test can be used to determine diode direction.

(2) A potentiometer may be checked for noise. Connect the test probes between the potentiometer arm and one end. A clean device will cause a diagonal line to be displayed, the angle changing as the position of the arm is varied. If the potentiometer is 'noisy' an additional intermittent vertical line will also be displayed.



Written by Brian Kendal, G3GDU, for the magazine Commonwealth Air Transport Electronics News, from which this article is reprinted.

THE CLASSICS 3: THE COLLINS 75A-4

Considered by many to be the ultimate in receivers, the Collins 75A-4 is looked upon by many with itchy fingers and memories of the good old days. It was a piece of equipment that cost something slightly less than a Jaguar car, a superb piece of engineering, says Julian Shakespierre, an amateur who first operated in the 1950s.

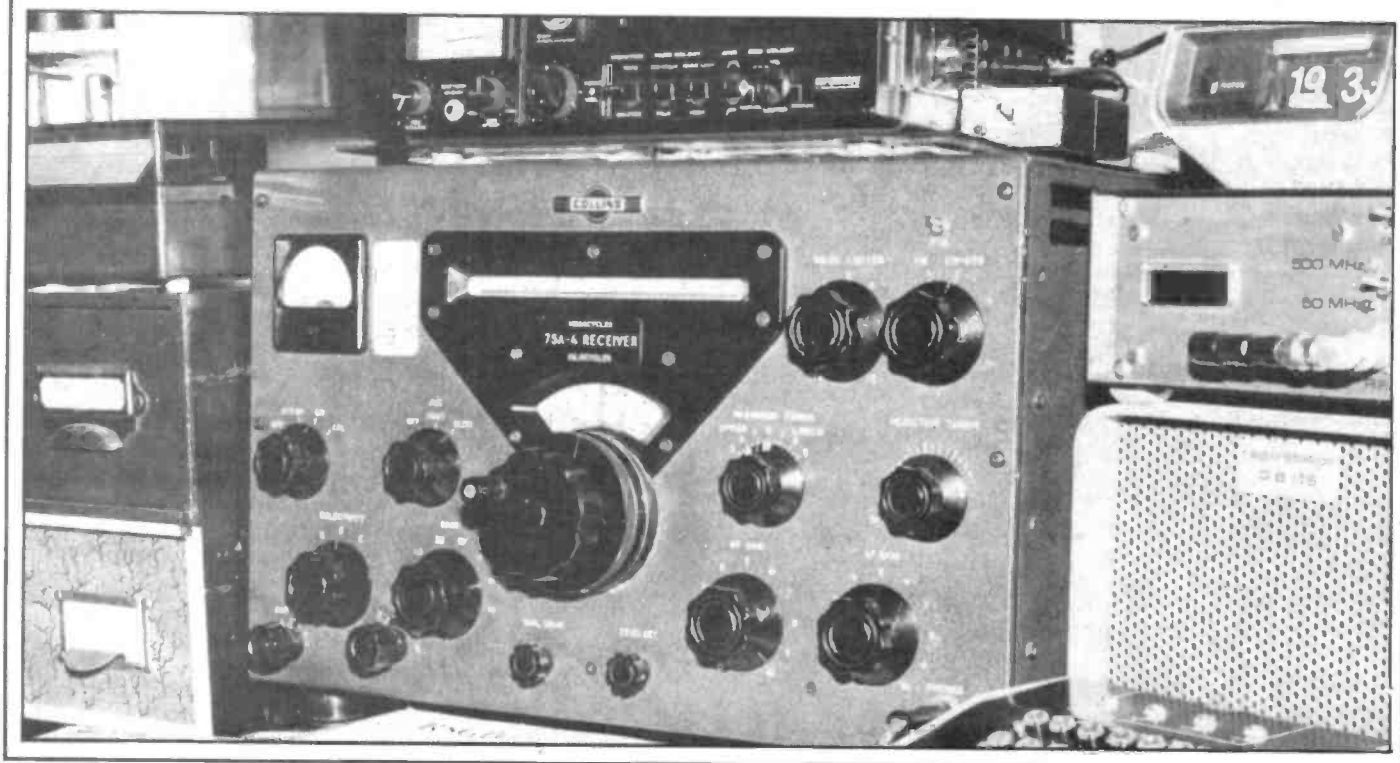
Rolls Royce . . . Rolex Oyster . . . Christian Dior . . . and Leica. Everyone has heard those names and for the past umpteen years thought of them as being the leaders in their fields. They have been regarded as the ultimate and have been used as comparisons and as metaphoric adjectives all over the world, for more years than many of us would wish to remember. Well, now you can add another to the list. Collins, and in particular, their classic receiver, the 75A-4.

Bob Henly's recent article on the greatest "workhorse" of all time, the AR88, took the author on a trip down memory lane. Having originally overcome the hurdle of the "Radio Amateurs' Examination held by the Postmaster General" back in the (very) early fifties (and with a scruffy piece of paper with some nice copper-plate writing on it, as proof) a rather raw recruit to the, then very technical, hobby of amateur radio, dreamed of the day when he could afford one of the glamorous pieces of technology which were regularly advertised in the American monthly "bible", *QST*.

"Built like a tank, for a tank, Flying Fortress bomber or a base station"

In Britain the greatest proportion of equipment on the market was the ubiquitous government surplus gear. A trip down Lyle Street, on the edge of London's Soho, would leave the mouth watering, with rows of shelves in every other shop filled with glorious goodies. One of the most popular was – you've guessed it – the AR88. There was in addition however, a selection of other classics. Notable were the R1155 receivers in their many guises, the equally famous HRO in either civilian or Service dress, vast quantities of smaller and more specialised receivers and transmitters, and . . . the Collins TCS receiver and transmitter combination.

The TCS receiver and transmitter were beautifully constructed and really were a matching pair. A quick glance wasn't enough to separate the two. They were almost duplicates of each other in size and panel lay-out and both cost somewhere around £10 to £15, depending on their condition. They were beautifully made and the appearance for those days was quite splendid; an almost square front in a magnificent combination of black and chrome. Built like a tank, for a tank, Flying Fortress bomber or a base station. That was the start of the author's love affair with



the Collins.

Once the need to manufacture World War II equipment was over for Collins, they moved into the wider field of the different commercial aspects of communications. They were among the earliest manufacturers to recognise the (then) new technique of single sideband. Although there were many firms producing updated versions of their pre-war catalogue items, Collins didn't have the same traditions as Hammerlund, National and Hallicrafters in the USA or Eddystone in Britain. They started from scratch with an original design concept. Aware of the needs for high stability, selectivity and accuracy, the designers made full use of all they had learned over the war years, to produce a piece of equipment which would be compatible with a completely new era.

With the vast amateur market in mind, as well as their commitments to the commercial and Services markets, they concentrated on engineering and produced the first of the 75A series of receivers, with the accompanying transmitter, which was known as the KWS1. They didn't finally appear together until 1955 but that is when the combination of the 75A-4 and the KWS 1 laid claim to the advertising slogan (reminiscent of Rolls Royce) "First choice"!!

Formidable specifications

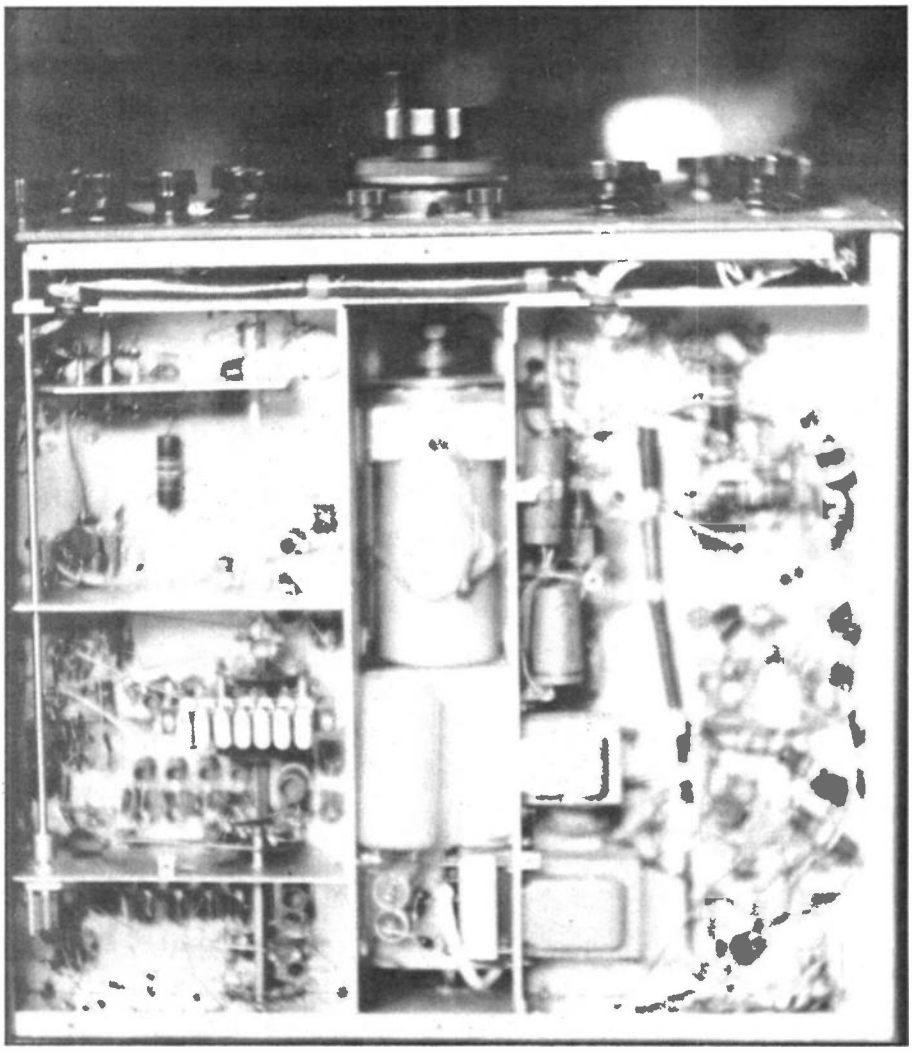
With measurements of seventeen and a quarter inches across, ten and a half inches high and fifteen and a half from front to back, the transmitter and receiver were, at a first glance, identical. The second glance would reveal that a pair of knobs at the top right of the receiver, were replaced by a meter on the KWS1, which also had a couple of additional but unobtrusive small knobs. Style was, of course, important, and the commercial transceiver was still quite a few years away which is also why the measurements come in inches!

The main purpose of this article is to present the 75A-4 receiver, but a few words about the KWS1 are perhaps relevant. For its day, the KWS1 was incredibly compact without the undue crowding employed by a lot of military-orientated equipment. It was easy for the amateur to maintain. The reliability was such that repair was rarely necessary! In the desk-top cabinet were the exciter, R.F. power amplifier, a P i-L output network and (the two items which contributed so much to the equipment's eventual fame), a sealed VFO and the incomparable Collins Mechanical Filter.

There was one minor snag. The description so far doesn't include the power amplifier. *That* put out a full kilowatt of SSB, CW or AM, into a 52 Ohm antenna, but it stood on the floor weighing 210 pounds and measuring 40 inches from the top to the tips of its rubber feet! Big enough to house many a modern station complete with operator!

The specifications were formidable. Even with that power, the spurious emissions were comparable with the best of today's technology black boxes. Frequency stability was claimed to be within 300 cycles of the starting frequency over any length of time, once it had completed its initial 15 minute warm-up . . . and the dial accuracy, within 300 cycles right across the scale. Cycles, please note! They hadn't invented Hertz in the fifties and, to digress, no-one has ever presented the author with a convincing reason for abandoning a piece of straightforward descriptive terminology. The scientific world could have honoured Herr Hertz in many more logical ways, such as, giving his name to an atomic particle or a natural phenomenon.

The heat generated by all the glassware (what our American cousins refer to as tubes) was quite sufficient to render many an electric heater obsolete. Stocking feet inside that cabinet could be warmed on the iciest of nights . . . providing the owner of the feet wasn't too concerned about the odd couple of kilovolts in strategic places!



View of the 75A-4 Collins with the base removed. Apologies for the quality of picture – by the time we went to press it was too late to have them re-taken. On the opposite page: Front view of the fascia panel.

The Collins 75A-4 was an unattainable luxury

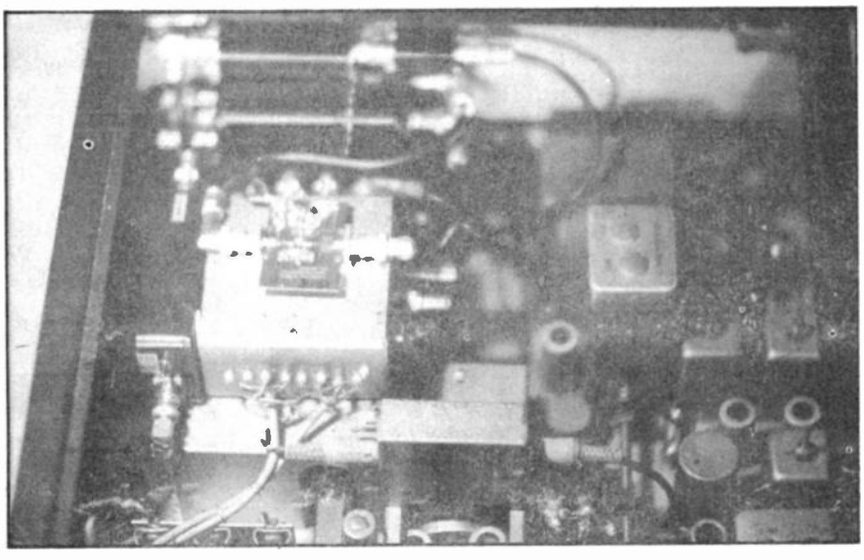
But that's enough about the transmitter (at last you say?) and on to the subject of your humble scribe's affections. All those years ago, with bare knees under the table, operating surplus government gear, the 75A-4 was an unattainable luxury. Costing in the order of 500 dollars, it was, in Britain, not far short of the price of a Jaguar car. Some seven years or so back, one finally stood resplendent on the shack operating desk, and it is still the main station receiver, still as good as new in performance if not in appearance. There have been several modifications but none of them with an essential need to improve on the Collins designers' original baby. Perhaps a quick tour around the 75A-4 is in order at this juncture.

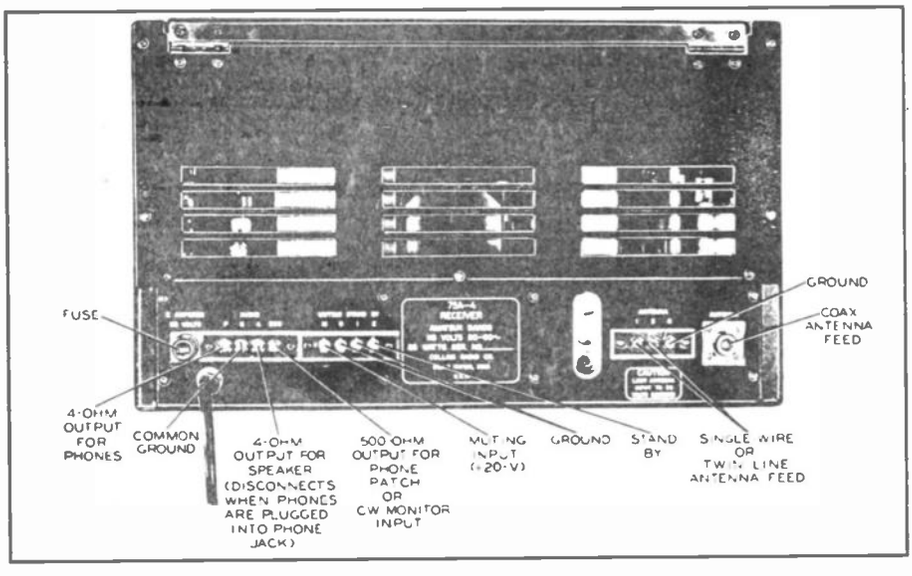
The size has already been mentioned. By modern standards it is pretty big, but inside there is a mass of fresh air, into which additional modules can easily be built, such as FM demodulator, VHF converters and so on. The weight is 35 pounds, which makes it rather a permanent fixture on the table top. Although it appears to be black, it is in fact what is called "St. James Grey", with white lettering (now rather more cream!). There are 22 valves, although some can be replaced advantageously with solid state devices. The available modes of reception are: AM, CW, SSB, MCW, and by "slope detection", FM doesn't sound too bad, providing the right mechanical filter is used.

The general operational scheme can be

THE CLASSICS 3: THE COLLINS 75A-4

Below: Inside the author's 75A-4 showing the added facilities for converting to all hands up to 1296MHz (at the left) on the permeability tuning screen. Bottom picture: External connections of the standard receiver.





seen in the block diagrams but there are some unusual and highly ingenious features. Unlike so many of the period's receivers, the Collins abandoned the idea of providing general coverage with mechanical or electrical bandspread for the amateur bands. Instead, there was a range of one MHz for each of the seven designated amateur bands, leaving a little to spare on the lower ranges. And if you're puzzled about the seventh band, it is 27 to 28MHz, now in the hands of the CB fraternity.

The heart of the whole system is the double conversion crystal controlled front end, although the lowest range from 1.5 to 2.5MHz is single conversion, for reasons which will shortly emerge. For all the other bands, there is a crystal oscillator. The first intermediate frequency is variable over the 1.5 to 2.5MHz range (there's your explanation for the single conversion), and it is mixed with the output of an incredibly stable variable frequency oscillator (the VFO). This is one of the finest points of the receiver, being hermetically sealed and should theoretically, be serviced only by factory.

So, the signal from the VFO is beat against the variable intermediate frequency, to provide a second IF of 455kHz. At this stage, Collins's other wonder comes into play. The signal is shaped by one of three switchable mechanical filters. These are plug-in devices and come in a wide range of frequency width. What makes them special is the very steep cut-off of the acceptance curve and the very fine skirt characteristics. Typically the 3.1kHz filter is only 5kHz wide at an attentuation of 60 decibels, and for receiving Morse, there is a 600 Hertz version, which is little more than one kHz wide at minus 60dB . . . and that's some selectivity!

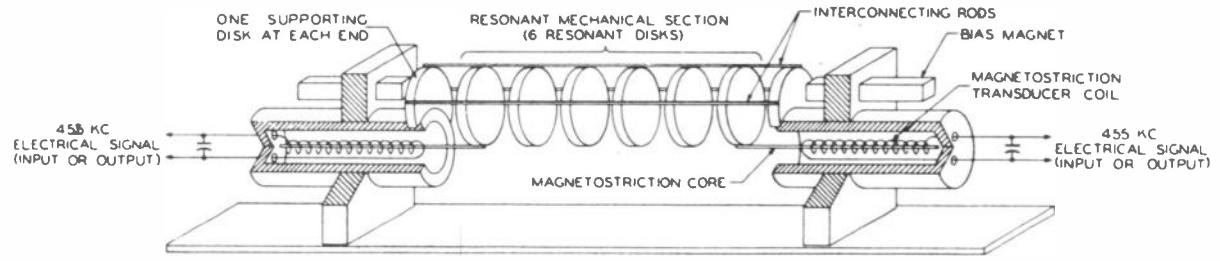
Until relatively recently, a "Q" multiplier was an add-on device for most receivers, but Collins thought of that one and went one better. There is a combination of "Q" multiplier and a bridge "T" filter. This bit of circuitry replaces the conventional crystal notch filter; it is , again, even more efficient. It provides a rejection notch anywhere in the pass-band without any of the disadvantages of the crystal filter. They become inoperative at frequencies only a little off their resonant frequency. In the 75A-4, the notch is incredibly effective on an unwanted signal as little as a few Hertz off the centre frequency, right to the edges of the pass-band.

Having mentioned the pass-band of the 75A-4, it brings forward another of the Collins designers' master-strokes – pass-band tuning. Judging by the revelations of recent advertising, one of the latest infatuations of the Land of the Rising Sun is the introduction of the idea of being able to vary the part of the receiver's pass-band or, to use a non-technical term, the window through which a signal can be heard, in order that unwanted signals can be diminished. Well, to be frank, that idea is "old hat". 1955 saw that system, in its purest and most complete form in (need it be said) the 75A-4.

Skirt characteristics

As background, it mustn't be forgotten that the average amateur was unfamiliar with the use of SSB transmissions, and he was indeed unfamiliar with FM . With side-band transmissions there was the need to reinsert the carefully filtered carrier by adding the BFO in the receiver . . . in other words, the beat frequency oscillator which was provided in most of the receivers classed as "communications receivers" for receiving Morse had to be inserted to receive the "new wonder mode", about which many words were written in all the periodicals, claiming wondrous power gains or disastrous failure. The latter was normally because of the operator's inability to tune in a wanted signal. There was, and still is from the unskilled minority, severe criticism that voices came over like Walt Disney's famous offspring, Donald Duck. The arguments about SSB versus "normal" audio modulation (AM) would, in themselves, fill a book. Even today, the protagonists and antagonists frequently approach blows. In 1955 however, the Rolls Royce of receiver manufacturers had a brilliant answer to the critics.

"Normal" AM reception was obtained through the orthodox diode detector – in this case, a 6AL 5 valve. For single side-band (or as Messrs Collins call it in their instructions manual, SSSC Single Sideband Suppressed Carrier) a product detector is used. The manual calls it "a mixed type detector". In practical terms, the BFO is injected and the listener tunes the passband control in such a way that the speech is both intelligible and at a pitch which suits his, or her, ear. When the 75A-4 was produced, it was rare for the gentler and more delightful sex to be interested in technicalities, and womens' lib hadn't been invented. Anyhow, in simple terms, the passband tuning system was the answer to the satisfactory resolution of SSB signals. There is however, a fat bonus, although it could have been the original intention.



A Collins mechanical filter, functional diagram.

When receiving CW, the operator can tune across the signal without the usual change of pitch. This gives greater selectivity and the ability to cut out unwanted interfering signals. At the same time, there is the stand-off that one has to tune the pass-band to select the correct upper or lower sideband when listening to SSB. However even here, there are advantages. In the modern receiver, there is a need for a "reverse sideband" control. On the 75A-4, you make your own choice and you can move away from the centre of the signal without the dreaded "Donald Duck" effect. And to think that the big Japanese firms have only recently started to include this facility as "the latest improvement"!

So, with two stages of IF amplification and one RF amplifier, with three quarters of a watt of audio, you have the general outline of how the 75A-4 works – except for one thing. You won't find any of those inaccurate variable capacitors doing the tuning for you . . . and of course, the idea of a synthesised tuning system was still a long way off when Collins had this one on the drawing board.

Their answer – and it is still used – was "permiability tuning", and it is the heart of the reason for those remarkable stability figures which are only marginally exceeded by even the most modern techniques.

Permiability tuning involves the use of fixed capacity, with the *inductors* being tuned, by a slug. A mechanical linkage, with high tolerances in the manufacture, moves the slugs in and out of the inductors, with the tuning knob's rotation. The resultant linearity is quite remarkable and ultimately reliable. The only snag comes when the rate of tuning is considered (this is a matter of 100kHz per full revolution of the tuning knob) but the author's model has been modified by the use of an additional reduction drive which gives a rate of approximately 16. The actual calibration is on two scales, one for the band in use, which is marked on a cylinder and which revolves with the band-change control. The second scale is marked in kilocycles, from zero to 100.

In practical terms, the tuning is a delight. There is virtually no back-lash, and a logged signal can be reset to within a few Hertz. The only criticism lies in the fact that, unlike that wonderful Eddystone design, you cannot spin the knob for quick changes of frequency from one end of the band to the other, there *is* friction.

A crystal calibrator can be switched in and gives "blips" at every 100kHz, and the "zero set" control moves a hair-line marker on the "kilocycles" scale, and the resultant calibration gives accuracy to within 300 Hertz throughout the band in use. There are three additional controls; a noise limiter which has an adjustable threshold, but is little use on SSB for impulse interference. The modern noise *blankers* are vastly superior.

"Pass-band tuning – another Collins master stroke"

Down at the bottom left, there is an antenna trimmer, which matches (or tries to) the impedance of the antenna to the required 52 Ohms, and it does a pretty fair job providing the mis-match isn't too bad. Finally, a tiny knob by the "zero set", is really a mechanical brake. It is the "dial drag" which locks the tuning when the pass-band is being tuned across a signal. In other words, the receiver stays tuned to the set frequency, while the pass-band is varied as required.

So, there's the description of the innards of the 75A-4. But how well does it work? Well, in a word, "superb". It may seem somewhat unfair to compare a 25-year-old receiver with its modern counterpart, but all in all there are few areas in which it fails to reach the same standards. Already mentioned are the tuning rate (which is easily improved) and the (almost) useless noise limiter. The bulk is another minus. In terms of front end performance, the most often criticised factor in modern receivers is the strong-signal handling capability. Transistors are notoriously easy to overload, and many systems have been tried over the years to avoid the problem of nearby strong signals decreasing the *wanted* signal's strength.

One of the more popular pieces of current equipment overcomes this problem by reducing the sensitivity of the front end (others use the minimum RF amplification) and many are using complex ring mixers, especially the Schottky (or "hot") diode. The 75A-4 performs as well, if not better than any of them, the reason being the inherently more linear response of these old fashioned valves.

On the subject of valves, these provide another cause for criticism. They do take a lot of current, with the need to supply the heaters with enough current to run a small transmitter, in modern terms. The power supply of 250 volts for the HT makes it a little dodgy to play around with the innards when the receiver is switched on, too. Some parts can be replaced by solid state devices, such as the rectifier. The original is of the 5Y3 type, but it can be removed and a couple of BZY127's wired in. 0A81 diodes can replace a couple of the 6AL5 valves, and all in all, the temperature inside the case can be reduced quite considerably as a result.

It would be pointless to make a detailed summary of the 75A-4 performance figures, but they boil down to claims of:
SENSITIVITY: 1 microvolt for 6db signal to noise ratio, at 3kHz bandwidth.
SELECTIVITY: This can be seen on the curves from the various mechanical filters.
AVC: Audio rise less than 3db for inputs of 5 to 200,000 microvolts, with time constants of:
AVC TIME CONSTANTS: Fast: rise time .01 seconds. Release .1 second.
Slow: Rise .01 second. Release 1 second.
IF REJECTION: Greater than 50db.
AUDIO OUTPUT: .75 watts, for a signal of 3 microvolts with distortion less than 10%.

The frequency characteristics have already been noted and are remarkably good. All that can be added is that even with a receiver which has seen use for 25 years, all those characteristics and specifications can be equalled and in some cases, exceeded.

There are a few classic modifications, which can easily be implemented. They certainly bring the 75A-4 close to, if not right up to, the standard of virtually any recent designs, albeit without the trimmings and gadgets. It must be said that there are, nowadays, many nice little additions to make operation of a currently made transceiver simple, quick and all-but-automatic. At the same time, it is questionable as to whether this is an amateur's requirement. Does the skill of an operator depend on the gimmicks or on his ability to get the best out of the basic station? Is there any pleasure in leaving the "rig" to run itself, without there being any sense of pride in the amateur's own ability? These may be reactionary questions, but it is arguable that we have become a race of operators, without any feeling for the challenge of

THE CLASSICS 3: THE COLLINS 75A-4

doing something well through our own skills and endeavours.

How many owners of currently produced equipment are able to repair, let alone modify, their Japanese Black Boxes?

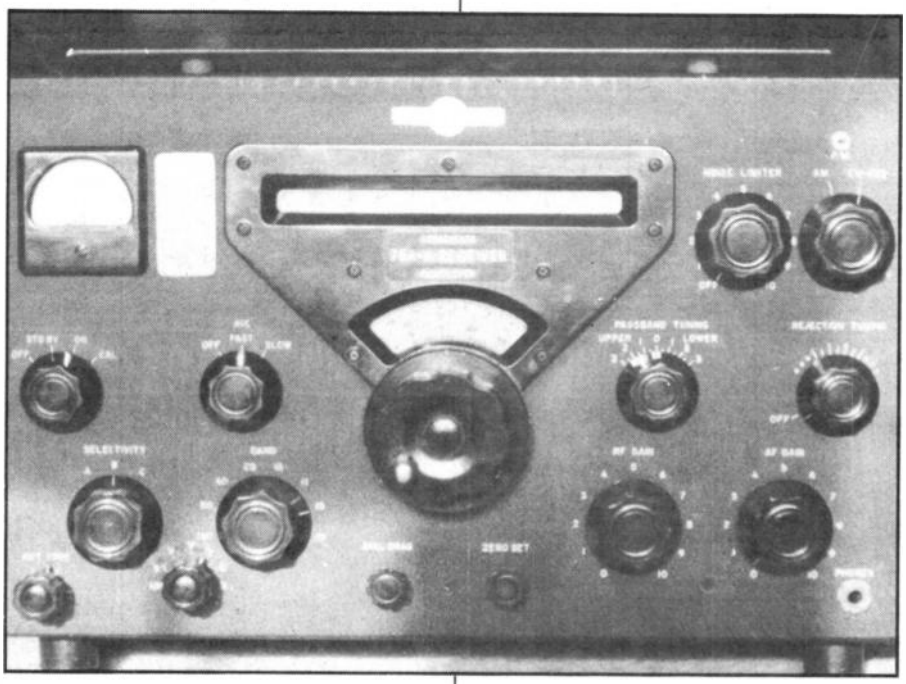
No Donald Duck effect

One thing about all "vintage" equipment, especially the Collins, is that it is easy to get at all the working parts. The author's own 75A-4 has been home maintained since its purchase . . . and it is still in top notch condition. On top of that, it has been modified to cover all bands, from 160 metres to 1296MHz, by the inclusion of switched converters, using the 28MHz bands as the intermediate frequency.

"It is a combination of modifications and overall condition that makes upper band contacts possible".

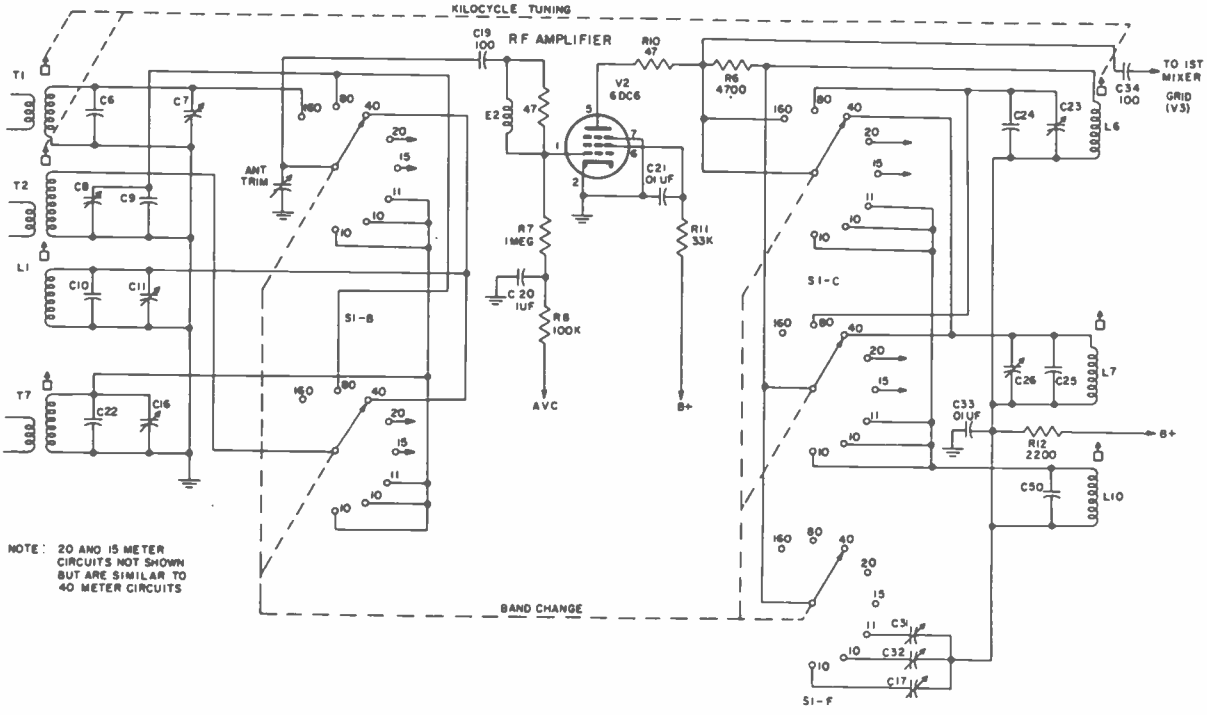
It is claimed that it is that combination which enables your scribe to be able to claim contacts upper bands which all visitors to the "shack" maintain are to all intents and purposes and theoretically, not possible.

The answer however, does not lie entirely in the operation, it is the use of a superb piece of engineering. It will stay in its present place of honour until a brand new Collins of the latest £2000 price bracket can be introduced... but that could be not for another 25 years!



Above: The author's Collins 75A-4 is still in top notch condition, plus, it has been modified to cover all bands from 160m to 1296MHz by using switched converters.

Below: Tuning elements of RF and mixer stages. This is a simplified diagram, taken from the Collins instruction manual, seen under "Theory of Operation"!



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 eleminates 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.

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

AUDIO FILTERS
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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.
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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

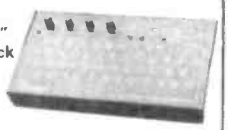
GENERAL COVERAGE RECEIVER CONVERTER MODEL PC1

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

KEYBOARD MORSE SENDER
THE ULTIMATE "MORSE KEY"



- STRAIN-FREE sending: Converts "hunt and peck" typing to perfect morse. Just plug into any key jack and type.
- CONVENIENCE: no need for a power cable, four internal pen cells last for 300 hours and give continuous memory back up.
- EXCLUSIVE COLOUR CODED KEYBOARD DESIGN: Separate key switches beneath a tough polycarbonate membrane combine excellent "feel" with a splash proof wipe clean surface.
- LAVISH MEMORY: four 64-character memories with auto-repeat and programmable "pause" function, for all the routine sending.
- BUFFER MEMORY: ensures perfect sending despite less than perfect typing.
- 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).

MODEL AD370

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 2½ 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 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

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FL2/A	34.00	(39.67)	AD270+MPU	45.00	(51.75)	Codecall (Switched)	29.50	(33.92)
FL1	69.00	(79.35)	AD370+MPU	60.00	(69.00)	Basic DF System	149.00	(171.35)
FL2	78.00	(89.70)	MPU	6.00	(6.90)	Basic Mobile DF System	159.00	(182.85)
PC1	119.50	(137.42)	DC144/28	34.50	(39.67)	Complete Mobile DF System	214.00	(246.10)
ASP	72.00	(82.80)	DC144/28 Module	28.00	(32.20)	PTS1	39.99	(45.99)
VLF	26.00	(29.90)	Keyboard Morse Sender	119.50	(137.42)	Model ANF	59.00	(67.85)
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HAM BYTE

Computing and the radio amateur, with John Morris, G4ANB.

Welcome to the first in a regular series about computers and amateur radio. Each month I shall be taking a look at what amateurs are doing with computers, on the air and off, give some hints and tips about how to make your computer more useful in amateur radio, and maybe even print a short program or two.

Exactly how the column develops is largely up to you. Let me know what you would like to see more of– or less of. Have you any hints you would like to pass on to the world at large? Any ideas that are too useful to keep to yourself, but too simple (the best ideas are often simple) to turn into a full-blown article?

Do you take part in a regular computer users net on the air, and want to invite others to join in? Do you want to start such a net? Are you the secretary of an amateur radio computer organisation?

Here at last is a forum for the growing band of amateurs who use computers as an integral part of amateur radio. If you answered yes to any of the above questions, then drop me a line at the editorial offices in sunny Bicester.

Let's get on with the first edition. I hope you enjoy it.

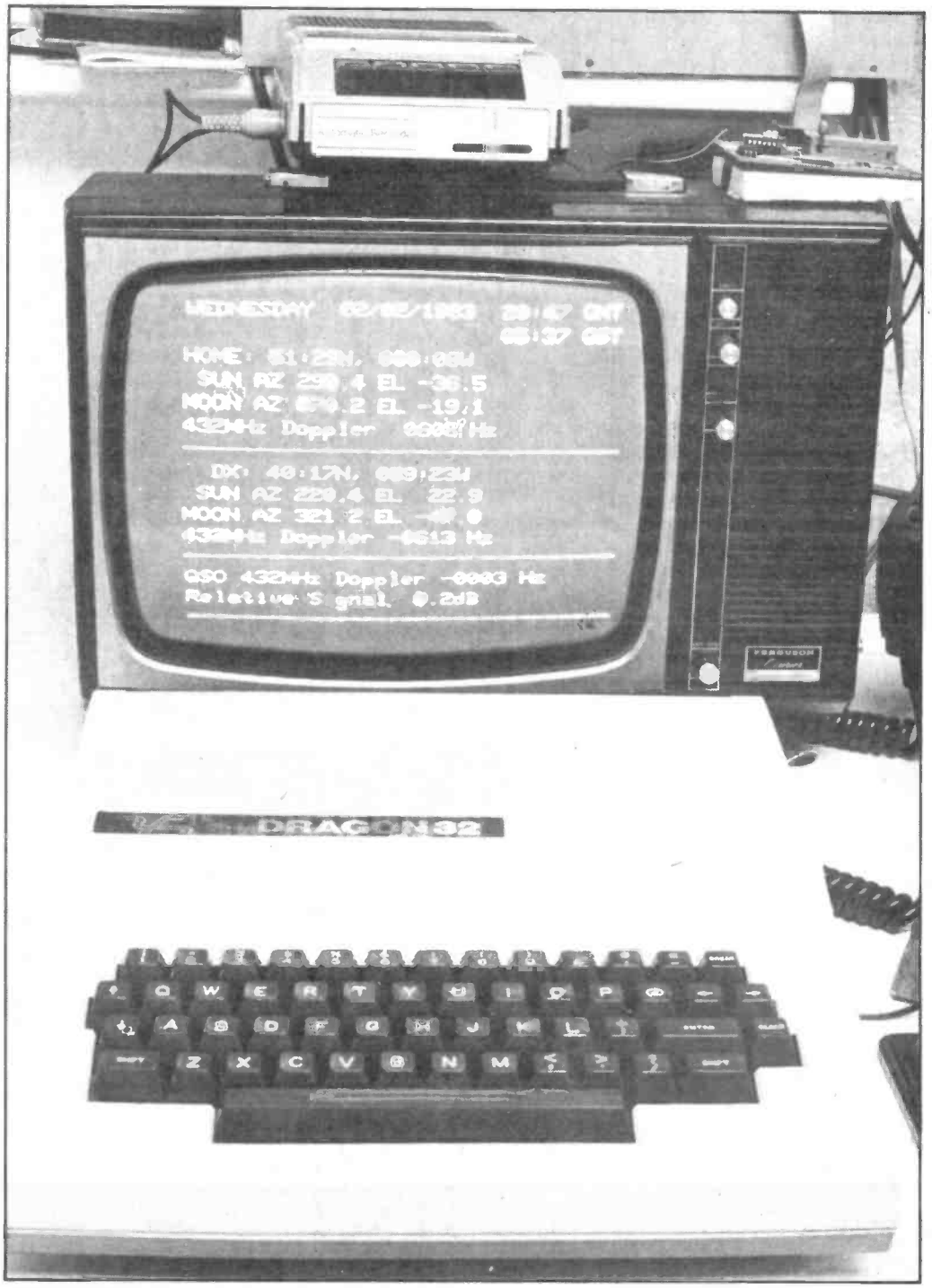
Interference from computers

I gave a talk about computers and amateur radio recently and did a quick audience survey. About 90% of those present said they had a computer and used it in amateur radio in some way or other. Of these only a small number, less than a quarter, actually used the computer while the rig was switched on.

I suspect that many of the remaining three quarters had hit the problem of interference from the computer. It is quite easy to write a program to, for example, send CW from the keyboard. The only problem is that going back to receive all you can hear is a massive amount of hash. Inside the computer, address and data lines are continually being switched high and low, with quite fast rise and fall times. All of this switching generates plenty of harmonics which can be heard – and can obliterate everything else – from long wave up to UHF.

Surprising amount of radiation comes from the chips

Getting rid of this noise can be quite a problem, especially as most computers live in plastic boxes which offer no screening at all. However, a surprisingly large amount of the radiation comes not from the chips themselves, but from all the leads coming out of the box, going to the TV, tape recorder, or mains.



There are two basic techniques. The first is to keep the antenna and computer as far apart as possible, while making sure that the rig itself is adequately screened. Most modern rigs are fairly good in this respect. A quick way to check is to disconnect the antenna, and tune around where you expect to hear strong signals. If the rig stays quiet its screening should be adequate.

The second approach is to stop the noise getting out of the computer box in the first place. This is very much like curing TVI, except that the aim is to stop RF getting out of the computer instead of stopping it getting into a television. Many of the gadgets that are used to stop TVI are equally good at stopping computer hash.

Just unplug the TV lead . . .

A lot of rubbish can come down the lead from the computer to the TV, often on the outer of the co-ax. In cleaning up one particular computer I found that a braid breaker in the TV lead reduced the hash on 14MHz from a solid S9 on the meter to an almost bearable S3, although at the expense of a slightly noisy picture. To find out if the noise is coming out this way just unplug the TV lead at the computer end and see if the interference goes away. Always fit any filters or other suppression devices as close to the computer as possible.

Get into the habit of unplugging the leads

The power lead can also be a good radiator. In the case of a computer with a built-in power supply a simple mains filter can be made for a pound or so. With an external power supply the low voltage lead should be filtered at the computer end.

The leads to the tape recorder are usually quite innocuous, but it could be worth getting into the habit of unplugging them from the computer when they are not in use. Remember to plug them back in again before trying to save a program! If you add filters to the tape leads make sure that they do not affect audio frequencies, otherwise loading and saving could become unreliable.

A couple of RSGB books, *Television Interference Manual* and *Amateur Radio Techniques*, contain constructional details for filters, braid breakers, and son, and these are equally applicable to cleaning up a computer. Local radio club members who have had experience of curing TVI should also be able to help.

Anyone interested in tracking amateur satellites (or any other sort of satellite come to think of it) will be interested in a new booklet by John Branegan. GM4IHJ. It is called *Satellite Tracing Software for the Radio Amateur* and is published by AMSAT-UK. I understand that it will also be available from the RSGB.

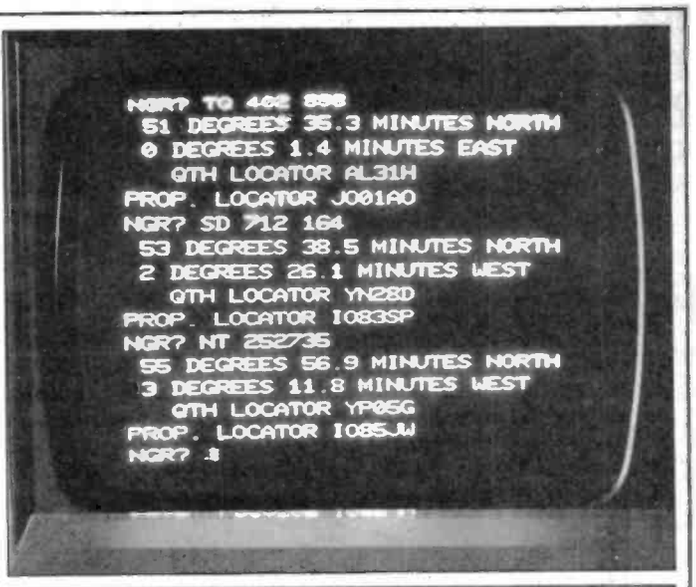
There are twelve programs, for various different satellites and types of orbit, from low circular oribts such as Oscar 8, through elliptical paths, as is planned for Phase 3, to geostationary satellites.

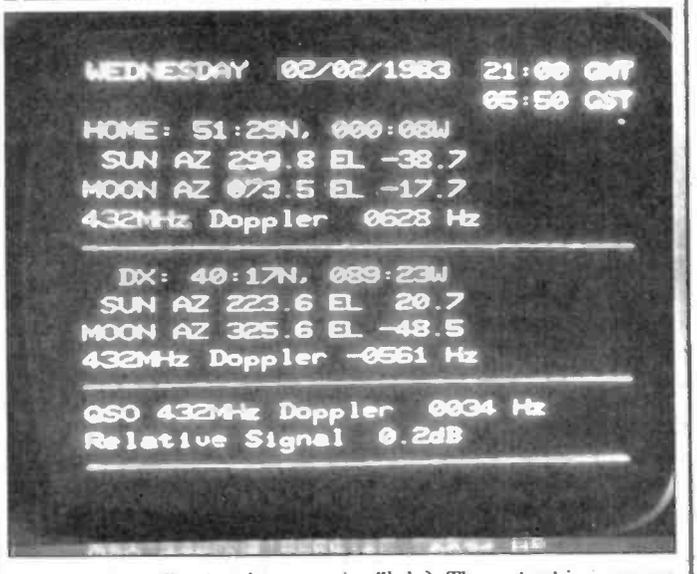
"You have all you need for a programmable audio signal generator"

All of the programs are written in the Spectrum version of ZX-BASIC. This is good news for Spectrum owners, but anyone else will have to do a conversion job. GM4IHJ has tried to avoid too many Spectrum dependent features, so the conversion will mostly be fairly easy, and an appendix gives some hints. The main problem will be that some of the programs make heavy use of PRINT AT, which is not available on some machines, particularly older ones. On these the fine display formats will be lost, but the numbers that come out will still be just as good!

Many 6502-based machines use a 6522 VIA (Versatile Interface Adaptor) chip for input and output. This chip has lots of nice features, including a couple of bi-directional input-output ports, a pair of 16 bit counter/timers, and a shift resister.

You may not have realised it, but if you have a 6502-based computer with a 6522 VIA (such as a PET or a BBC and many others) then you have nearly all you need for a programmable audio signal generator. All that has to be added is a simple program, such as the one shown here.





It uses timer-1 of the VIA in free running mode to produce a square wave on output PB7 of the 6522 (pin 17). This probably emerges out of the computer box somewhere, and a bit of delving into the manual should tell you where. Sometimes it is used as the tape output, which is ideal.

Change the "7.5E5" in line 10 to the actual clock frequency of your computer and the "49088" in line 20 to the base address of the VIA (this is also the address of data port B). Consult the manual for details.

The program takes care of the rest. Tell it what frequency you want. It calculates and prints the nearest frequency it can actually produce, and kicks the VIA off.

Be careful about what you attach to the VIA. Some sort of isolation should always be used, the bare minimum being a simple capacitor (about 0.1uF will do). The output is a square wave and full of harmonics, so whatever else you do please don't shove it straight into the microphone socket of a transmitter!

One point about using the VIA to generate tones in this way is that once it has been started it will carry on by itself, and the computer can wander off doing other program type things.

Signal generators have all sorts of uses in the shack, and a programmable one is quite handy – especially when it comes practically for free! I have recently found it very useful for providing accurate tones when setting up an RTTY system. More of that another time.

That's it for the first edition, but before finishing I must tell you my favourite quote of the month. It came from a fellow addict who was having trouble with a recalcitrant program. "Why," he demanded, "won't this damn machine do what I *want* it to do instead of what I *tell* it to do?"

SELF RESONANT HALF WAVE DIPOLES

By John D. Heys, G3BDQ

A New Look at Wire Aerials: 3

So far we have examined those wire aerials which do not need to be of specific length. This was because either their end or centre impedance could be accommodated by an ATU which then allowed matching into the nominal 50 ohm impedance needed by most transceivers.

During the 1920s the concept of the 'resonant' of Hertz aerial was exploited and amateurs began to put up wires which were arranged to be approximately a half wave long at the operating frequency on the 'new' 40 and 20 metre bands. Remember that licence restrictions on aerial length stopped the use of half waves on 80 metres or longer wavelengths!

End feeding was invariably used and also, following the practice pioneered by the German airships the so-called 'Zepp' feed became popular. This latter and now discredited system used open wire feed line which connected to the end of a resonant aerial. One leg of the feeder joined the aerial and the other remained unconnected in limbo! Aerial expert 'Dud' Charman, G6CJ, pointed out the inadequacies of the traditional 'Zepp' feed in 1955, and although such systems do radiate (almost any bit of wire will!) they are not recommended.

Centre feeding a half wave wire with low impedance line to match the inherent low impedance at the centre of such an aerial was far from easy in the early 30s when proper low impedance line was not available! The writer well remembers the practice of feeding dipoles with twisted pair lighting flex. This was even more 'hairy' than it would be today, for before WW2 a combination of rubber and cotton insulation was used. Plastic-covered wiring did not exist (the first I saw was in the radio gear of a shot German aircraft), and in wet weather the actual impedance and losses on such primitive feeders could not be calculated. The action of rain and sunlight rapidly perished rubber insulation and ensured their rapid demise. Such lighting flex feeder had a nominal 'dry' impedance of around 120 ohms. Today the correctly matched and fed half wave dipole is perhaps the simplest effective and trouble-free aerial system available, and of course it is found at the heart of most multi-element Yagi beams.

Dipole length

A half wave dipole is really (with one exception) a one band device and its length must be cut to suit the operating frequency, although dipoles are not too frequency conscious and have quite a wide bandwidth. Even so, the LF band SSB operator is well advised to make his dipole resonant in the centre of his phone band which may be two or three hundred kHz from the CW sector. A dipole cut for 3.5 MHz is about 113½ feet long whereas one resonant on 3.75MHz will be some 8ft 9in shorter. On the higher frequencies this problem is not so acute and a dipole designed for listening to the down signals from the amateur satellites around 29.5 MHz will only be 8½in shorter than one cut for 28MHz. The bandwidth of dipoles is wider on the higher frequencies, one reason being a greater fraction of a wave length on those frequencies.

That impossible hypothetical device, the 'free space' or isotropic dipole would be, if it existed, resonant at exactly half a wave length. We live however in the real world and must allow for its proximity and stray capacities which lower the natural frequencies of all our aerials. The term 'end effect' refers to the capacity created by the insulators at the ends of our dipoles and also the loops of wire needed to secure them there. This end effect makes a dipole behave as if it were 5% longer, and for half wave dipoles using end insulators the formula

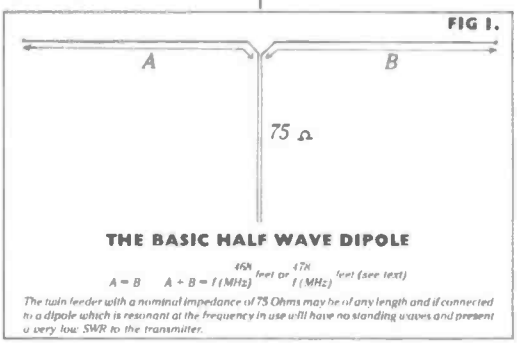
$$\text{Length (feet)} = \frac{468}{\text{ft(MHz)}}$$

is usually adequate. Les Moxon, G6XN, favours aerials which do not need insulators, but instead are held just with polythene or nylon cord. He suggests that the formula

$$\text{Length (feet)} = \frac{478}{\text{ft(MHz)}}$$

is better under those circumstances. This means that without end insulators a dipole is only some 2.4% shorter than the hypothetical 'free space' job. Experience has taught the writer that all aerial length formulae are just a guide, and his aerials have seldom been resonant at the desired frequency immediately. Trees, buildings, overhead wires etc all seem to have an effect upon resonant frequency (shall we forget all about indoor antennas today?) and it is best to make the wire a little longer

FIG 1.



THE BASIC HALF WAVE DIPOLE

$A = B \quad A + B = \frac{468}{f\,(MHz)}$ feet or $\frac{478}{f\,(MHz)}$ feet (see text)

The twin feeder with a nominal impedance of 75 Ohms may be of any length and if connected to a dipole which is resonant at the frequency in use will have no standing waves and present a very low SWR to the transmitter.

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 ¼ 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.

than suggested and proceed using 'cut and dry' techniques. Using a Dip Oscillator at the centre of a dipole is a ludicrous suggestion put out by some writers on this topic, and one wonders how do you get up there? If you lower the wire so it is easily reached by step ladder the 'ground effect' takes over to confuse things. A noise bridge may be used but the writer favours the SWR method. With very low power into the aerial the SWR on different frequencies over the band is noted and it soon becomes obvious that the wire is too long or too short at the desired frequency and remedial action can then be taken. It may be helpful to give the approximate adjustment in dipole length for each 100kHz on the five main bands:

3.5MHz	7MHz	14MHz	21MHz	28MHz
3½ft	10ins	2¾ins	1¼ins	¾ins

Radiation pattern

There remains a myth, promulgated as fact which pontificates upon the radiation from half wave dipoles. This myth says that the radiation is broadside to the line of the wire, and that off the ends there are beautiful nulls! Such thoughts have inspired many innocent souls to install at no small expense in terms of cash, time and effort, rotary dipoles. These beasties then to the surprise of their creators seem to radiate in all directions at once! Our old friend the free space dipole would show some directivity, and radiation from it would be in a pattern suggesting a torus or 'doughnut' with the wire running through the centre hole. This pattern cannot be achieved on or near Mother Earth and we must be realistic and accept something less satisfactory. The earth itself is the villain of the piece for it behaves like a mirror (a distorting mirror too) and reflects much of the radiation from our aerials. If a horizontal dipole is below half a wavelength from the gorund it is as well to forget thoughts of DX work and be content with S9 reports from all over the UK and Europe.

"Over dry chalky ground, the actual earth is well below the surface, unlike on marshy areas"

Most of the radiation will go off at high angles and it accounts for the tremendous signals from many of the 80 metre 'net' boys who are often using different versions of half wave dipoles which are seldom up higher than 40 feet. A half wave on 80 metres is about 130 feet so little low angle long distance radiation will occur. This may help to explain why many are heard complaining that they cannot even hear the 3.8 MHz SSB DX that is being worked by the cognoscenti with their low angle 'sky hook' or vertical aerials.

Regardless of its height above ground a half wave dipole will behave as an 'all round' radiator, but its height determines the low angle content. At an angle of 15 degrees (which allows first skip distances exceeding 500 miles) the signal off the ends will be some two to three S points down from that coming away at right angles to the wire. At the higher angles, say around 30 degrees which is not good for DX work, the difference between the 'best' (broadside) and 'worst' (off the ends) directions is only one or two S points. Here lies another explanation of the all round short range capability of low dipoles on the lower frequency bands. When 'real' DX is wanted, radiation angles of nine or ten degrees are achieved when the dipole is up really high. The ends will radiate signals some three to four S points down, but even then *some DX is still workable* in those direction at times when conditions are very good. Instead of S9 you will be S5-6.

When a dipole is ½ wavelength high most of the radiation leaves at 30 degrees but there is a nine degree component at about 6dB (one S point) down. Real DX can therefore be worked when the dipole is a half wave up, and raising it higher will progressively bring down that all important angle of radiation. At two wavelengths the angle is only eight degrees but there will also be lobes at about 22, 38 and 60 degrees above horizontal. At some heights, particularly ¾, 1¼ and 1¾ wavelengths above ground there is a lot of radiation directly upwards. This is really wasted power and contributes nothing towards communication so it pays to be sure that a dipole sits at the right altitude! All the references to height above ground assume that it is a perfect conductor. This is unhappily never true and we must assume that the ground below our aerials is imperfect and not expect textbook results. Over dry chalky ground the actual 'earth' is well down below the surface, whereas in marshy (especially salt marsh) areas the effective earth is almost at ground level.

Don't expect any 'gain' from a dipole. Poor dipoles will have negative gain – ie a loss.

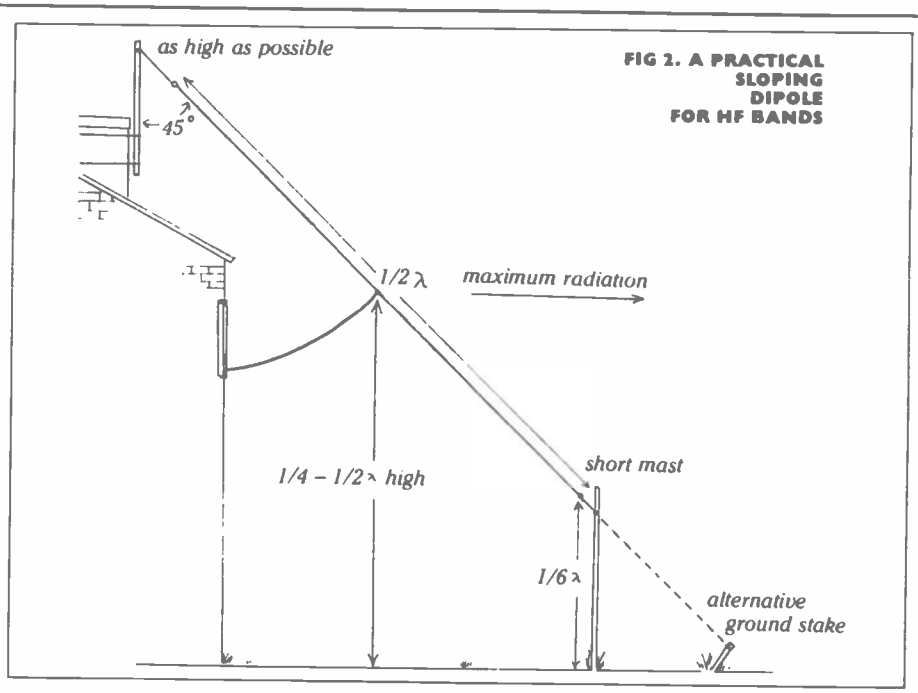
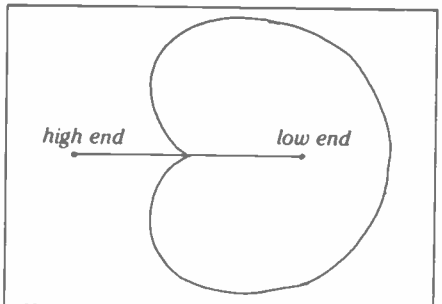


FIG 2. A PRACTICAL SLOPING DIPOLE FOR HF BANDS



Heart shape radiation pattern of a sloping half wave dipole

Fig 2 shows a practical sloping dipole for the HF bands. The drawing immediately above this caption is a heart-shaped radiation pattern of a sloping half wave dipole.

As you might have realised, these drawings were included, in error, with last month's article by John Heys G3BDQ. This month they go with the correct article, although the drawings that should have gone with last month's copy are on page 00.

Feeding the dipole

An earlier reference was made to the use of twisted flex as a feedline and in an emergency this approach should not be despised. Modern plastic covered twin flex will certainly work but of course impedances remain an unknown factor and they can range from under 100 to about 200 Ohms. For short runs (¼ wavelength or less) its use can be tolerated and will be satisfactory when new, but these wires are not designed for outdoor and will soon deteriorate. The specially manufactured 72-75 Ohm twin feeder is now available and it costs about 18p per metre; much cheaper than good coax. Avoid the thin lightweight stuff made for VHF-tuner aerials. The standard stuff is strong and seems to last for ever.

A New Look at Wire Aerials: 3

The writer still uses some bought more than 30 years ago. The black plastic (*not* pvc) never seems to age or weather but some care must be taken to prevent capillary movement of rainwater along the conductor wires. Such an event can make the wires turn green and give rise to a high 'skin' resistance at RF. The really good 75 but local features, buildings, telephone enamelled 18swg copper wire and is just about weather-proof. This kind of feeder may go near or even touch brickwork and masonry but must be kept several inches away from metal objects. It cannot be buried and must not be knotted! As is the case with all feed lines avoid acute angles and bends. There is almost no radiation from this unscreened low impedance line and if anything it is better than coax in preventing TVI. It can go straight into a transceiver despite its higher impedance but the writer always prefers to use an ATU between the aerial and the rig. It helps attenuate any harmonic content in the signal and allows a true match between antenna and transceiver or transmitter.

"All they are doing is kidding the rig that everything is matched . . ."

Thus far no mention has been made of the use of coax to feed a half wave dipole. Many antenna articles and books suggest that a length of 50 Ohm coax between dipole and gear is all that one needs and often neglect to point out the inherent imbalance of such a system. Lots of TVI headaches would vanish it aerial feeds were balanced. If coax feed is used a Balun must be put up at the antenna centre. The writer admits to never making or using a Balun at HF, always using instead twin wire feeders, so he cannot really say too much about these devices. Full constructional details of simple Baluns wound on ordinary ferrite aerial rod may be found in G6XN's excellent (if a little technical!) book *HF Antennas for all Locations*. Ready-made Baluns are available from many of our amateur radio emporiums (emporia?).

A further snag when using coax feed to dipoles is the sheer weight of the cables which pulls the aerial centre down considerably and drops that part of the wire which does most good – the high current point. A high powered station which uses UR67 or similar would need mighty strong wire, cord and sky hooks to hold up 40 feet of the stuff! Many of those plumping for coax feed do so to avoid an ATU. Then to their disgust they often discover that their SWR is nowhere near unity and begin 'pruning' the coax to get it down. They should be pruning the aerial length, for all they are doing is kidding the rig that everything is matched whereas in fact there are standing waves on the feed line and some horrible mismatch up at the centre of the dipole.

The sloping dipole

If a half wave dipole is arranged to slope at an angle of about 45 degrees its radiation patteren differs from that of the horizontal versions. Most of its radiation is at quite low angles and comes off the lower end of the wire. There is little radiation off the high end so the antenna becomes directional. The radiation pattern is heart shaped but local features, buildings, telephone wires, high walls or steep banks can distort this simple pattern. Such a sloping wire is fine for DX work so long as its average height lies between ¼ and ½ a wavelength. Just one tall support is needed; a short mast on a chimney stack being ideal, and the wire can slope down to the garden.

The low end must however be well clear of the ground, say 10-12 feet for dipoles cut for 14MHz but this ought not to be difficult to achieve. As one dipole leg is closer to earth the system becomes unbalanced. Ideally the lower leg should be trimmed until the aerial current in each wire of the feeder are equal. A cheap and easy way to do this is to put a .2a pea bulb in each feeder wire down at the shack, reduce power to about three watts and check for equal brilliance. Cut-and-try on the dipole will allow equal currents in each wire to be achieved. With high power the bulbs can be shunted across a few inches of the feeder wires instead of actually going in series with them.

If coax *must* used, remember to connect the outer screen to the higher half of the dipole and the inner to the other wire.

The inverted vee

If not exactly the answer to a maiden's prayer, the inverted vee dipole certainly has a lot going for it! Perhaps the need for just a single centre support and its excellent DX capability are the two most important points which have contributed to its adoption by thousands of amateurs all over the world. The inverted vee will go into smaller gardens than a conventional dipole cut for the same band, for it has a reduced base line and no end masts with their attendant guy wires. Its maximum radiation is up there at the highest point, and there is little feeder strain for it can be tied to the mast just below the feed point. Because both legs slope down, the aerial's resonant frequency is raised and it will need to be about 5% longer than a horizontal dipole.

To work correctly, the included angle at the mast head must be greater than 90 degrees and preferably 120 degrees or more. For serious DX work and low radiation angles the high point should be at least ¾ of a wavelength up from the ground, although many people work the rare stuff with inverted vees lower than this. The greatest radiation is at right angles to the wire but the end nulls do not seem to be deep.

The writer's long wire has pronounced nulls at right angles to its run so it was decided that an inverted vee by the side of the house might help to put some kind of signal towards the two worst directions. A lightweight mast was devised (a 'BDQ lash-up' says the XYL) made from wood, plastic downspouting and bamboo. This attained the dizzy height of 35 feet and had a 'U' cradle arrangement at the base ot allow easy 'one man' raising and lowering. Three nylon cords about hald way up acted as guys and were tied to bushes, branches and 'what have you'.

A practical multi-band inverted vee

The sloping top consisted of three thin dipoles (cut for 7, 14 and 28MHz) with their centres having with a common feed point and all taped to a thin nylon cord. This cord took all the strain and enabled the use of thin plastic covered 'bell' type wire. It also helped stabilise the whole structure which otherwise was rather 'whippy'. Plastic-covered aerial wire resonates about 5% lower in frequency than bare wire so this was taken into consideration when measuring out the three dipoles. The feeder was standard 75 Ohm twin which was taped down the mast for about 15 feet and then run across to a convenient hole in the brickwork which led into the roof space and thence to the shack. Its total length was around 45 feet.

No 'cut-and-try' pruning was done, yet amazingly the SWR on each band was low and ranged from 1:1.3 to 1:1.7 even on 21MHz which used the 7MHz dipole as three half waves centre fed. At the end of each leg of each dipole no insulators were used but the final foot or so of wire was allowed to hang down away from the other wires and the nylon support cord. It is the final few inches of a dipole which carry the high voltages and I did not want any arcing or undue losses in damp weather.

Not brilliant

This aerial was in use through the autumn and winter of 1982-3 and was useful for DX especially on 7MHz. It seemed particularly useful in the evenings towards Japan, UA0 and ZL on 7MHz and reports back were often 579. The long wire was usually 2 S points down on the inverted vee in some directions but was at least 2 S points better for VK! USA and Canada were also better on the long wire which is not surprising as North America was end-on to the vee. Switching from inverted vee to LW on the higher bands was interesting; the long wire having the 'edge' for most stations but certain DX, particularly VP8 was only workable on the vee. As expected the new antenna was not brilliant on 21MHz but gave fair results all round, for on that band it was 1½ wavelengths long.

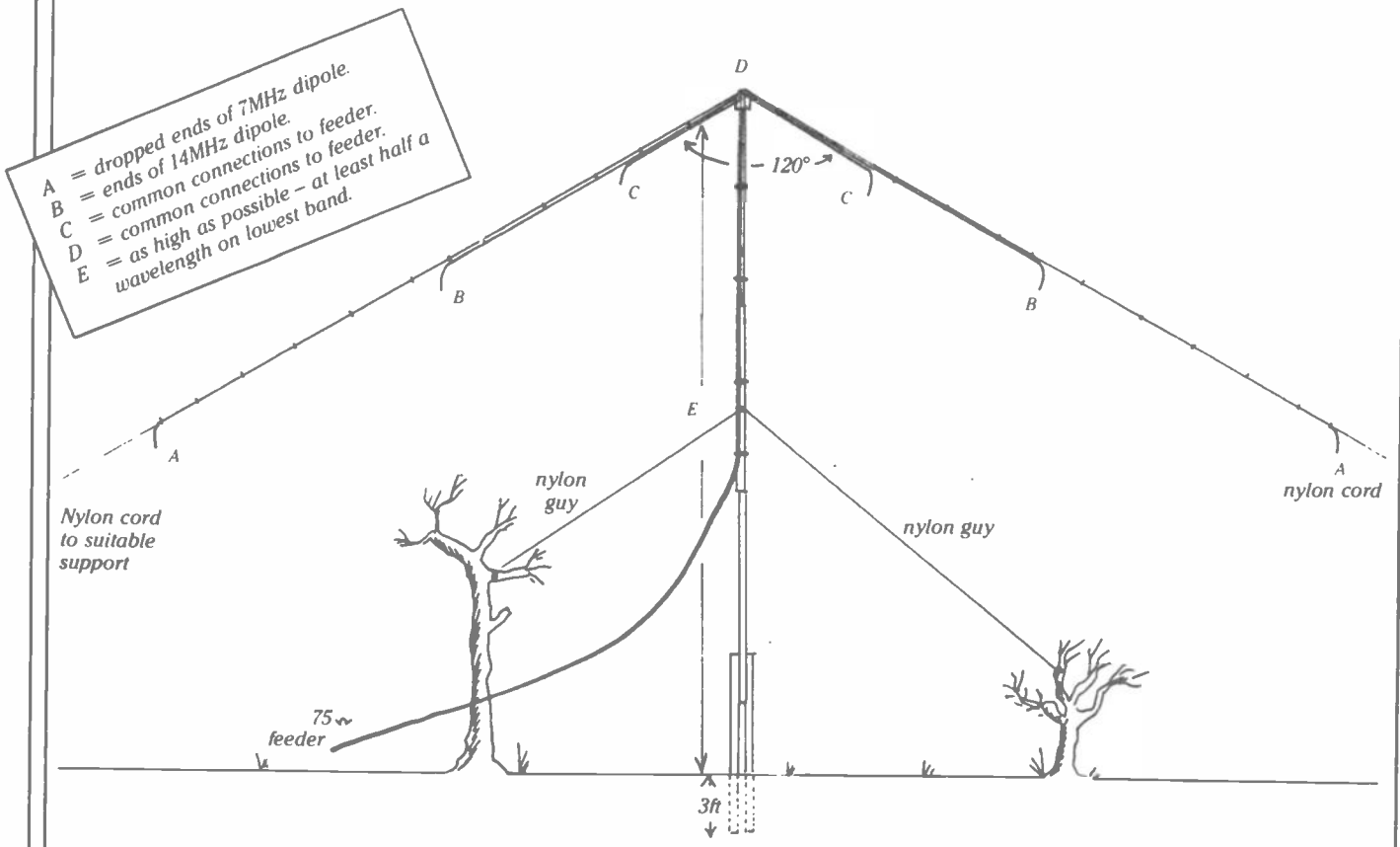


FIG 3. A MULTI-BAND INVERTED VEE

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!

On 28MHz the inverted vee showed that it was semi-vertically polarised for it gave good inter-G working on ground wave, something not possible on the long wire. Alas the vee fell victim to the heavy snowstorm which hit the south-eastern tip of the country early in February 1983, and sheer weight of damp snow clinging to the wires and the pole bent everything over and broke the bamboo section. With simple masts of this type replacement parts are very cheap – a nine foot bamboo replacement costing just 90p! Short skip reports from Europeans on all the bands used indicated there was little to choose between the inverted vee and the long wire aerial; certainly not more than one S point.

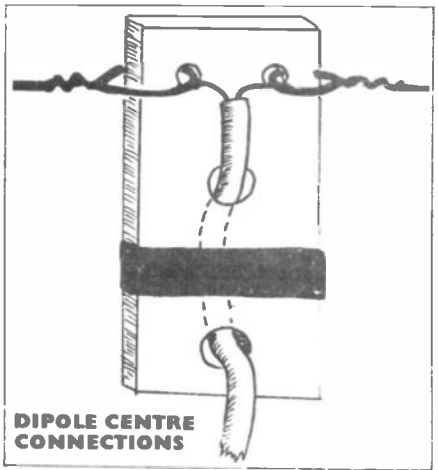
Multi-band dipoles are usually described which have separate dipole elements well apart along their lengths. Experiments with the aerial described have indicated that such separation is not necessary, and a flat multi-core cable of the type used in motor vehicles would serve admirably so long as the ends of each dipole were pulled away from the cable body for about a foot in the way already described.

Constructional points

Centre fed wires (excluding inverted vees) impose a considerable strain upon their feeders where they join the top section. Any tension should be put on the body of the feed line and not its internal wires. There is no need to go to extravagant lengths with the insulation at the centre of half wave dipoles. The feed point is at low impedance and almost any insulating material can be used there; even hardwood! Try to avoid insulators at the ends of dipoles and just tape the wire to nylon cord and remember G6XN's length formula. A point often neglected is that the gap between the centre of the dipole must be quite small. If wide (say 6in) the feeder wires will need splaying out and this wire will then become part of the dipole length and throw the resonant length down LF considerably on the HF bands. This important consideration is not mentioned in earlier articles.

"Yagi beams made from bamboo covered with conductive aluminium paint!"

Bamboo rods wrapped with aluminium kitchen foil then covered with tape will replace aluminium tubing and function well as simple dipole elements on the higher frequency bands. It is said that the Japanese army used cheap and easily constructed Yagi beams made from bamboo covered with a conductive aluminium paint! This is something the writer has not yet tried!



The rectangular block is of strong insulating material about ¼in 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.

Dipoles *do work* and they are in use all over the world, putting out surprisingly good signals. Many expeditions and stations in the remoter parts of the world rely upon them. With a half wave dipole its own length high you will work all over the globe. You probably won't receive many S9 reports but you will surely be heard.

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DB10/15A	3 Element Yagi 10-15M	23.0'LE	13.0'B	198.95	4.80
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TH2MK3	2 Element Yagi 10-15-20M	27.3'LE	6.0'B	169.05	3.50
TH3MK3	3 Element Yagi 10-15-20M	27.0'LE	14.0'B	274.85	5.30
TH5DXX	"Thunderbird" 5 Element	31.0'LE	18.0'B	419.75	6.70
TH6DXX	"Thunderbird" 6 Element	31.1'LE	24.0'B	396.75	8.50
TH7DXX	"Thunderbird" 7 Element	31.0'LE	20'TR	511.75	8.75
HYQUAD	2 Element Quad 10, 15, 20M	13.5'TR	8.0'0	354.20	6.00
18TD	Dipole Tape 10, 15, 20, 40, 80M		132	121.90	2.80
JAYBEAM					
VR3	Vertical 10-15-20M. DC Short	6.1b	13.5'H	46.00	2.50
TB3	3 Element Yagi 10-15-20M	14.6'TR	14.1'B	189.75	5.40
MINI BEAM					
C4	Vertical Miniature 10-15-20M	8.1b	11.5'H	59.00	2.50
HQ1	"Mini" Quad beam 10-15-20M	11.0'LE	4.5'B	139.00	4.00
G4MH MINI BEAM					
	Mini Beam 10-15-20M			82.50	4.00
SMC TRAPPED DIPOLE 10-80M 110' Potted Traps					
SMCTD/HP	14SWG H/D cx traps 1000W PEP			43.41	2.50
SMCTD/P	Portable cu/beryllone 75' coax			59.80	2.50
SMCHPT	High Power 7MHz 1000W Per Pair			15.52	1.80
SMC-HS ANTENNA					
SMCHF5V	Vertical 10, 15, 20, 40, 80M	15.7'		54.80	2.50
SMCHF5R	Radial kit loaded	6.5'-7.3'		34.90	2.50
SMCHF3VNB	Vertical 10-18-24M 1000W PEP	16.0'H		51.35	2.50

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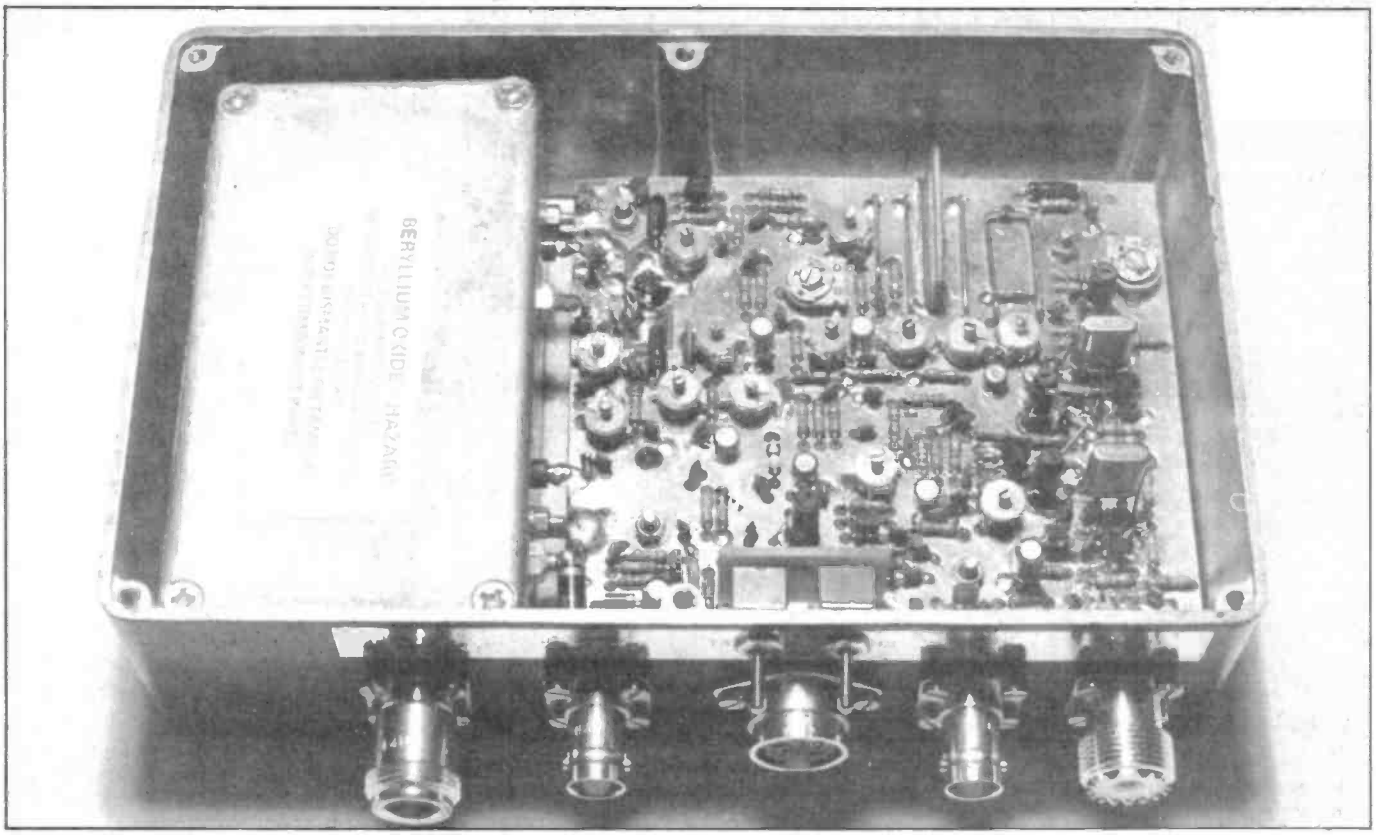


TRANSVERTER ON TEST

In the last issue you saw Angus McKenzie having a peer at transverters and black boxes. Here and now, we take a look at a typical amateur-type transverter from the firm whose name is always associated with transverters and has been since the year dot – that's to say Microwave Modules of Liverpool.

The idea of a transverter is to take the output from an HF rig and convert it up to the band you're interested in, which in the case of this review is 432MHz transverted from 28MHz. MM do one up to 144MHz as well, which must have sold thousands over the years,and they also make one for 70MHz. There's also a 1296MHz-from-144MHz beast, which we really must take a look at sometime. 1296 is getting more popular every day, and the MM device seems to be a popular way of getting on the band.

Anyway, what about the 432MHz version? It's in the usual MM die-cast box, with the sockets for 432MHz in and out and 28MHz in and out; the name "transverter", of course, comes from "transmit" and "converter" and of course it doesn't only convert the transmitted 28MHz to UHF, it converts the 28MHz band into a sort of tunable IF for 2MHz of the 432MHz band. Actually, the MM job has a couple of switches so that you can opt either to transvert to the "DX" section of the band or the satellite area a couple of MHz higher, which is a nice touch.

The idea of a transverter is to take the output from an HF rig and convert it up to the band you're interested in. Here, Nigel Gresley puts the MMT 432/28S through its paces.

The supply volts come in on the usual MM-style multiway DIN socket, and they thoughtfully supply the matching plug for it. The 432MHz transverter containing both RF VOX, so that it switches to transmit with a whiff of RF, and also a hard-wired PTT whereby you apply earth to one wire and it goes to transmit – this connection is also on the plug.

Taking the top off and peering inside shows that this unit is well up to Microwave Modules' usual standards – ie very nice indeed. There's a separate little box inside for the PA compartment, and the transmit and receive small-signal gubbins is all built on one very well made pcb. As supplied the unit needs about half a watt of 28MHz drive on transmit but there's an internal pot so that you can vary the level from 1 milliwatt to 750 milliwatts, which is a very useful facility – we tested ours with an Icom IC740 that only produces a few millwatts at the separate transverter socket, but there was more than enough for the MM transverter to do its stuff with. Also inside are the separate switches that enable you to transmit or receive on either 432-434 or 434-436MHz, assuming you have 28-30MHz available on the HF rig.

The way this transverter works is to start with an oscillator on 101 MHz (or 101.5MHz if you're using the satellite which is doubled twice up to 404MHz. This is used as the local oscillator on receive, following a couple of RF stages using a BFR34A and a BFY90 – the mixer itself is a 3N204. On transmit, the 28MHz drive is mixed with the 404MHz in a pair of 3N204s and this is followed by a couple of BFY90s and a 2N6256 to amplify the drive to a reasonable level for the PA stage. This latter beast consists of a 2N5944 driver and a CM10-12A PA stage and the whole deal is specified as producing 10 watts of FM, CW, SSB or what-have-you. The beauty of a transverter,

of course, is that it doesn't care a bit about what mode it's transverting so anything that's available at 28MHz will happily emerge at 342MHz none the worse.

One thing that needs to be watched with every transverter ever made is that there's always a tendency for there to be a bit of the main mixer oscillator – which as we've seen in this case happens to be 404MHz – in the output. MM say theirs is better than –65dB in this respect, as indeed it is, but it's an important point and it's been the death of many a home-brew machine. 404MHz isn't a million miles from 432MHz, after all, and you need some pretty purposeful filtering inside the unit to make sure it doesn't escape.

"Constructionally speaking, everything looked solid and thoroughly British"

In fact, one of our own house rules is always to use a nice sharp bandpass filter in the antenna to and from any transverter just in case the filtering decides to have an off day and let out something it shouldn't. It's even worse with a 144MHz transverter, because the injection here is at 118MHz (144-28 = 116) and that's in part of the aeronautical navigation band. We're quite fond of aircraft, and the F-111s from Upper Heyford give us a private air display every now and again, but the last thing we want is for some aviator to decide that our antenna system is the beacon he's homing in on instead of the one at Heathrow or whatever, so good filtering to make sure that naughty signals don't escape is a must with transverters. You also wouldn't want troubles with the neighbours, would you ?

Coming back to earth *(oh, funny – can't you give him a pill or something? – MD)* MM give you a nice manual which explains all the principles and gives you a specification to read. There are also come circuit diagrams and a block diagram, so you can find your way around with no trouble at all. Constructionally speaking, everything looked solid and nice and thoroughly British and even Technical Face couldn't find anything to grumble at. Another plus point is that MM supply all the plugs, sockets and what-have-you so you can get on the air more or less as soon as you have it home and get soldering.

So, having sniffed around the box and gawped at the circuitry it was nearly time for plugging in and firing up. There was a bit of a hitch here because we hadn't realised that the IC-740's output was quite so low at the transverter socket on 28MHz, but we soon sorted that out – the adjustment procedure is simple and well explained in the manual. The antenna in use was our trusty old 19-element Tonna (we'll soon be doing some antenna reviews so if you hear a yell followed by a resounding crash you'll know that we stepped back to admire the Monster Megabeam we just put up on the roof and forgot that there's a 40 foot drop . . .) and we thought we'd try the machine barefoot first and then maybe apply the big linear if there was anything interesting happening on the band.

So we applied the volts; we used a 12 volt supply, although the thing is apparently happy at anything between 11 and 13.8 – and a nice reassuring noise was audible in the receiver. We pointed the beam in the general direction of GB2SUT at Sutton Coldfield and – nothing. Oh. Let's try GB3MLY in Yorkshire, which is usually about the same strength as 'SUT here. Not a tweet. Oh well, wind the beam round and see if we can hear GB3WHA – yes, there it was, about 5 and 5, a bit better than usual! 432MHz can be a very odd band sometimes, we said to ourselves as the heart-rate returned to normal! At least it's all working.

We spent an hour or so listening around and getting the feel of the receiver side of the transverter. General feeling was, not bad. So the next step was to have a couple of SSB contacts. The audio was reported as very nice indeed although with a little bit of FM on the signal – oh dear, what can that be? Cutting about twenty minutes' worth of story short, the power supply we were using didn't take very kindly to having 432MHz SSB sprayed around it and was retaliating by varying its output volts quite wildly; a couple of capacitors, a ferrite bead, and the problem went away. Reports then said "nice audio, like it, wonder what the rig is?" which made us smirk a lot.

Better noise figure

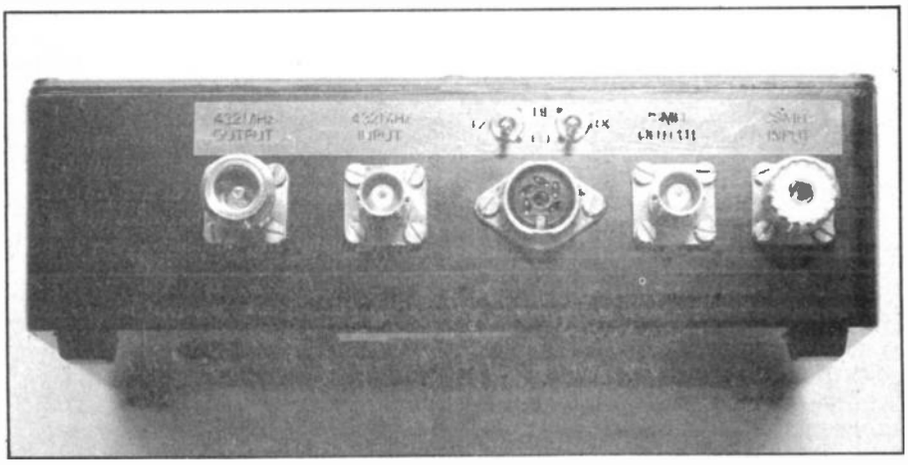
Anyway, the next step was for Boris to take it away into his den and give it the once-over with the test gear while we got on with something else. However, it didn't pan out quite like that because of all things, we had a power failure about five minutes later! We wondered whether the technical department's pet linear had proved too much for all the main fuses, but it turned out to be a cut over a small part of Oxfordshire including ourselves – so that was the end of wireless for the day and we went to the pub. Great things, candles.

So next morning it was back to the lab tests. We had a look at the receive side first, and the noise figure was the first measurement. It came out as about 2.5dB, which is better than MM specify and good for this type of design. Overall gain turned out to be exactly 30dB, just as the spec says, and herein lies a point worth making – 30dB is quite q lot of gain to stick in front of an HF transceiver if it isn't designed for it, and could cause some overload problems. The IC740 takes you straight into the mixer when you're transverting, bypassing its RF stage completely, and this is a Good Thing, but you can't do this with every HF rig we know and you might have to play with attenuators to get the overall gain distribution a bit more reasonable.

". . . A lot of gain to stick in front of an HF transceiver if it isn't designed for it"

MM don't specify the image response of the receive side of their transverter and we thought we'd better measure it on the grounds that it can be important in some parts of the country – the image frequencies, of course, are at 404 minus 28MHz, which comes out as 374-376MHz. At 376MHz, taking the average, the image rejection was -26dB, which isn't bad but it certainly isn't brilliant – there's another good reason for having a nice sharp bandpass filter in the feed from the antenna. We measured another one belonging to a friend of ours in Oxford in case ours was a bit of a rogue, but his one measured -24dB instead! OK, it probably doesn't matter on 432MHz as much as it does on 144MHz – the image frequency there would be 86-88MHz, which is a very busy part of the radio spectrum in most parts of the UK – but it could be improved.

Opposite page: With the top off, the 432/28MHz transverter looks neat and well put together. With the supplied circuit diagram and manual, you can easily find your way around. MM supply all the plugs, sockets so you can get on the air almost as soon as you arrive at your front door. Below: Straight on view of the connection points of the transverter.



TRANSVERTER ON TEST

The next item on the measuring list was the third-order input interceptor, which is a measure of how good the front-end is in the presence of strong signals. To be honest, this wasn't too good either – the figure we got on the review sample was -22dBm, which is about the same as your average black box. Now, there are several ways of looking at this. In essence it isn't a very good performance and what it means is that during a contest or at any time when there are hordes of stations beaming your way and doing their thing, it isn't going to be very easy to hear a weak signal because there'll be a lot of intermod products at about S2 all over the band. On 432MHz, you can argue that this doesn't much matter because it's only contests and the occasional tremendous opening that produces activity at this level; true enough. However, 432MHz is getting busier all the time, and transmitter powers are creeping up, so it's worth thinking about.

"But we'd hate to live on a good site near London"

Basically, the signal-handling properties of the transverter aren't exactly fabulous. The chief reasons for this are that it's an old design using quite elderly devices and to some extent trading off a quiet front-end for fairly feeble signal-handling. In many parts of the country that's still a reasonable trade-off but we'd hate to live on a good site near London, say, when lots of QRO stations were on. We'd end up thinking that they were all 10kHz wide, and even though one or two of them might well be that wouldn't console us! However, the technology to get a quiet front-end *and* good dynamic performance is available – GaAsFETs, high-level mixers and whatnot will do the job – and we would dearly love to see the lads in Liverpool updating this part of their transverter, if only to cope with contests and the like. And as sure as eggs are eggs 432MHz QRO DX-chasing is going to be up-and-coming in future and we'd dearly like to see a transverter that would handle it.

Anyway, they were our thoughts on the receiver section – to sum up, nice and quiet but not so hot at handling the loud ones. We thought we'd have a prod at the transmit bit next, and the plot here was to put in the usual two tones and inspect the linearity at the rated power. Rated power, by the way, is 10 watts – ours actually produced 12 and a bit when driven to saturation with a carrier and 12 volts applied to it. The third-order product of 700 and 1700Hz applied at such a level as to produce 10 watts peak envelope power (we've never said it proper like that before) turned out to be 24 dB below one tone of the two, which is a sort of average black-box-type performance. If you wound the power back to 5 watts pep this improved to -28dB, which is better and would drive a linear amplifier quite well and cleanly. However, to put this in perspective, a pair of 4CX250Rs driven to 400 watts will produce a third-order performance of about -37dB, which in practice means a signal which is two or three kilohertz narrower! This isn't a snide dig at MM, by the way – transistor power amplifiers are very difficult to get really good IM performance out of and your average BB (black box) doesn't actually show better than about -30dB even at its best.

When asked to produce 10 watts, by the way, the MM transverter required just on two amps from our power supply at 12 volts. On standby it was taking about a quarter of an amp, and receive it stung us for about 80 millamps.

Looking on the spectrum analyser, the output of the MM beast looked pretty clean to us. The 404MHz spurious was more or less in the analyser's noise floor at about -75dB, which is 10dB better than MM claim and is good. The second harmonic was also as near as dammit 70dB down, which suggest no problems to local TV gogglers. And that was about it! We found that varying the volts between 11 and 13 produced a drift of about 10Hz, which we felt we could live with, and that the overall drift was really quite low and not worth bothering about.

So, what's the verdict? Basically, the 432MHz transverter – and, to some extent, the 144MHz one, which we haven't formally reviewed but which we know well – from Microwave Modules are good, solid, reliable designs that must be consiidered a bit long-in-the-tooth now. We have the highest respect for MM, and certainly their things are well put together,well conceived and nice to have – especially their solid-state amplifiers. However, both the 144MHz and 432MHz transverters are really ready for an update now, both from the point of view of receiver performance and, to a lesser extent, to improve the IM performance of the transmit side.

A real world-beater

Let's face it – the last ten years or so have seen the incease in performance of the solid-state front end to the point where it's the transmitter that causes the bandwidth to be excessive, not weaknesses in the receiver making it appear so. If MM did something about the fornt-end – ie grafted in something like a GaAsFET configured for quite a high current and trading off signal-handling for a bit of noise, or even a decent bipolar, followed by a bomb-proof mixer given stacks of injection – and then maybe pepped up the Tx stages a bit to give us 10dB better IM performance than anyone else, they'd have a real world-beater on their hands. Maybe they could even do a de-luxe version of the standard transverter for twice the price?

But maybe we're just perfectionists. Still, the crystal ball tells us that something like it is the way to go, and we'd dearly love to see a great British company in there and winning. They're a clever bunch up there in Lverpool – maybe if we all ask them nicely . . . . . .

GENERAL

Frequency coverage	:	*432-434MHz low range* *434-436MHz high range (Oscar)*
Selectable offset	:	*2MHz*
Input frequency range	:	*28-30MHz*
DC power requirements	:	*11-13.8v. 12.5v nominal*
Current consumption	:	*2.1 amps peak*
RF connectors	:	*50 Ohm BNC sockets*
Power connector	:	*5-pin DIN socket*
Size	:	*187x120x53mm*
Weight	:	*900 grams*

RECEIVER

Overall converter gain	:	*39dB typical*
Overall converter noise figure	:	*3dB maximum*
Input impedance	:	*50 Ohm*
IF output impedance	:	*50 Ohm*
Quiescent receive current	:	*100mA typical*

TRANSMITTER

Input impedance	:	*50 Ohm*
Input modes	:	*SSB, FM, AM or CW*
Input drive for full output	:	*1mW to 750mW by means of variable input attenuator*
Power output	:	*10watts continuous rating*
Output impedance	:	*50 Ohm*
Relative 404/406MHz output	:	*Better than – 65dB*
Other spurious outputs	:	*Better than – 65dB*
Quiescent transmit current	:	*250mA*

LOCAL OSCILLATOR

Maximum frequency error at 432MHz	:	*± 5KHz*
Typical drift at 432MHz	:	*2KHz/hour*
Frequency sensitivity (11-13.8v)	:	*50Hz*
Oscillator frequency 432-434MHz	:	*101MHz*
Oscillator frequency 434-436MHz	:	*101.5MHz*

Q·&·A

●

Q I'm using a Microwave Modules 144MHz transverter from a Trio TS520 on 28MHz, I seem to be having a lot of problems from breakthrough of what sounds like ambulances and taxis and it's making life a misery sometimes; there's one particularly bad one on the calling frequency.Can you help? **C L Claydon, Manchester.**

A *Yes we can help, but no we can't, if you see what we mean. Our guess is that you have come across the classic bogey of image interference – this is what happens when you hear signals below the IF as well as above it, or vice-versa. In this case, the transverter is using an injection frequency of 116MHz, which is mixed with 28MHz to get you up and running on 144MHz. Now this is all very well, but you'll appreciate that if there are any signals 28MHz below 116MHz and the selectivity of the front-end isn't all it might be, you'll hear them as well as signals on 144MHz. You say you're hearing a bad one on 144.300MHz –well, it's odds on that this is the image you're hearing.*

144.300MHz corresponds to 28.3MHz on the HF rig, and is the product of 28.3 plus 116. If, however, you take 116 minus 28.3, you find a frequency of 87.7MHz; now if the transverter's front-end will let in 87.7MHz you'll hear it at the same time as you're tuned to 144.3MHz.

It just so happens that the MM transverter is known to be prone to this – the image response of it, we're told, is only about -15dB – and if you live in a big city we'd imagine that part of the spectrum is heavily used by private mobile radio, or PMR. The only way round it would be to put a very good 144-146MHz bandpass filter in the antenna to and from the transverter, making sure that it had loads of attenuation between 86 and 88MHz. Alternatively, you could try some quater-wave stubs to take out the worst ones you found.

On balance, we'd go for the bandpass filter because that'll keep any odd harmonics and sproggies out of the antenna as well – two for the price of one. Either way, ten gets you one you've got a minicab service on about 87.7MHz at the other end of your road!

●

Q I heard a station signing TO2YT on 3.5MHz last week – I can't find him in the prefix list, is he a pirate? Also, is it OK to use UR67 coax on HF bands, or is that for VHF only? **B Lantern, Ashton-under-Lyne.**

A *TO is a special French prefix for World Communications Year, and we'd imagine that it was F2YT you heard. UR67 is perfectly good for the HF bands, and indeed any coax is more or less OK for any band as long as (a) it's the right impedance to match the transmitter and the antenna – usually 50Ohms for commercial ones and (b) it'll handle the power you have in mind. There isn't such a thing as "HF coax" or "VHF coax" and indeed UR67 ought to be more than good enough for the legal power any HF band you care to name. The only thing with all coax is that it gets lossier as the frequency increases, so you need to use really really high-grade stuff for good performance on 432 or 1296MHz, for instance.*

●

Q Every time I use my rig on 14MHz the turntable on my hi-fi slows down. Any ideas on how to fix it because the XYL complains like mad and I want to keep the peace in the household. **M. Rice, London E11.**

A *Don't we all brother. It depends on whether it's a simple 50Hz motor-driven turntable or (more likely, we'd guess – you didn't tell us) something fancy with a crystal-controlled servo system of some sort. If it is, presumably there's RF getting in somewhere in the electronics of it and you'll have to be a bit careful about where you start sticking RF bypass capacitors and things in case you upset time-constants and such around the thing. Our first line of attack would be to sprinkle some ferrite beads around likey-looking wires and maybe decouple the supply lines to the circuitry, but we'd need to see the circuit of the turntable before going any further. We'd suggest getting on to the maker or his agent in this country and asking his advice, but if all else fails send us a circuit diagram and we'll see what we can do for you. We could even publish the results in case it helps someone else.*

●

Q Can you help me? I believe there's a formula for working out the series resistance for using a LED with any supply rail voltage but I can't remember it. Also, how do you use an LED with an AC power source, or can't it be done? **J. Williamson, Birmingham 13.**

A *It rather depends on what forward current the particular LED needs, Mr Williamson, but most red LEDs need somewhere between 5 and 25 milliamps and the green and yellow ones need a bit more, somewhere between 10 and 40 milliamps. It isn't critical, and you'll get adequate light out of most LEDs with about 10 or 20 milliamps.*

Strictly speaking, the formula will be the supply voltage less the supply voltage less the forward voltage of the device (which we usually take as a couple of volts) divided by the forward current – Ohm's Law strikes again! In practice, if it's a bog-standard LED and the application isn't critical (it usually isn't) we use 330 Ohms for a 5V rail, 1K for 12 volts and 2.2K for 24 volts.

You can certainly use an Led on an AC supply if you simply connect a small diode, such as a 1N4148, in inverse parallel with it – ie the diode anode going to the LED cathode and vice-versa – and halve the value of the series resistor to compensate for the fact that you're only using half the supply cycle for illumination.

Mind you, maybe it's us but we'd never use an LED across a 240 volt mains supply in this way; we stick to neons!

●

Q I've been trying to decide what antenna to get for 144MHz recently and have been looking through catalogues from various manufacturers. Some of them specify gain in dBi and others in dBd; I think I understand what they mean, but can you tell me why there seem to be two separate standards? Am I missing something? Also, what rotator would you suggest for a 3-element tribander with something like a 16-element Tonna on top of it? I like your magazine and feel it fills a gap in the market.
F C Marshall, Guildford, Surrey.

A *Well, sir, so do we. At least we hope it does, otherwise we're all on the dole!*

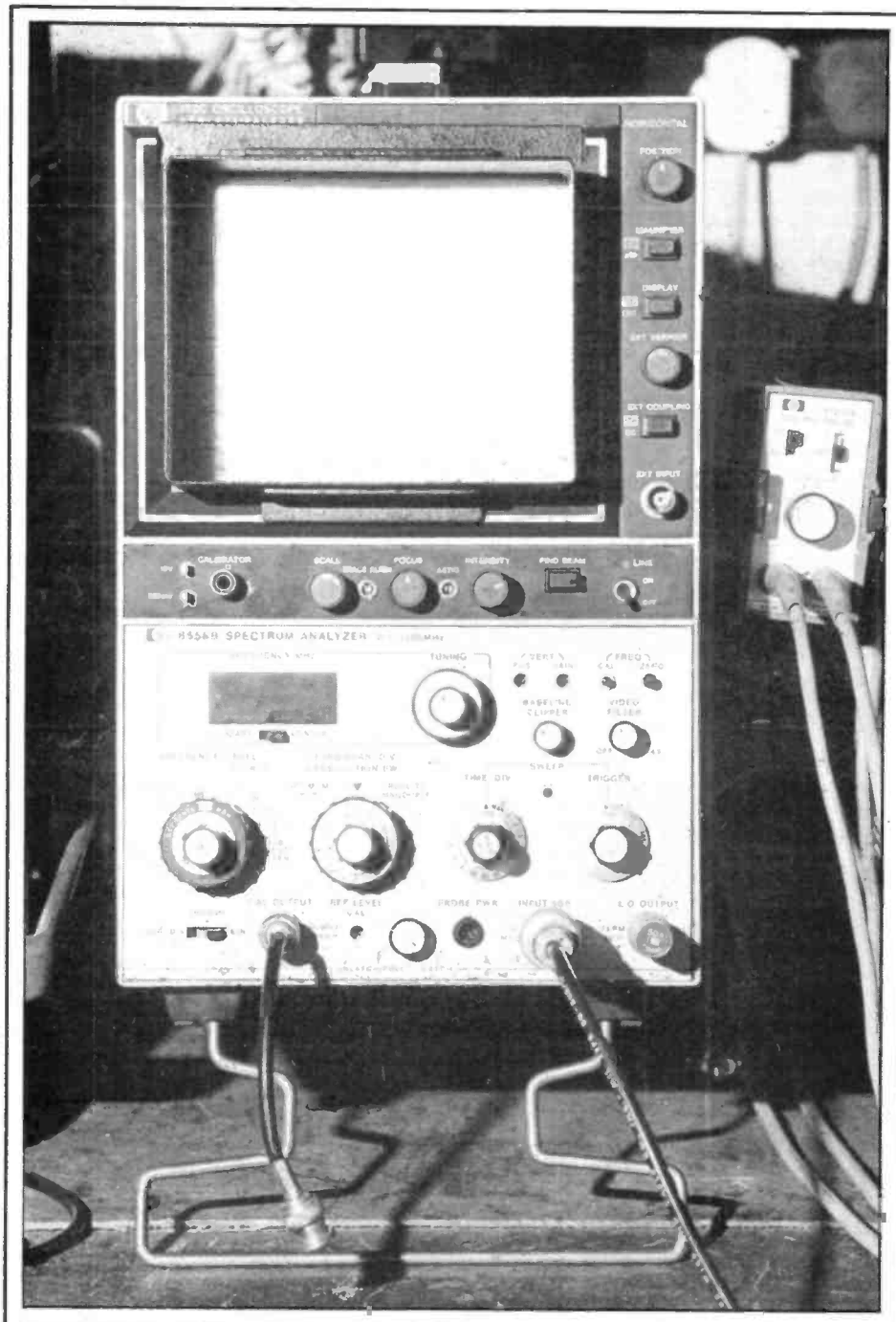
Regarding dBd and dBi, the difference is that dBi refers to an amount of gain refered to a mythical type of antenna known as "isotropic", which means radiating equally in all directions. Since such an antenna doesn't exist except in some clever chap's skull, there doesn't seem much point to us in referring gain to it – but maybe there's some sneaky mathematical reasoning to it that escapes us.

The dBd strikes us as more useful because this is gain referred to a half-wave dipole fed with an equal amount of power. In practice, all this means is that if you want to get to dBd from dBi you deduct 2.15dB; so if you take an antenna which is specified as having a gain of 17.5dBi and decide you want to compare this with one having a gain of 15dBd, all you do is remove 2.15 from the 17.5 and see what you get. You'll find it's 15.35, of course, which is a fraction more gain than the one with 15dBd.

There must be some reason why makers use different units, since both Jaybeam and Tonna could hardly be said to be anything other than reputable purveyors of antennas to the nobility and gentry of amateur radio, but one uses dBd and t'other uses dBi. Next time we speak to either of them we'll ask in case we've missed something!

Regarding rotators, we honestly can't say because it all depends whether the rotator is on a tower or a stub mast and how much height above it you want the beams to be, as well as a few other subtle things. In fact, we'd dearly love to see a good article about this because it's yet another of those highly grey areas in amateur radio and the only articles we've seen in other mags have just confused us some more. We'd have thought something in the CD44 class ought to be OK but we really can't say without knowing a bit more about it. Any engineers out there who'd like to do us a brilliant article all about headloads and overturning forces and all those other things that make us lie awake at night in case we've got them wrong? We'll even pay you for it . . . .

Some of the technical problems sent in by readers. If there's something fazing you and you'd like our tech. dept. to assist, send us your query and we'll see what we can do.



From the lab to the shack

Part one: The relevance of laboratory measurements and the importance of subjective judgements. By Angus McKenzie, G3OSS.

The first in a major series of articles by G3OSS on how amateur radio equipment is measured, and why those advertised specifications should be noted and digested by anyone interested in the subject. What the reader usually wants to know is whether the prices represent good value for money, says Angus. Comparative reviews, although disliked by the manufacturers, are often of the greatest use to the buyer. This important series of articles describes the tests carried out by reviewers like G3OSS, and he shows how and why they are relevant to you and us.

Although every one of us tends to disagree about minor differences between rigs, there are often particular points of criticism which affect virtually everybody. It is the job of a reviewer to point out the good and bad points of a piece of equipment, whilst giving as much useful information concerning ergonomics as is practical.

Of course, there are matters of personal taste, and a reviewer can often introduce his own preferences – provided he makes these clear. There are many measurements which are pointers to the manufacturer rather than to the user, and it is very useful to back up various points of criticism with lab measurements that can be published with a degree of confidence.

Many rigs are poor, particularly if they are inexpensive, but what the reader usually wants to know is whether the prices represent good value for money. Comparative reviews, usually disliked by manufacturers, are often of the greatest use to the reader.

In these articles I will explain my own priorities in performance parameters as measured in the lab. Some tests are of course rather esoteric, but understanding *how* a rig is tested (and may fail to come up to par) can often help an amateur make his purchasing decisions more easily. As I have done with the technical parts of many of my reviews, I'll work my way through from the input to the output of a receiver.

The receiver's front end

The front end part of a receiver has a very difficult job to do; it has to cope with signals from a small fraction of a microvolt, to tens of millivolts, and mix these widely differing strengths up to the first intermediate frequency with the minimum of distortion of any kind, and with the optimum dynamic range capability.

The input sensitivity controls the weakest signal that can be resolved; the front end has to amplify weak and strong signals up to a level which can be easily handled later. But input circuits themselves generate noise, audible as a hiss. The more gain there is in a receiver, the more hiss will be heard (ignoring FM), but the amount of hiss that is audible in no way reflects the actual signal to noise of the system. A quiet receiver can be very sensitive, but require the audio volume control to be lifted on very weak signals, whilst a very noisy receiver may be as deaf as a door post, but have a lot of gain after a noisy front end.

In the laboratory, we measure the weakest signal that can be satisfactorily resolved clearly, and it is customary to measure the RF input level required to give a 12dB ratio between the signal modulation or carrier beat plus the noise and distortion of the system to the level of the noise (etc) itself. Any audio distortion of the modulation or beat developed in the process counts as noise, and 12dB represents a ratio of 4:1 voltage, or 16:1 as power. The receiver's gain control is set to a reasonable level, and the output loaded appropriately, with a resistor, usually of eight Ohms, across

which is connected a form of distortion meter which gives a read out of the sinad ratio.

CW and SSB are checked by developing a 1kHz beat oscillator on the receiver, resulting in a 1kHz audio signal, and then the RF signal generator level is reduced so that background noise begins to increase. When the sinad ratio is seen to be 12dB the RF level is noted. Matters are not quite as simple as just noting down a measurement, for great caution is necessary to ensure accuracy of the result and the means of measurement.

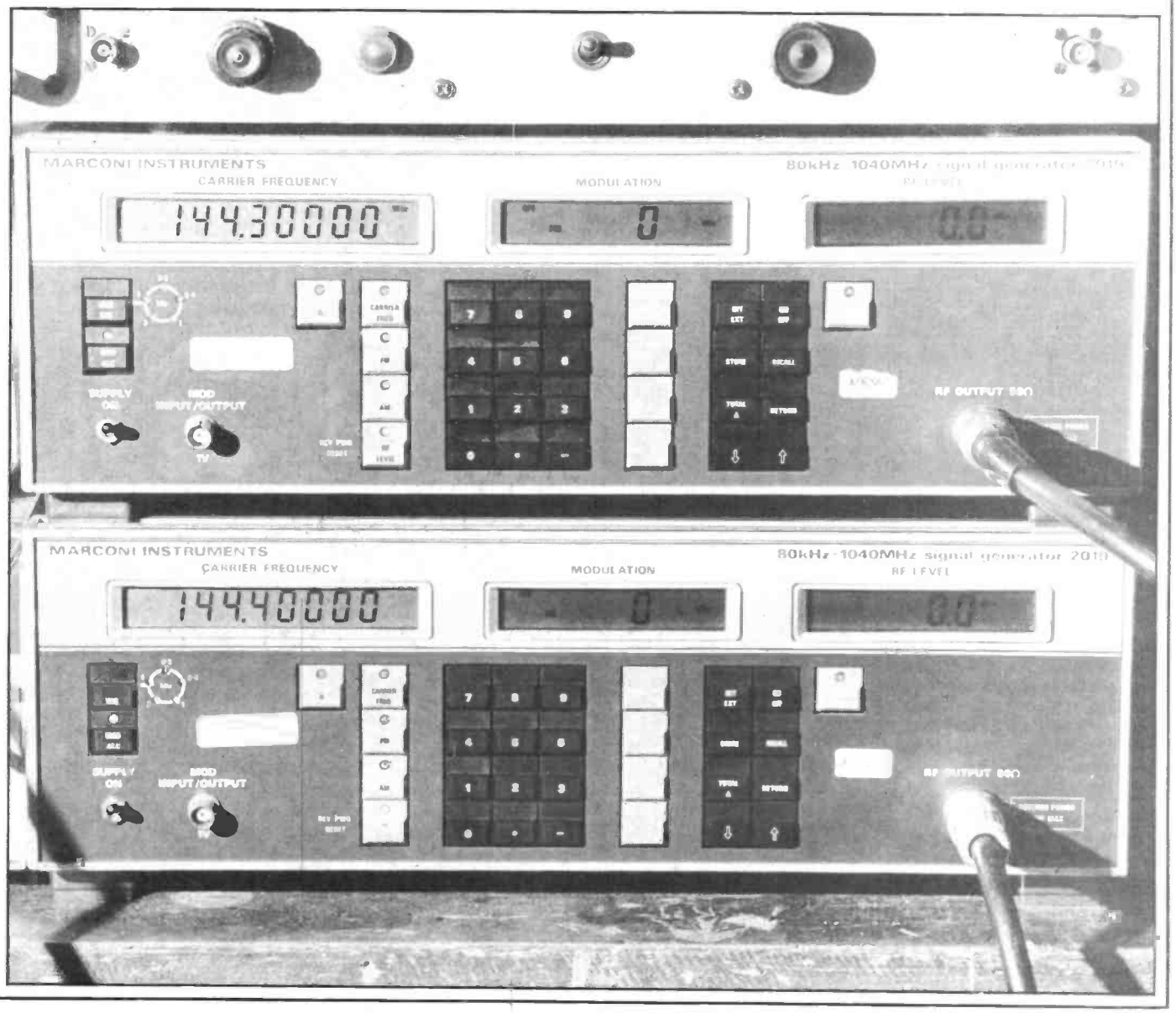
Some laboratories quote EMF developed by the generator as at the generator output, as the voltage that would be given into open circuit. A cable, usually of indeterminate length, can be used to interconnect the generator and rig. Unfortunately a rig usually has an input impedance that is far from 50 Ohms, and the test lead can act as a transformer, and muck up the readings. There can also be generator breakthrough into poor quality leads, or in the output circuits around the attenuators, and I must admit that developing accurate levels below 10uV is quite difficult, let alone levels in the region of 0.1uV.

"Receiver sensitivity is often more important under mobile conditions"

In my lab we we tend to use an extremely accurate coaxial 20dB attenuator screwed on the generator output, followed by a very high quality coaxial cable with excellent screening, which then feeds the aerial socket via an additional 10dB attenuator connected as close to the aerial socket as possible. This stabilises the 50 Ohm source impedance right on the receiver input, and results in more consistent and more accurate sensitivity measurements.

For FM receivers the input sensitivity sinad ratio measurement is of the FM modulation, and I choose between two and 4kHz deviation of a 1kHz tone dependant upon the IF filter bandwidths of the system. Straight signal to noise measurements are particularly misleading, especially since the very presence of modulation actually increases the background noise and some harmonic distortion. The point where 12dB sinad is measured could be equivalent to a signal to noise ratio several dBs better, but the latter is irrelevant since a listener needs to know the readability of the signal itself, and not the difference between the signal level and the noise level with no noise modulation.

One must relate the sensitivity measurement of the receiver to that which is actually required on the relevant frequency band. Normal sensitivity requirements are very different indeed if we compare low frequencies such as 1.8 to 7.1MHz with very high ones such as 432 or even 1296MHz. Receiver sensitivity is often more important, rather than less important, under mobile conditions or where there is a fairly crude aerial system. Where there is a very good aerial system at a home base station, front end sensitivity may not be so important on the lower frequency bands. Let's take a look at what I mean by this.



Left: One of the most-used pieces of equipment in the Angus McKenzie laboratory – a 182C oscilloscope (Hewlett Packard) plus spectrum analyser, measuring from 0.1 to 1500MHz. Below: Marconi Instruments 80kHz-1040MHz signal generator – or two of them to be exact.

On lower frequencies, say up to the 40 metre band, there is much band noise, apart from signals, developed by everything under the sun, including the sun! Much of this is crackling from thunder storms, and even interference from mains electricity supplies and devices. The amount of noise will vary dependant upon the time of day, but a good aerial will contribute more noise to the receiver than is introduced within any but the deafest wirelesses! Even weak signals have to be above this band noise to become audible at all, and so receiver input noise is not so important. If, however, we have a very mediocre antenna, which can be included, perhaps a mobile whip, then the amount of band noise relayed to the receiver will be less, although the ratio of this to the signal may well be similar to that at a home station.

There comes a point where a poor, noisy receiver can actually add more noise than is contributed by the poor antenna, particularly during the day, for example, on top band, or 80 metres. But how about 10 metres? When the band is open, a big beam can contribute noise equivalent to 20dB more noise than that given by a pure 50 Ohms load. If the receiver has an 18dB noise figure (which is bad), then the signal to noise ratio on the band would be 3dB worse apparently, and this is perhaps not quite so serious.

What happens when the band noise is dying down in the evening, but the band is still open? The band noise can be as low as an 8dB noise figure equivalent, ie 12dB quieter than previously mentioned. A weak signal would have to be 12dB above noise just to begin to equal the noise of the receiver, which is ridiculous. Improving the receiver sensitivity by 12dB brings a staggering improvement to the readability of the weak signal. The weak station may be running only 10w, but if you are running 400w, he should be able to hear your reply very easily indeed even if he has a duff receiver, whereas you wouldn't hear him if *you* had a duff one!

"If you live out in the sticks, you can use good pre-amps to good effect . . ."

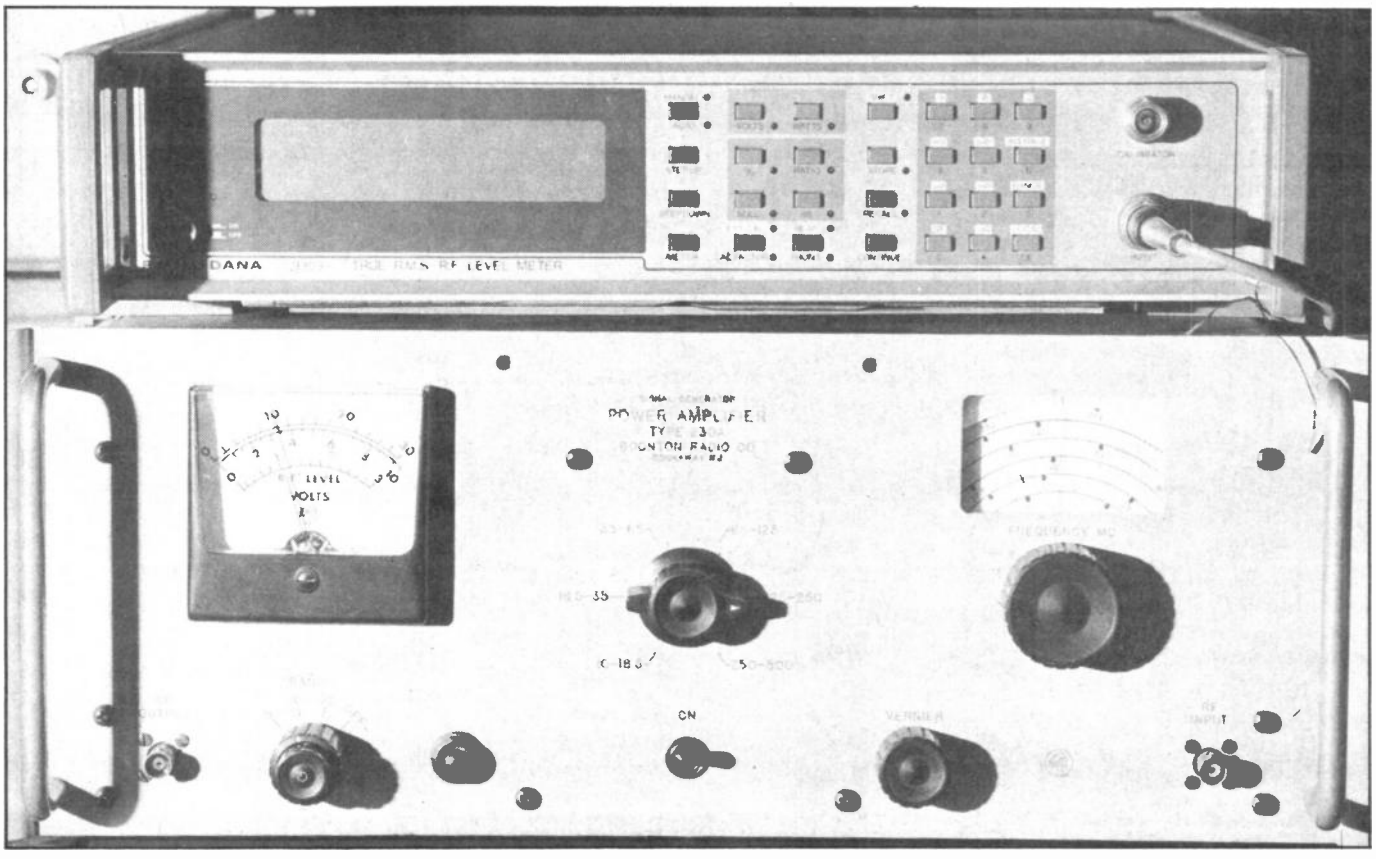
As we go up in frequency, the band noise picked up by a good aerial system gets lower and lower, but unfortunately man-made interference tends to get more annoying up to 145MHz. Ignition interference, and the noise produced by thermostats, arcing switches or motors, and various electrical monstrosities peaks up between 70MHz and 145MHz unfortunately, and so excellent sensitivity is only worth while if your antennas are very high up, and you are a night bird. Alternatively, if you live way out in the sticks, you can use extremely good preamplifiers with effect, provided you are well away from neighbours and main roads. Even so, there is not much point in having better than a 3dB noise figure receiver on 4 metres, or perhaps a 2dB one on 2 metres.

On 70cms, band noise and man-made interference is much lower, and there is a considerable advantage in having the best noise figure you can afford at masthead. My 1dB GaAs fet at masthead is astonishingly good, and the only really troublesome noise is ignition interference, although noise shoots up if I beam at the sun. On 23cm (1296MHz) you fight for every dB, and a really hot masthead preamp seems to lift what would otherwise be almost inaudible signals right up out of the hiss to full intellegibility. I never dreamed 20 years ago that I could have an 0.8dB noise figure preamplifier on 23cms at mast head, but the equivalent pre-amplifier on 10 metres would be totally ridiculous, as it would just be amplifying band noise.

When you look at the sinad measurement then bear in mind the frequency band of the measurement. As a rough ball park, a virtually perfect receiver (which, of course is a physical impossibilty) would just amplify up the noise of a 50 Ohm resistor at its particular temperature, without adding any additional noise. The degree to which a front end adds noise compared with a perfect amplifier is called the noise figure, or noise factor; noise figures quoted in dBs of noise increase compared with perfection, whilst noise factor is the number representing how much more noise there is in power compared to the noise of the input resistor at its quoted temperature. Many people, unfortunately, mix up noise figure and noise factor.

Taking into account the bandwidth of an average SSB receiver, a 0dB noise figure, ie

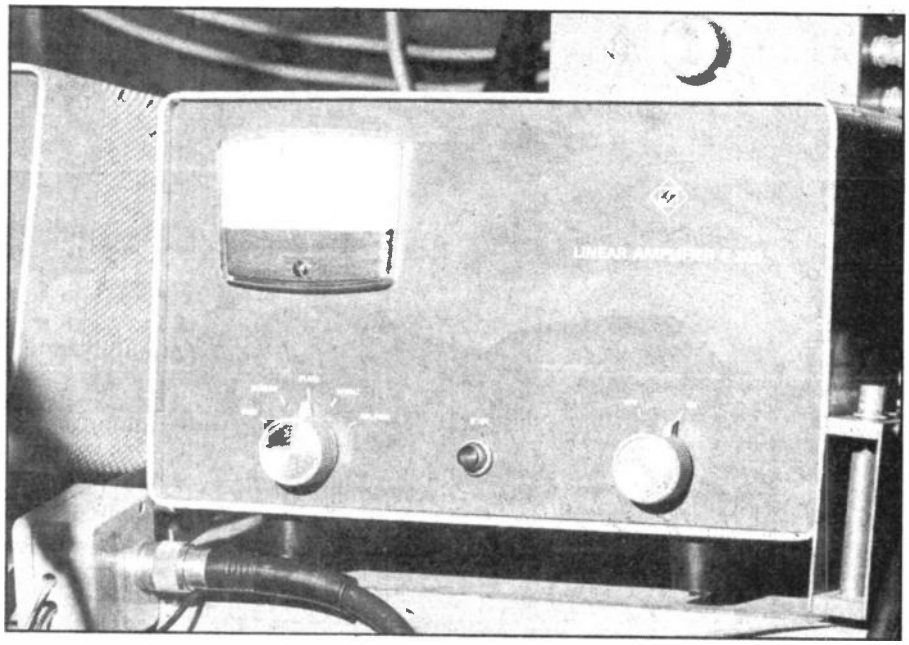
Below: Racal-Dana true RMS level meter, and below it is a Boonton Radio Company power amplifier.



perfection, would be equivalent to a noise input of around 0.022uV with the 50 Ohm dummy antenna at room temperature. Very roughly, a receiver having 0.1uV for 12dB sinad FM would be equivalent to just better than 2dB noise figure, so 0.14uV would be roughly equivalent to 5dB noise figure. If you feel like working out the voltage EMF noise given by various resistors at temperature T deg absolute (ie Kelvin) in a noise bandwidth of B Hz, and with a resistance of R Ohms, then have some fun with a cold wet towel round your head, and helpfully with your tame computer, by using the following fascinating noise formula V= sq.rt. (4 x KTBR) where K= 1.38 x 10^{-} 23. K is Boltzmann's constant. Remember that V is EMF, and a load of 50Ohms into an input impedance of exactly 50Ohms would attenuate the effective noise by 6dB, as it would then be a potential difference applied to the amplifier terminals.

What all this means in practice is that there is a world of difference between a Yaesu FT290 portable rig with, and without, the Mutek front end, whereas the difference between 0.14uV sensitivity and, say, 0.25uV on an HF rig tuned to 80 metres will be of no consequence unless you are using a bicycle spoke as an antenna!

Input sensitivity is one of very many factors, though, which control the effectiveness of a front end. The noise figure of a front end should be almost completely unaffected by the remainder of the receiver, unless there are major design problems.

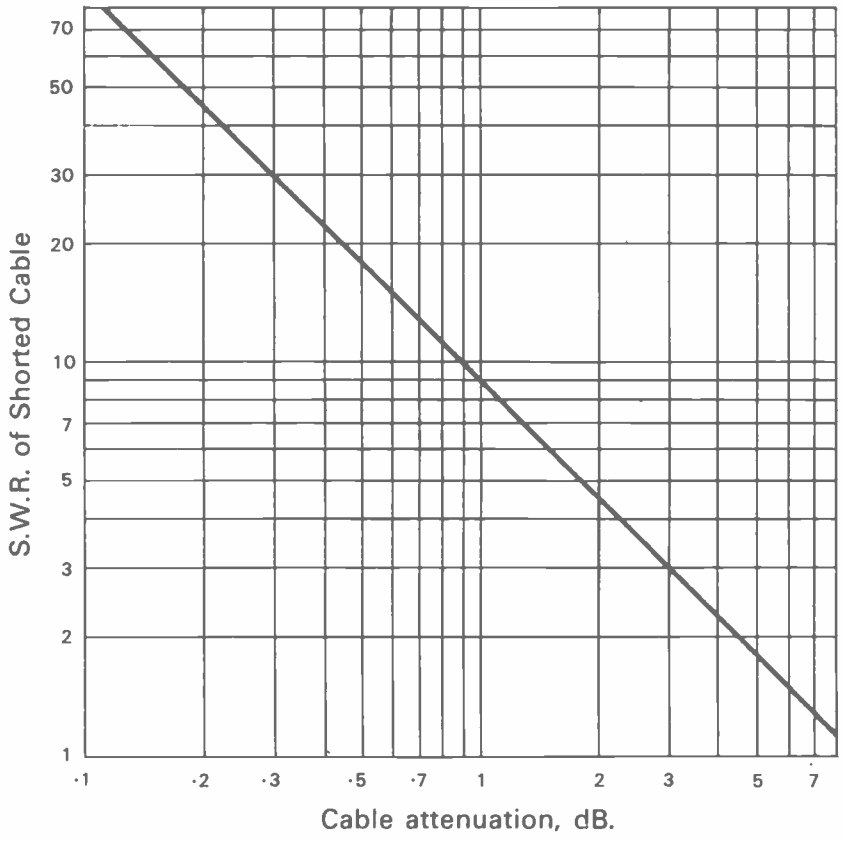


Above: Plain-looking, but useful all the same, is the WFG linear amplifier F200, and sitting on top is the same company's relay device.

But sensitivity as a measurement figure in uV depends not only on the goodness of the front end itself, but the actual bandwidth of the intermediate frequency stages, a narrower bandwidth filter with the front end giving an apparently improved sensitivity measurement.

Next month we'll take a look at some other front end measurements, including radio frequency intermodulation distortion, reciprocal mixing, image response and front end band width.

How to check coaxial cable

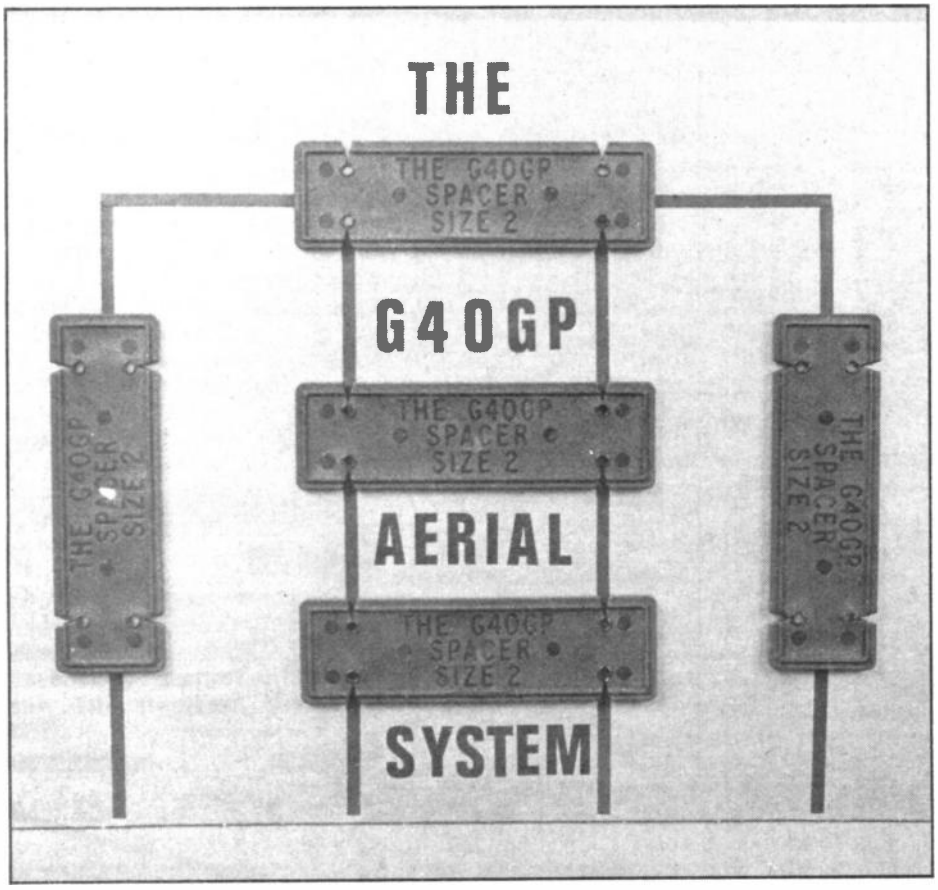


Most of us will accept coax from the dealer. Nobody has doubts about coax bought from a reputable dealer, but what happens if you answer an advertisement from a bod who is selling off some odd lengths of cable? It might have been hanging around in a damp garage for years. While often a quick snip off the end, and a glance at the metal bits will give you a good idea of its condition, you might well consider that a proper check is in order. Checking the performance of a length of coax is straightforward, and in some rare cases, there is a requirement to check the cable and its performance.

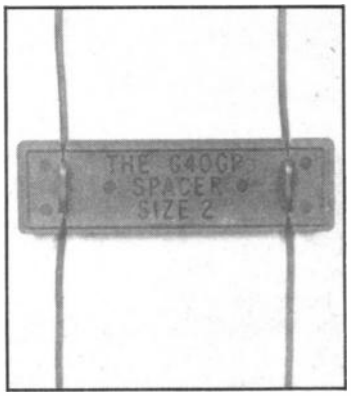
As we said, a perusal of the manufacturer's figures will often satisfy the buyer, especially if you're buying from a friend, or fellow amateur. This is usually in order if the cable is new, but how can you tell whether the cable has been in store for any length of time? The answer is in an inexpensive voltage standing wave ratio meter.

The cable to be inspected is short circuited at its distant end and a few watts of RF at the frequency to be used, sufficient only to operate the VSWR meter, are fed via the meter to the cable. The resulting VSWR measurement can be transformed to the line loss (when perfectly terminated) by referring to the graph on this page.

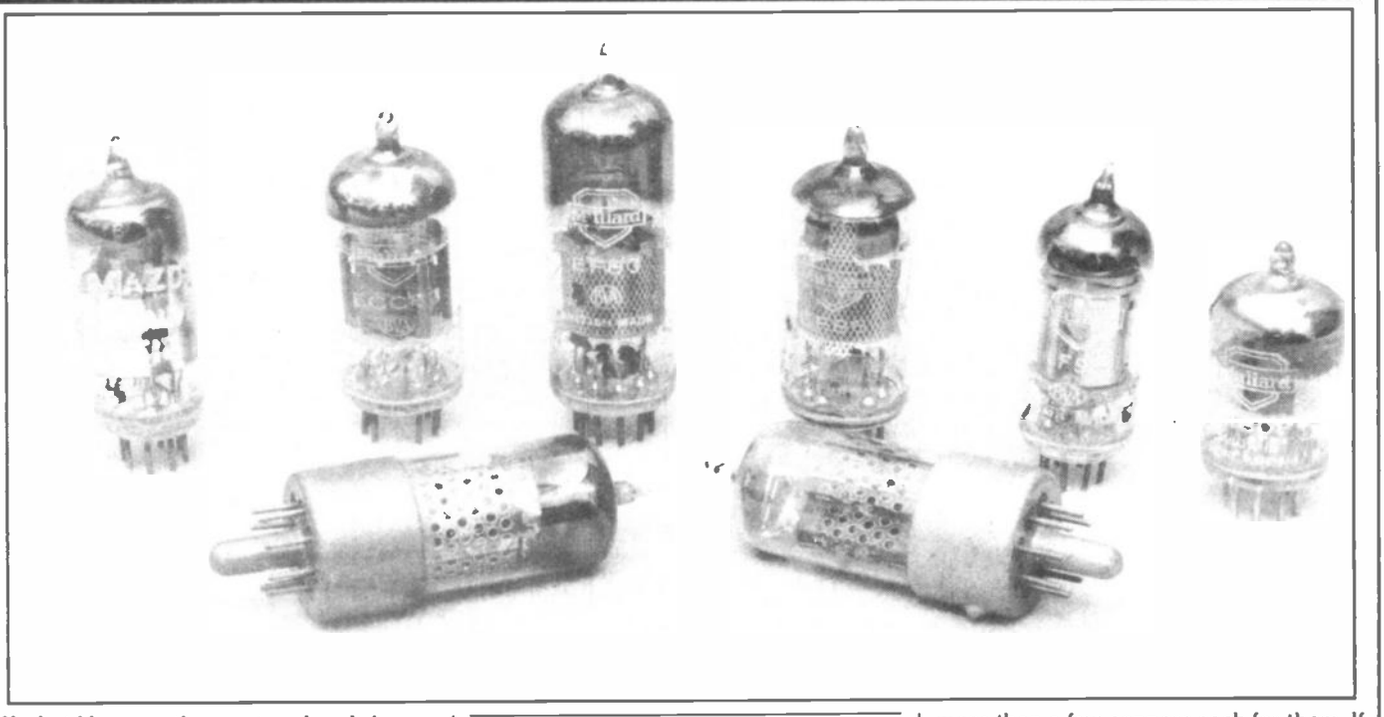
EASY AERIAL ASSEMBLY



This is Tony Johnston's (G4OGP) new aerial spacer system which makes putting up open wire feeders much easier and quicker than before. In a pack you get 20 ultra-violet stabilised co-polymer polypropylene spacers, ready-drilled, and the cost is £10.45 including VAT. The spacers will take various diameters of plastic or pvc multi-strand wire. Even the YL could put it together! Tony welcomes trade enquiries, and whether you want to buy one or 1000, contact him at 0695-27948, or write to G4OGP Electronics, 116 Darlington Street East, Wigan, Lancashire.



RE-INTRODUCING VALVES...



If what I hear on the amateur bands is any indication, home construction is sadly in decline. Whilst I must admit that the present generation of commercial equipment is first class value for money, buying it still requires a commando-style raid on the piggybank.

Even when home construction is considered, the would be constructor is frequently put off by the high cost of ready made PCBs and transistors which he is well aware will be so much scrap, less than one microsecond after applying voltage the wrong way round. No wonder it is often decided to wait until a ready made commercial product can be afforded.

Yet, devices can be obtained which will stand reverse or 100% overvoltage, can be overloaded until their innards glow, and still come back for more. They can be obtained in all sizes from half a watt to many kilowatts and in the sizes which are of most interest to home constructors are as cheap as the cheapest transistors.

"And what" you may ask, is the name of these paragons of virtue?"

"Valves" I reply.

Since transistors were introduced about 20 years ago they have surprisingly, taken over much of the traditional role of valves. In commercial equipment they have many advantages. However, in the field of home construction they have not always proved a boon, for although mechanically very robust, they permanently cease to function if subjected to excess or reverse voltage heat or excessive dissipation. Valves, although less mechanically robust are more tolerant

As cheap a transistors, come in all sizes, can be overloaded until their innards glow, take reverse and 100% overvoltage, and they are what Ken Williams calls "paragons of virtue!" Here he describes how you can roll your own by using the old fashioned bottle.

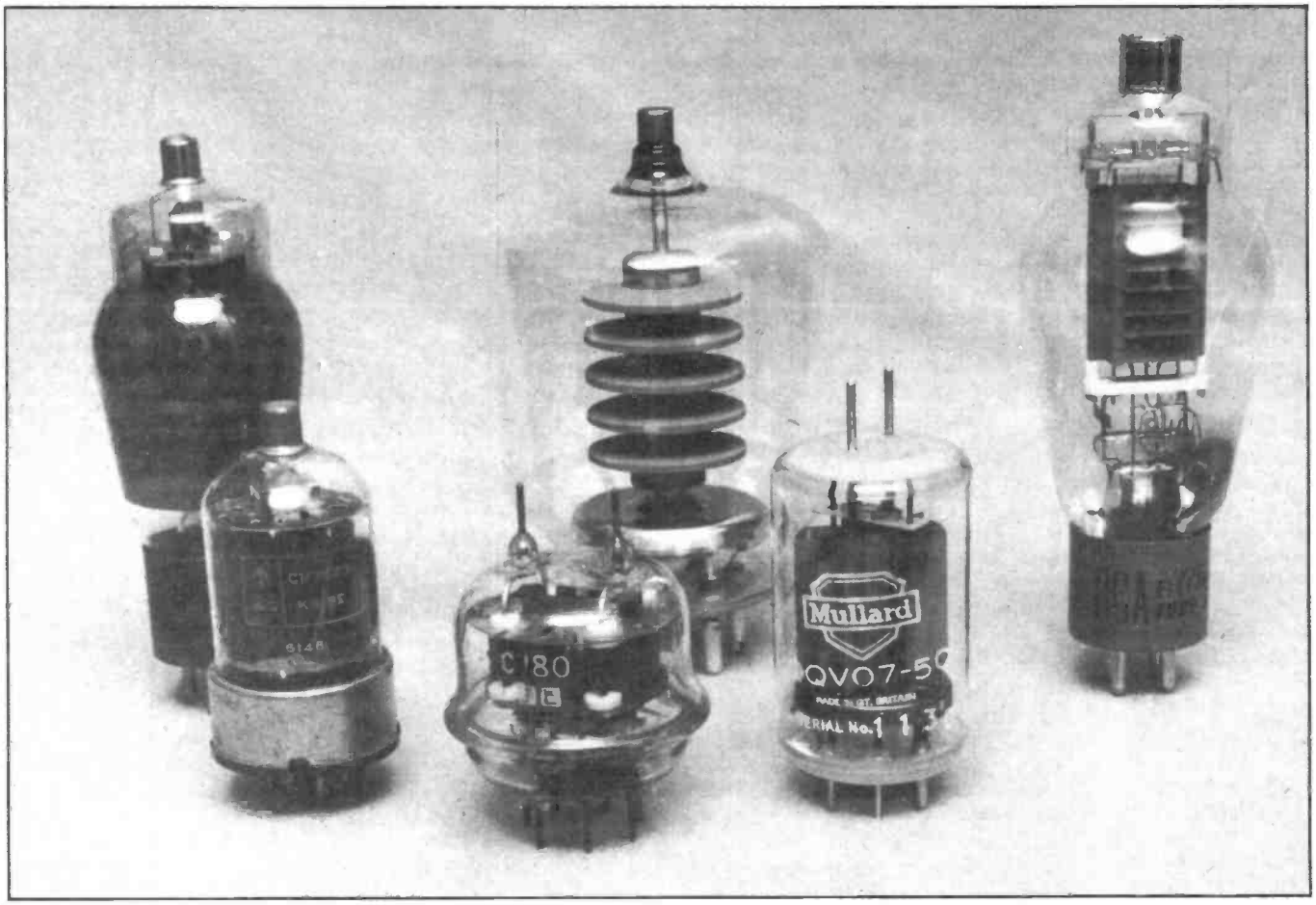
to electrical abuse, physically much larger – a boon to those of us who have five thumbs on each hand or failing eyesight, and in general, operate at much higher power levels which considerably simplifies design. Overdriven power valves also have desirable distortion characteristics which make valve amplifiers first choice for many groups on the popular musical scene.

Whenever a piece of equipment must be small or consume as little power as possible, solid state is best, but the home constructor will very often find, particularly with transmitters, that valve equipment is both cheaper and simpler to build.

Today, very few manufacturers still make valves, but over the past half century so many have been produced that there is unlikely to be any shortage for many years to come. Nevertheless, few radio shops stock any other than those used in the last generation of hybrid TV sets. Where then, can they be obtained? Old valve TV sets provide multitudes of reasonably modern types, and at your local radio club junk sale I would be surprised if you have to pay more than a few coppers each for them. If all else fails, there are certain specialist dealers who can supply almost any type of valve ever made at quite reasonable prices. It is very easy when building up a stock of valves for home construction to find yourself with dozens of valves which are no use to anyone but a historian. To decide which types of valve will be useful from all the thousands which have been made over the years would seem to be an almost impossible task. But it is not.

Valves may be classified in several ways. Firstly, by valve base which will also give a very good idea of the time at which it was developed. An example of this is the Octal base which was used for many valves during the period 1937-1944, and since then has frequently been used for medium power output valves. The B7G valves were designed from 1941 to the early 1950s and the B9A was the last series of valves to be made. Secondly, valves may be classified by their type: triode, pentode, etc. This method can be almost impossible without a valve data book but the numbering system used by some manufacturers can sometimes help. Typical of these is the 'European' system in which the first letter indicates the type of filament or heater, the second letter the type of valve (triode etc), the first number the type of valve base and the remainder gives the development number.

Unfortunately at times, different manufacturers make the same type of valve but under different type numbers, whilst during WW2 all useful valves were classified under various systems by the Royal Navy, The



Army, the Royal Air Force, the United States Navy and the United States Army. To reduce this confusion a system was derived in the United Kingdom giving a common classification for all commercial valves (CV). Typical of this problem is the 6AM6 which may also appear in the guide of an EF91, a Z77, an 8D3, a 6F12 or a CV138. A table of equivalents is therefore a must.

Having identified the valves in your collection, it is then necessary to decide which will be likely to perform with reasonable efficiency. Initially, unless spares are required for existing equipment, all diodes, double diodes and rectifiers can be disposed of, for modern solid state devices can do the same job with far higher efficiency. Secondly, all receiving valves using UX, B4, B5, B7 or side contact bases should be put on one side. I say "on one side", as distinct from disposal because they may be of interest to vintage radio enthusiasts.

Octal valves

The Octal series of valves was probably the most comprehensive ever made. However, care should be taken not to confuse these with a series made by Mazda which uses a somewhat similar base but which had a larger locating spigot and a slightly increased spacing between pins 1 and 8.

The present day home constructor will be particularly interested in the power output valves in this series for these can be used on all amateur bands up to 30MHz.

Opposite Page: A selection of receiving valves. Left to right:6F12 (B7G RF pentode), ECC82 (B9A double triode), EF80 (B9A RF pentode). EF86 (B9A RF pentode), EF92 (B7G RF pentode), E180F (B9A VHF triode). In front: two B8A based EF 42s (RF pentodes).

Above: A selection of transmitting valves: Left to right 807 (UX5 base, 25w tetrode), 6146 (Octal-based 25w tetrode), C180 (2x 10w double tetrode), TY4-400 (400w triode), QQV07-50 (2x25 double tetrode), 811A (65w triode).

The smaller ones such as the 6F6 and 6V6 can give RF output powers of between five and 10 watts whilst the larger ones will give up to 50.

For receiver applications, this series of valves is quite suitable for use up to about 20MHz but beyond this, their inherent noise becomes excessive and it is then preferable to use miniature valves or solid state. Very often, Octal valves were produced in several versions. An example of this is the 6J7, a metal RF pentode. Almost exact equivalent were the 6J7G, a "full size" glass valve, the 6J7GT – a glass valve of smaller construction and the 6SJ7 – a metal valve with all the connections brought to the base (the other versions have the grid connection brought to a top cap). All except the 6SJ7 are interchangeable except that extra screening is sometimes needed when substituting a glass valve for metal.

Two further advantages for the newcomer to home construction are that the valve pin numbers are printed on the sockets, and provided that there is not an S in the type number and that the valve is not a power rectifier, the base connections to all valves is consistent.

Miniature valves

Towards the end of WW2, a series of all-glass miniature valves was introduced. These use a seven pin base (B7G) without a top cap. In general the power valves are more or less equivalent to the Octal series but with improved HF performance, some being satisfactory up to 150MHz. The receiving types in the series are far superior to the Octals, some being useable up to 500MHz. When used on the HF band, many have characteristics which, even today, are hard to match with solid state design.

The success of the B7G series, coupled with the requirement for more connections for multiple purpose valves led to the introduction of a further series of miniature all-glass valves. This, the B9A, represented the final development before the solid state revolution. As in the case of the B7G, the power valves were broadly modelled on the previous series, but with the exception of the VHF triodes, the basic receiving types offered little advantage over their B7G predecessors – the two additional base connections, however, made possible a profusion of multiple valve types – double triodes, triode-hexodes, triode-output pentodes and even double tetrode transmitting valves such as the QQV03-10. The larger envelope also assisted cooling, especially in the case of power valves running near their limit.

Even discounting all but the Octal, B7G and B9A series of valves, there are still hundreds of different types remaining and unless the would-be constructor has a warehouse to store them, he still has to decide which types will be most useful.

The newcomer to valve construction can do little better than to select the Octal series for his first attempt; they are robust, will stand a great deal of electrical abuse, are physically the largest which simplifies soldering and the pin numbers are marked on the sockets. Performance will be quite reasonable up to the 20 metre band. Useful types to look for are: 6J5 and 6C5 (triodes); 6SN7 and 6SL7 (double triodes); EF39, 6J7, 6K7, 6SH7, (RF pentodes); 6K8 (triode-hexode); 6F6, 6V6, 6L6, KT77 and KT88, (power output). These also appear under different manufacturers type numbers.

Having gained a little experience, the constructor can progress to the smaller B7G and B9A. With these it is possible to build HF equipment which will stand comparison with any on the commercial market although it must be admitted that this requires a high standard of workmanship and design. Especially useful valves in the miniature series are 6C4 (triode); 12AU7, 12AT7, 12AX7, 6J6, E88CC (double triodes); 6AK5, 6BA6, 6AM6, EF92, EF80, EF183, EF184 (RF pentodes); 6BE6 (frequency changer); 6AM5, 6AQ5, 6BW6, 5763 (RF/AF output).

Some readers may be surprised that I have included any double-diode-triodes in the list. This is intentional for although this type was very popular in the past as a detector/AVC/audio amplifier stage, the task can now be performed far more efficiently by two small silicon diodes and a double triode, the other half of which can be used for another purpose such as BFO etc. When using home constructed valve equipment it is almost inevitable that you will be accused of not being up-to-date. However, you will have had the pleasure of "rolling your own" and your equipment will not have to be returned to the local emporium for expensive repair at the first sign of trouble.

Ken Williams

Our contributer is a liceneced amateur of over thirty years standing. For many years he operated a completely home-constructed station, but eventually business and family calls on his time forced the purchase of commercial equipment. He still spends some time in his workshop, constructing mainly ancillary equipment. In his shack is equipment for all bands from top band to 70cm but he prefers 2m SSB.

Professionally he has been involved in communications and radar all his working life but is at present employed by an international organisation concerned with civil aviation. In this capacity he has visited many countries as far apart as Hong Kong and South America.

TABLE 1
'Pro-Electron' or 'European' valve nomenclature

The first letter indicates the heater or filament voltage or current:

A 4.0V	**G 5.0V**
C 0.2A	**H 0.15A**
D 0.5 to 1.5V	**K 2.0V**
E 6.3V	**P 0.3A**
	U 0.1A

The second and subsequent letters indicate the general class of valve:

A Single diode	**L Power output tetrode or pentode**
B Double diode	**H Hexode**
C Triode	**K Octode**
D Power output triode	**M Tuning indicator**
E Tetrode	**Y Half wave rectifier**
F Pentode	**Z Full wave rectifier**

Two or three of these many be combined, eg, BC – double diode triode.

The first figure indicates the type of base:

2 B10B or B8G (Loctal)	**5 B9D**
3 Octal	**7 B8D**
4 B8A	**8 B9A**
	9 B7G

Where there is only a single number after the letters, this is the development number and the base is a side contact.

The second number is the development number. If this exceeds 9, a 1 is inserted before the valve base type number. Examples: EC90 is a triode with a B7G base with a 6.3V heater. And DF33 is a high frequency pentode with an Octal base and a 1.4V filament.

Some common valve bases. Top row l to r: B4, B5, B7 Mazda Octal, Bottom row: International Octal, B8A, B7G, B9A.

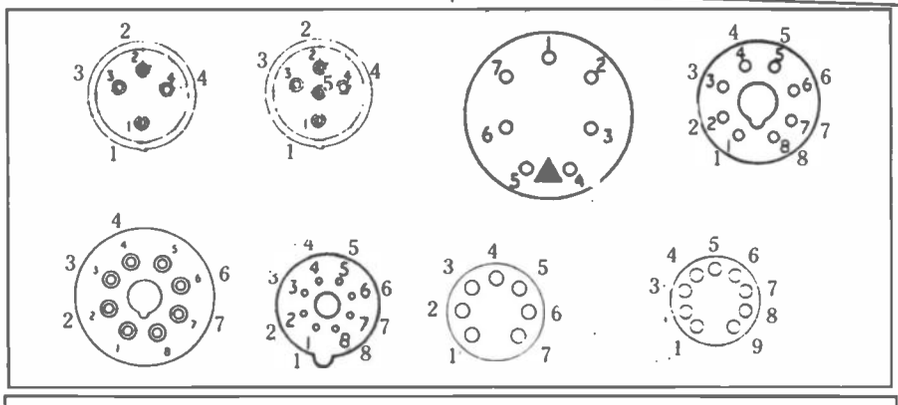


TABLE 2
Some useful valve types

Valve	CV no.	Equivalents	Description	Base	Dissipation (watts)	Max HT (volts)
6AK5	CV850	EF95, DP61	RF pentode	B7G	1.7	180
6AM4	CV5073	–	RF triode	B9A	2.0	200
6AM6	CV138	8D3, EF91, Z77, 6F12	RF pentode	B7G	2.5	275
6AQ5	CV1862	EL90, N727	O/P pentode	B7G	12.0	250
6BA6	CV454	EF94, W727	RF pentode	B7G	3.0	300
6BE6	CV453	X727	Heptode	B7G	1.0	300
6BW6	CV2136	–	O/P pentode	B9A	12.0	315
6C4	CV133	EC90, L77	Triode	B7G	3.5	300
6C5	CV581	–	Triode	Octal	2.5	300
6F6	CV1911	KT63	O/P pentode	Octal	11	375
6J5	CV1932	L63	Triode	Octal	2.5	300
6J6	CV858	ECC91	Double triode	B7G	–	–
6J7	CV1935	Z63	RF pentode	Octal	0.75	300
6K7	CV1941	KTW63	RF pentode	Octal	2.75	300
6K8	CV1944	ECH 35	Triode Hexode	Octal	.75	300
6L6	CV1947	KT66	O/P pentode	Octal	19	500
6SL7	CV1985	–	Double triode	Octal	1.0	250
6SN7	CV1988	ECC32	Double triode	Octal	2.5	300
6U8	CV5065	ECF82	Triode-pentode	B9A	2.8	300
6V6	CV509	–	O/P tetrode	Octal	12	315
12AT7	CV455	ECC81, B309	Double triode	B9A	2.5	300
12AU7	CV492	ECC82, B329	Double triode	B9A	2.75	300
12AX7	CV492	ECC83, 6L13	Double triode	B9A	1.0	300
E88CC	CV2492	–	Double triode	B9A	3.0	220
ECC85	–	6AQ8, 6L12	Double triode	B9A	2.5	300
ECC88	CV5358	6DJ8	Double triode	B9A	1.8	150
ECF82	CV5065	6U8	Triode pentode	B9A	2.8	300
ECL82	–	6BM8	Triode Output pentode	B9A	7.0	300
EL34	CV1741	6CA7	Output pentode	Octal	25.0	800
EL84	CV2975	6BQ5	Output pentode	B9A	12.0	300

Than E.T.

YOU'LL MEET THE MOST INTERESTING PEOPLE

290H . 490E

The recently introduced IC-290H has proved so popular that we have decided to concentrate on this (25W) model 2m multimode. With its bright green display, 5 memories, scan facilities on either memories or the whole band, tone-call button on the microphone and instant listen input for repeaters, this little box really is a beauty. The 70cm version, the IC-490E has similar features (although the output is only 10W in this case). These two multimodes make an ideal pair.

IC-25E

The FM mobile of choice has to be the ICOM IC-25E. It is amazingly small yet has a powerful voice (25 Watts) and a sensitive receiver. There are five easily programmable memories and facilities for changing the repeater shift from the default value of 600kHz. You can tune the VFO while in a memory without losing or changing the memory. Of course you can instantly listen on the input and there are also priority channel facilities should you want to be sure of not missing that private message. The HM10 scanning mike is supplied as standard, but the HM11, with tone call on the mike, can be used.

IC-720A

The main problem the amateur of today has to deal with is deciding just which rig out of the many excellent products available he is going to choose. Technology is advancing at such a rapid rate and getting so sophisticated that many cannot hope to keep up. Some go too far!

Perhaps one way of dealing with the problem is to look at just What each model offers in its basic form without having to lay out even more hard earned cash on "extras". The IC-720A scores very highly when looked at in this light. How many of its competitors have two VFOs as standard or a memory which can be recalled, even when on a different band to the one in use, and result in instant returning AND BANDCHANGING of the transceiver? How many include a really excellent general coverage receiver covering all the way from 100KHz to 30MHz (with provision to transmit there also if you have the correct licence)? How many need no tuning or loading whatsoever and take great care of your PA, should you have a rotten antenna, by cutting the power back to the safe level? How many have an automatic RIT which cancels when the tuning dial is moved?

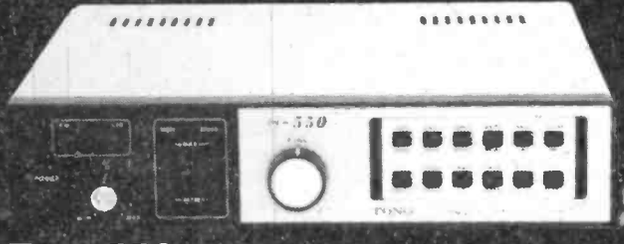
Well you will have to do quite a bit of hunting through the pages of this magazine to find anything to approach the IC-720A. It may be just a little more expensive than some of the others – but when you remember just how good it is, and of course the excellent reputation for keeping their secondhand value you will see why your choice will have to be an IC-720A!

Than ICOM Than ICOM Than ICOM Than ICOM Than ICOM Than ICOM Than ICOM Than IC

CWR-685E

Can YOU read the many RTTY and CW stations to be heard on the air?

Short wave listeners and amateurs are able to take more interest in other modes of transmission than speech with the new ranges of decoders and senders available. As well as amateur transmissions there is loads of interesting news and other broadcasts which can be read using these space-age devices. As UK importers of the renowned TONO and TELEREADER products we can offer you a wide range of devices from a simple morse and RTTY reader which can be plugged into your TV to complete send and receive systems with memories and built-in displays or outputs for a high definition VDU. Please call us for further details or visit us or your dealer for a demonstration.



Tono 550

Securicor or post despatch free
Same day if possible

IC-740

The 740 is already known as one of the tranceivers of choice by the discerning operator. Before you buy look carefully at the 740 – call us and we will be pleased to send you a leaflet.

And remember we also sell **Yaesu, Jaybeam, Datong, Welz, G-Whip, Western, TAL, Bearcat, Versatower** and **RSGB** publications from our shop showroom at the address below.

Come in for a demonstration or just a chat, our qualified sales staff and technicians will be glad to assist you.

Listed below are other sets available from Thanet Electronics, a more detailed specification of these will appear in future advertisements, prices are inclusive of VAT. IC-730 IC-740 IC-2KL + PSU IC-SP3, IC490, IC-AT500, IC-251, IC-505 IC-2E, IC-45E, IC-551, IC-AT100, IC-PS20, IC-PS15, IC-ML1 IC-451, IC-4E, IC-R70 TELEREADER: CWR-670 CWR-610E TONO: MR250, 9000E

Agents

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

Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM

Thanet Electronics
143 Reculver Road, Herne Bay, Kent
Tel: (02273) 63859/63850

CLUB NEWS

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

Southdown AR Society

G4OIA (Simon Hartgroves) says, in the club newsletter that so far his DXCC "is still a long way off at 42/8 as I sit slavering at the letterbox for the elusive cards – always 'sure 100% – like hotelecholimalima!" Nice one.

In the same newsletter, writes a member about the Morse exam: "Prospective CW candidates are, as of now, required to bring a valid passport or other recognised ID document with them to their exam". It appears that tests can no longer be booked by telephone for the North Foreland station. (Bob G6GVN who is now 'up to speed' rang to book his appointment on Monday 29th Jan and was told that he must book in writing and in any case the test could not take place before June). Our team of investigative reporters have been hot on the scent to discover the reasons for the policy change. It transpires that seasoned operators, persuaded by vast sums of filthy lucre, have on occasion 'done a ringer' and sat the test on behalf of well-heeled aspiring G4s.

This was first brought to light when an examiner at Southampton was presented with a candidate who achieved a faultless score in the examination, but whose ill-fitting dress and wig gave 'her' away. Upon checking, it was discovered that 'Sally Plum (17) G6---' was in fact Sid Faraday (68) G2---, ex-signals, down on his luck and uncomfortable in corsets.

"This scandal had not been discovered one minute too late for your scribe, who still has the negatives. As regards the time delay in obtaining a test appointment, this is a direct result of the foregoing as the rigorous vetting process is to be extremely comprehensive and, in future, candidates are required to produce a specimen, have their fingerprints taken and sing an affadavit in front of their peers allowing sequestration of their estates if they prove on forensic examination to be other than the person that they represent themselves to be."

Meanwhile, life goes on, and on June 4th, the society holds its Butts Brow open meeting, with bangers and beer, and on the 1st August, is the open evening at Chaseley. September 9th means the junk sale. Interested potential members can get in touch with the Secretary of the club. T. Rawlance G4MVN, at 18 Royal Sussex Crescent, Eastbourne.

British Young Ladies' Amateur Radio Association

The British Young Ladies' Amateur Radio Association (BYLARA) was formed in April 1979 to further YL operating in Britain and so promote friendship, stimulate interest and in particular, encourage good operating techniques and courtesy to all operators at all times. BYLARA is affiliated to the RSGB and is open to all licensed and non-licensed YLs and OMs wishing to join.

Since its formation, BYLARA has been instrumental in establishing several YL activities which are detailed as follows:

1. THE BYLARA NET takes place weekly on Mondays at 7.15pm (local time) on 3.690Mhz = QRM. Net control varies and YL matters are discussed for half an hour, after which the net is open to any OM wishing to join in.

2. OTHER YL NETS take place informally on Wednesdays and Saturdays at 10.30am (local time) around 7.088MHz. All YLs are welcome. If no one is heard please call 'CQ YL" to start things off.

3. MEETINGS take place over a cuppa in the tearoom at 2pm (local time) between YLs at whatever radio rally they may attend. BYLARA stands and displays may also be put on at some local rallies.

4. A NEWSLETTER is produced quarterly in May, August, November and February. All YL news and views will be welcome by the Editor, Miss Angelika Voss, G5CCI, PO Box 49, Colchester, Essex CO4 2SF.

5. YL ACTIVITY DAY is on the 6th of the month. Look for other YLs particularly on the hour, any hour, around the frequencies 7.088, 14.288, 21.388, 28.588 and 28,688MHz. If no one is heard please call 'CQ YL".

6. THE BYLARA AWARD. This beautifully designed and colourful award is available for working YL members of BYLARA.

Britain and Europe: Work 15 YL members of BYLARA to include at least 10 British YL members. (G, GM, GI, GU, GJ.)

DX outside Europe: Work 10 BYLARA members, six of which have to be British members. Starting date for the award is 29th April 1979 and YLs must by BYLARA members at the time of contact. All bands, all modes, one contact per member. Open to everyone, including SWL. NO QSL's necessary. Send log data, signed by applicant, with fee of £1.50 to Mrs D. Wood, 13 Scotland Drive, Dunfermline, Fife KY12 7SY.

Anyone itnerested in joining BYLARA should send the current subscription of £2.50 to the Treasurer, Mrs Shirley Smith, GM4LUS, 80 Deanburn Park, Linlithgow, West Lothian EH49 6HA. Overseas members paying £2.50 (or dollar equivalent) will receive the newsletter by surface mail. An additional £1.50 will speed the newsletter to you by air mail. (This does not apply to Europe, of course).

BYLARA badges are available from Shirley, GM4LUS, price £1.50. Attractive design in pink and silver. May be ordered anytime or when joining or renewing membership. BYLARA stickers are also available, price £1.00 (please enclose SAE) from Jasmine Marshall, G4KPF, "Hedgeways", 64 Highmoor Lane, Cieckheatong, W. Yorks. Chairman of the Association is Mrs Mary Adams, G4GAJ, Little Croft, Shurdington Road, Cheltenham, Glos G53 0NJ. The Secretary is Diana Hughes, G4EZI, 3 Primely Park Crescent, Leeds, LS17 7HY.

Wirral AR Society

The NEC exhibition is one of the topics of conversation (?) in the WARS newsletter. We quote, with genuine amusement: "The 'restaurant' ran briefly out of food on the Saturday. On the Friday night, we had a strong argument with the NEC authorities about the inadequacy of two ticket booths. However, they claimed 'experience' and won the argument. Large queues formed from 9am (opening time was 10am) and many had a very long wait. On Sunday, there were four ticket booths open!"

Anyway, also in the newsletter is the club's programme for May, and it includes: May 4th problems night – solve your radio problems by asking the experts. May 18th insight into microprocessors – how to use them. The club meets at Minto House School, Birkenhead Road, Hoylake, on the first and third Wednesdays of each month, from 7.45pm.

Brighton & D AR Society

Come along and announce yourself, says Chris Reader, G6VAJ, the self-appointed "writer to magazines" for the Brighton society. He adds that they meet at the YMCA Centre, Marmion Road, Hove, on alternate Wednesdays, and Chris can be contacted at 0273 550509, or written to at 55 Springfield Road, Brighton. Alternatively, speak to the Secretary, Wendy Firmager at 26 Brownleaf Road, Brighton.

Special event

Special Event Stations GB4FES and GB8FES will be operating

from 23-30 July 1983 as part of 'Festival 83', a Christian festival to be held at the County Showground, Stafford. Operation will be on CW and SSB on HF, and CW, SSB and FM on VHF. More details from G6CZM or G4LOF (both QTHR).

Bury Radio Society

June is the month that Clive Hardisty, G8XUR, gives a talk to this club which is entitled "Confessions of a television repair man". It promises to be very interesting, yet we understand.

There is another speaker (not yet finalised) on June 14th, while on July 19th there's a surplus equipment sale, and on August 9th is the fox hunt. Meetings are held at the Mosses Community Centre, Cecil Street, Bury, every Tuesday evening at 8pm. Main meetings, as above, are held on the second Tuesday of each month, and the rest are informal. Man to contact for more information is Brian Tyldsley, G6OKE, at 4 Colne Road, Burnley. Telephone 24254.

Nunsfield House Community Association Amateur Radio Group

The Elvaston Castle Mobile Radio Rally will be held, as in previous years, on the showground at Elvaston Castle Country Park. Elvaston Castle is located about five miles south-east of Derby on the B5010, which runs between the A52 and A6 roads.

The rally opens at 10am and admission is free, other than a parking charge of 35p which is levied by the local authority. Talk-in will be available on both 144 and 432MHz, by GB2ECR. Attractions include over 70 trade stands, a bring & buy sale and flea market, demonstrations and children's entertainment, plus full on-site catering. Further details available from Ian Cage, G4CTZ, Secretary, tel: Derby 799452.

The rally is organised by the Nunsfield House Community Association Amateur Radio Group.

CLUB NEWS

Edgware & DRS

Club meetings are held at 145 Orange Hill Road, Burnt Oak, Edgware and the telephone number of the Secretary Howard Drury, G4HMD, is Northwood 22776. On June 4th/5th is the National Field Day at Copthall Playing Fields, and on the 9th is an RTTY evening although this is provisional at the time of writing.

On June 23rd there is a VHF FD briefing, while the VHF FD will be at Hatfield School on the 2nd/3rd July. Incidentally, in the latest issue of the club's newsletter is a story about G4IUZ's visit to the ARRL HQ at Newington, Connecticut, explaining all about their still-working spark transmitter, and the interesting fact that every metal part of the building had been connected together by earth straps at regular intervals.

Kidderminster & D AR Society

This club meets fortnightly on Tuesday evenings at 8pm at the Aggborough Community Centre, Hoo Road, Kidderminster, Worcs, and in June are the following get togethers 7th antenna systems, by G3PGQ Dave Yates; 11th Brintons Bicentenary special events station. There's a Morse course on Wednesday evenings, and more information is available from Tony Hartland, G8WOX, Secretary of the club, at 22 Granville Court, Offmore Farm, Kidderminster.

Echelford AR Society

Seen in this society's newsletter: "After some recent research, it was discovered that the Woodpecker which emanates from three locations in the USSR, is, in fact, a 'behavioural stimulant'. The frequency at which it oscillates is approximately seven cycles per second, and this, by no coincidence, is the frequency of the human nervous system."

Interested? Then you'll need to get in touch with the society's Secretary, Alfred Othen, G8FSZ, at 5 Millan Close, New Haw, Weybridge, Surrey. And he'll probably want you to join the club anyway!

RAIBC

Hamfest 83 is a major new mobile rally which will be held at Wimborne, Dorset on Sunday, August 21st. Wimborne is about 10 miles from Bournemouth and the rally starts at 11am and finishes at 5.30pm.

Bournemouth and District RAIBC will be promoting the event, at the invitation of the Flight Refuelling AR Society, and a full programme for the day is forecast. Also, the RAIBC Committee will be holding their AGM at the event, and we gather a large number of national and local traders will be present. There will also be a special demonstration station, showing all aspects of amateur radio in use, and a talk-in is available on VHF/UHF under the callsign GB2FRH (Flight Refuelling Hamfest). Side shows, displays and stalls will cater for all members of the family. More information from Bob Burrows, G6DUN, 9 Rannoch Court, Adelaide Road, Surbiton, Surrey, HQ of the RAIBC.

Stourbridge & DAR Society

This club holds a lively programme of talks, and other meetings, at their HQ, The Garibaldi, Cross Street, Stourbridge, and they usually begin at 8pm. They are considering starting up a Morse class, by the way. Potential members can get in touch with the Secretary, Malcolm Davies, G8JTL, at 25 Walker Avenue, Quarry Bank, Brierley Hill.

Thornton Cleveleys AR Society

This club's programme for June is as follows: June 6th talk on computers, June 13th talk by Len Green, G3AOW, on HF aerials, June 20th film and talk on car rallying (rally cars use two way radios for car-to-car, car-to-base and car-to-service barge contact), June 27th natter night. Time and place of meetings is as usual, that is, at the 1st Norbreck Scout Hut, Carr Road, Bispham, Blackpool, at 7.45 every Monday. Mrs. Jen Ward, G8YOK, at 143 Arundel Drive, Poulton le Fylde, Blackpool, is the lady to speak to for more information.

Exeter AR Society

On June 13th is the Inter-Club Quiz and the event will be hosted by Torbay Amateur Radio Society, at Torquay (details from M.G. Rider, "Harmony", 7 Kingston Close, Kingskerswell, Newton Abbot TQ12 5EW). The Exeter AR Society meet at the Community Centre, St. Davids Hill, on a regular basis, and more information is available from Francis Stower, G6FGS, 4 College Road, Exeter.

Medway Amateur Receiving and Transmitting Society

MARTS meets every Friday, the only exception is Good Friday and if Christmas day should fall on a Friday, some members seem so keen that we are sure that they would attend even on those days . . .

The venue is the number one hall, St Luke's Church, King William Road, Gillingham, Kent, from 7.30pm onwards, usually ending at around 10.15pm. Provisional programme includes the following: June 3rd film evening; June 24th junk sale; July 8th a social evening at home to South Essex A R Society; July 29th film evening. And in the future, you can attend on Nov 18th "a return to real amateur radio", a talk by G4EVY.

DODSON ON THE ROAD. The first of a series of profiles of distributors who serve the Amateur Radio fraternity.

DEALER PROFILE

South Midlands Communications Ltd.

A compact shopfront, but a big company behind the scenes. Although they are Yaesu importers and sell equipment from The Japan Radio Company, KDK, Hansen, Kenpro, TTE, Delica, Leson, Telewand, Dengineer, Comet, Fitlay, Hokushin of Japan, Hygain, CDE, Mirage, ETO, Dentron, MFJ, KLM of America, etc, they still find time and space for the chap who wants, say, a secondhand transceiver or a shopsoiled linear. Peter Dodson visited the firm at their Totton headquarters.

Nestling behind the modest shop front of South Midlands Communications in Totton are the showrooms, stores and workshops of one of Hampshire's expanding business concerns. Almost on the outskirts of Southampton, this is the headquarters of a chain of six suppliers of amateur radio equipment, with branches at Chesterfield, Leeds, Grimsby, North Wales and the Channel Islands. The company originated in the Midlands some twenty-five years ago as a one-man-band manufacturing radio masts and antennae, then called South Midlands Construction.

Moving south, an astute management visualised the potential of marketing a wider range of radio products, but having gained the respect of customers all over the world, decided to retain the basic title. Joining the company in 1972, Marketing Director Nigel Curzon now completes a team headed by Managing Director Barrie Gardner (whose wife acts as Company Secretary) with Commercial Director Richard Diamond and Production Director David Petie.

The company employ 60 people in their establishments and it will be encouraging to their radio amateur customers to know that forty of them hold amateur transmitting licences.

Nigel Curzon himself is a quietly spoken, competent and confident executive who knows his trade and travels worldwide in the interests of his company; at "around thirty" he is unmarried and drives an Aston Martin. A product of University College Wales, he emerged with a B.Sc. in electronics and oceanography, not to mention the capacity to handle a £¾m deal with the Gulf States – his most recent success. Having an interest in amateur radio from the age of 12 or 13, Nigel was licensed in February of 1977 and is an active participant.

His views on things like citizens' band radio are interesting. "Government CB legislation was the worst bit of drafting I have seen. There was no enforcement, no testing, and the samples *we* tested in our workshops were way off spec. The cowboy operators just stuck on the "official" label and started selling!" Similarly, his views on the amateur radio examinations are objective. "Probably a little too easy". To a B.Sc. in electronics, it probably was! "If it is the intention to ensure that there is a level of competence, it is probably OK. On the other hand, you won't get so much out of the hobby if you're not interested in the technical aspects. It is all a matter of what you want from amateur radio – some just use it as a telephone."

One of the happy band of workers at the SMC offices at Totton. All aspects of amateur radio are covered here, from technical to procedural matters.

The stocklist of South Midlands Communications is comprehensive, containing some 2,000 items. Everything from a simple co-ax connector to a £1,500 transceiver is available, including a variety of marine, coast and land mobile equipment. "We are" in the words of Nigel Curzon "the biggest dealer/distributor in the United Kingdom, with the widest product line in our field."

So how does he compare British, American and Japanese products? "Well there are few British products, although those that do exist are extremely good. American equipment tends to be over-priced, not particularly attractive and something you would be proud to have made at home! Japanese products on the other hand, are pleasing to look at and they do yield to market pressures, building in a lot of features." A sympathetic attitude, in keeping with the fact that Nigel Curzon has a warehouse full of Yaesu Musen radio equipment!

"Customers are encouraged to use the equipment provided – or bring their own"

Immediate customer reaction to the Totton premises is pleasing. Tastefully decorated, the sales area has four free-standing operating positions, each equipped with everything necessary for amateur radio operation. Everything works, and customers are encouraged

to use the equipment provided – or even bring their own. "They can stay all day if they want to" as Nigel says, "and some of them do!" At SMC, a customer can set himself up with an amateur transceiver for around £300, although, like all other hobbies, the sky's the limit.

Credit facilities are available; making a 20% deposit and the balance over six months will cost the client nothing in interest. Similarly, 50% down and the rest over twelve months, is interest-free. On longer commitments, SMC also provide an insurance arrangement to cover repayments in the event of sickness or redundancy.

Range of antennas

Not that South Midlands Communications have forgotten their roots – they still carry an extensive range of antennae for amateur and commercial use; their mail order service, Nigel admits, has been disappointing but he is happy with the way they have come out of the recession and mail order is still an active part of their business. Under the eye of Sales Manager Norman Dilley, there are four people in the Despatch Department which requires the daily use of Securicor and Roadline services. The Despatch Department is also involved with sub subcontract work, putting together, packing and exporting orders for masts and antennae manufactured at Totton.

Even the bargain-hunters are catered for at South Midlands Communications; in a smaller showroom is displayed their stock of secondhand and shop-soiled equipment, all of which have been thoroughly tested to ensure technical (if not cosmetic) perfection. Also on sale in this department are samples and prototypes which attract as much as 30% to 40% discount.

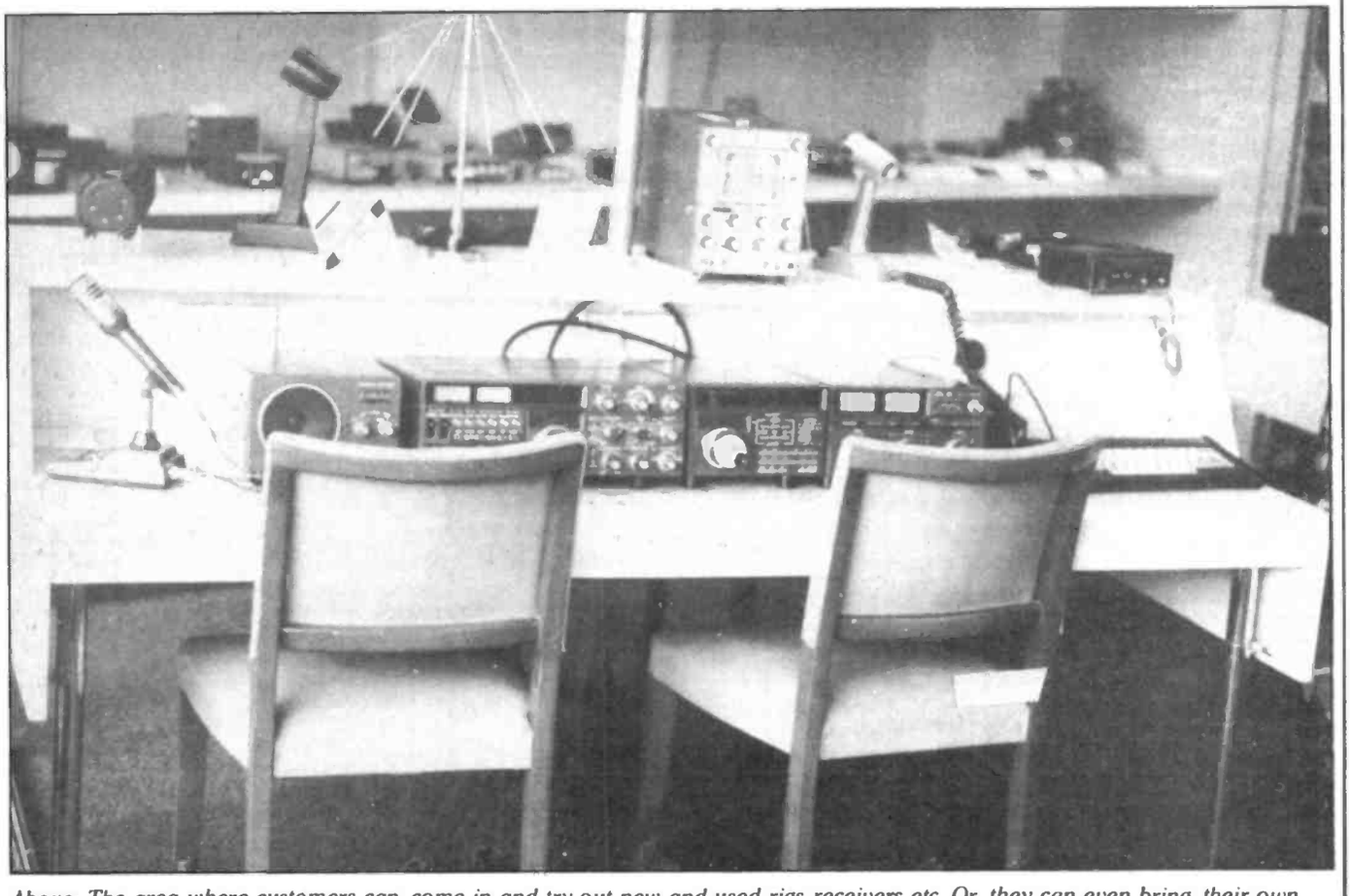
Not particularly keen on buying in secondhand gear due to complications with VAT, SMC are nevertheless happy to trade in such equipment against new. And like other SMC activities, it is doing "quite nicely, thank you!"

"In the field", each of the SMC outposts carries a Manager and a technician to handle first-line repairs and servicing – 90% of which is done on the premises. At the Totton headquarters there is a ten-man team of experts who have at their disposal some quarter of a million pound's worth of test and maintenance equipment. And expertise is the key word. Yaesu have 12 current lines in radio equipment, which are being constantly superceded. Over a ten-year period, that represents a lot of different models to "keep in touch with" in terms of maintenance.

As they stand, the "hind quarters" of South Midlands Communications are more functional than attractive. A succession of extensions to accommodate a growth rate of some 30% per annum has left its mark in terms of lack of cosmetic perfection! However, an extensive rebuilding programme will be completed by this time next year that will match elegance with efficiency.

All the badges of success are in SMC's head office at Totton, not the least of which is the twin-engined motor cruiser used for testing marine radio equipment (and for staff outings) and the three delivery lorries. And, of course, there is the Cessna light aircraft – but not in the back yard at Totton!

On the right is the head office in all its splendour. Ninety percent of repairs and servicing is done on the premises, with something like a quarter of a million pound's worth of test and maintenance equipment.



Above: The area where customers can come in and try out new and used rigs, receivers etc. Or, they can even bring their own. Some stay all day long, says Nigel Curzon, their MD.

·MULTI-BAND·
·CENTRE-FED TOPS·

By John D. Heys, G3BDQ

These drawings (that should have illustrated last month's article by John D. Heys G3BDQ) show how centre fed wires must be balanced if they are to work properly. don't confuse them with resonant dipoles, by the way, and for further information, see G3BDQ's article on pages 54-58 in the May 1983 issue of Amateur Radio.

Fig 1.

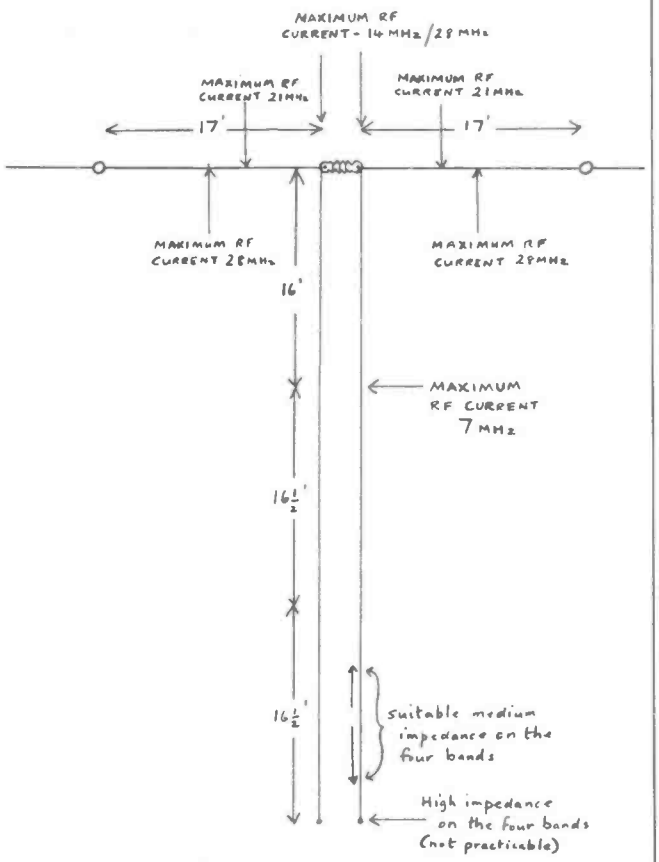
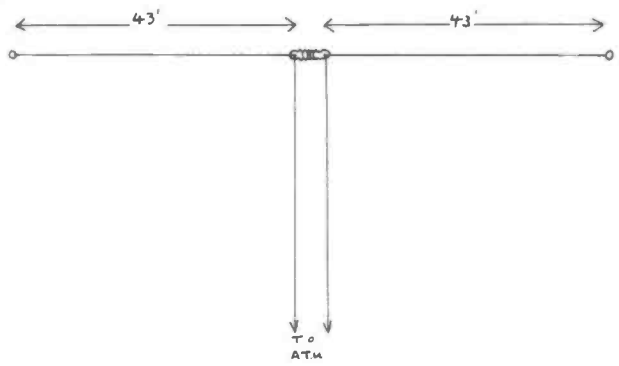


Fig 2.



A simple multi-band antenna

Fig 3.

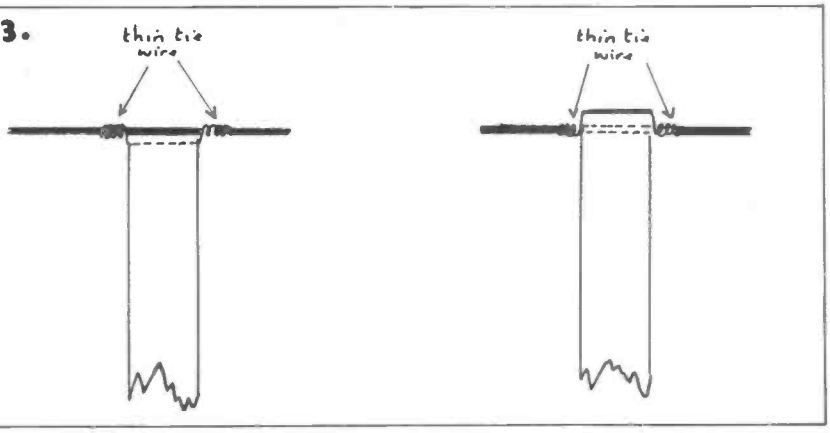


Fig 5.

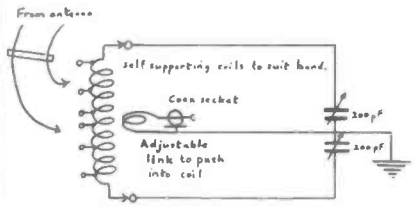


Fig 4.

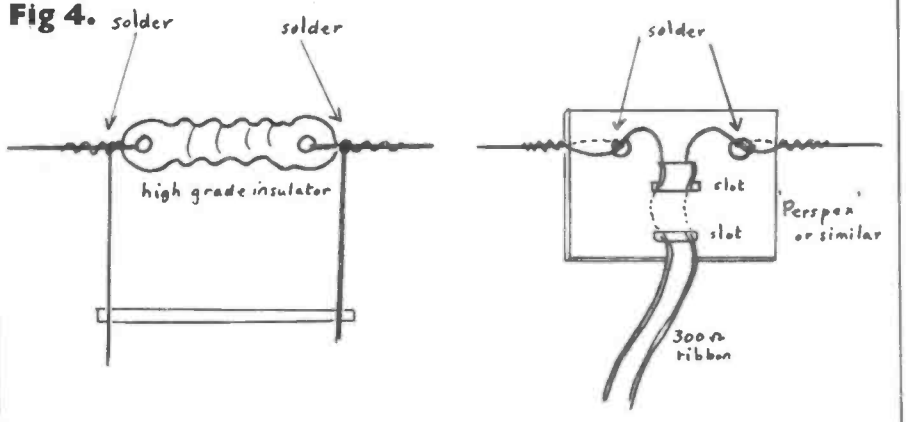


Fig 1: A short centre fed antenna for four HF bands. For easy matching to the ATU, a feeder length of around 41-45ft would be suitable.
Fig 2: A simple multi-band antenna.
Fig 3: Two methods of tying the feed line to the spreaders.
Fig 4: Joining the feeder to the antenna.
Fig 5: Simple ATU to match feeders to the 50SL coax.

Classified Ads

● **2200GX** complete with original box including charger also spare nicad pack and mobile mount together with IOW PA VB some spare crystals £100. Phone Uxbridge 58800.

● **26-30MHz AM-FM-SSB-CW** transceiver belcom LS102L 10W digital mobile as new £225 or will exchange for Trio R600, R1000 or YAESU FRG7700. Mini beam 26-30MHz, 3 element £25 Tel. Reading 696148 after 4pm.

● **CREED 7B** teleprinter working on amateur bands £5 collected. RACAL LF frequency adapter suits RA17/RA117 £60 plus carriage. Homebrew 2 metre 10w FM transmitter mains powered £25 PYE Vanguard transceiver suit 4 metres with control gear £25 plus carriage. S. J. Haseldine G8ERM, Leamington House, Windley Lane, Weston Underwood, Derbyshire. Tel. Brailsford (033 528) 755

● **SX200N SCANNER** mint condition £190 plus carriage 01-886-9363 (evenings).

● **FOR SALE** AR88D receiver clean condition, needs attention £45. Buyer collects. STE APAG R, 70 10M 9432M £70 Little use. C. R. S. Smith, 19 Hyde Road, Kenilworth, Warks. Tel. Kenilworth 54609

● **AVO TT-169** transistor tester new £20 ono. REXEL numbering machine 6-digits 5½ mm consecutive or repeat 1/2/3/4/5/6/12 times £10 ono. Briefcase large capacity brass corners and lock £15 ono. Tel. Norwich 33103.

● **YAESU FT-480R** 2 metre transceiver 144 to 148 MHz includes 2 mobile brackets £295 ono. Trio 9R59DS General coverage receiver 550KHz to 30 MHz £85 ono. Realistic DX-100L general coverage receiver 150KH to 30 MHz 240/12v £75 ono. Realistic Pro-47 VHF/ UHF receiver 68 to 88 MHz, 144 to 174 MHz, 43 to 490 MHz includes 70cm crystals. 240v/12v £75 ono. 70cms mobile antenna £5. M. Veasey, 7 Westmead Close, Heron Water, Droitwich, WR9 9LG. Tel. 0905-771571.

● **RECEIVER FOR** two metres Daiwa SRII. VFO plus 6 crystals controlled scanning channels (no crystals), squelch, 12 volt working. Ring Slough 37323 after 6pm. £30

● **YAESU FR101DD** +2M6M FM digital readout. Hardly used £350 ono. JEAC V9 cassette recorder +30 tapes £130 ono. Zeiss Notorem 8 x 32 BMC as new £75 ono Phone 01500-5395

● **YAESU FT290R** case fibreglass whip charger nicads mobile mount £185 ono or exchange IC25E why 96 JWE. 024 020 660 Bucks.

● **AVO 8MK5** multimeter with case as new cash offers consider exchange CB equipment, shortwave receiver, radio control equipment, tent. Phelps, 35 Belmont Avenue, Hereford HR2 7JQ

● **MY AR88** Good order. Buyer collects £40. Very heavy,bring your mate to assist. Fred Gaplin, 23 Upper Highway, Hunton Bridge, Kings Langley, Herts. WD4 8PP.

● **EXCHANGE** Grundig Video 4000 & blank films. Just serviced by Grundig for HE transceiver or, FRG 770 or any good HF rig. M. Milton, 30 Batford Road, Harrowden. Tel. 64349 after 7pm please.

● **YAESU FT202R2M** 6 channel hand-held, with nicads, charger, speaker mic and aeriel. £85 or swap for 120 channel, AM, FM, USB, LSB, CB. Tel. 021-459-1381

● **FOR SALE** YAESU FJ107 with built in mains PSU mint condition £550 .No offers. Ring 021-730-1762 evenings

● **VEGA** 8 waveband satellite transistor radio complete with batteries new condition £16.00. M. Quirk, 10 Prinn Place, Sunniside, Newcastle-on-Tyne. NE16 5PA.

● **YAESU FT720R** 2M FM mint condition. Original packing £150 ono. Trio/Kenwood TR3200 70CM portable nicads etc RB14 RB14 reverse RB4 RB11 SU18 £90 ono Tel. Weymouth 786930

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● **GRUNDIG SATELLIT** 3000 RX covers all bands VHS, long, med, short waves 160-10 mtrs. Built in BFD large red digital readout on all bands. Perfect condition £100. Also have for sale Eumig R2000 silent projector for all 8mm film formats. Has built in screen, also wall projection. Five speeds 18-12-9-6-3 FPS & freeze frame all on forward and reverse, perfect condition. £60. Elmo Super 110R super 8 movie camera 18-24-54 FPS and single frame. Ten times 200m lens f1.8 7-70mm, also macro. Perfect condition £80. For more details ring Mr Dew, Croydon 01-656-0069.

● **WANTED** for Sommerkamp FT307 antenna tuner, FC107. K. J. Dunkeld, 16 Jefferson Close, Lancaster, LA1 5EZ.

● **FOR SALE** ICOM IC.45IE. ICOM IC240. £575+ £120 for later or exchange for recent HF TCVR and ACCS. Mr J. D. Gibson, 6 May Avenue, Newbiggen by the Sea, Northumberland, NE64 6LA.

● **FOR SALE** Grundig Yacht-Boy (210) FM/SW/MW/LW in immaculate condition one owner £20 ono complete with handbook and detailed circuit diagram. Mr. M. T. Fletcher, 34 Mount Camel, Camelford, Cornwall. Tel. Camelford 212742 (After 6pm).

● **WANTED** Second hand YAESU FRG 7 Good condition. Mr G. Hebden, 34 Kingsway East, Newcastle, Staffs. ST5 3PZ. Tel. 0782 618271.

● **HAM INTERNATIONAL** multimode II 26.965 – 28.305. MHZ.AM.FM. LSB USB. LO.MID. HI 360CH. – AVO CT378A signal generator 2250Mc/s harmonic range 500170 Mc/s sine square switches with manual – SWL convertor 45220 MHZ 440870 MHZ IF 2830 MHZ will swop. All for decent HF transceiver. S. A. Deacon (G6 HVS), 25 Mosely Road, Bebington Wirral, Merseyside. L63 9NT. Tel 051334 6359.

● **YAESU FT102** Fully fitted all options AM/FM extra filters, complete with FV102 VFO MDI base microphone value in excess of £1000+ selling price £925 or exchange ICOM720A plus PSV or something similar Telephone 0202 482074

● **WANTED** Lloydtron Pathfinder 12 bands radio. Delroy Rowe, 9 Marcus Drive, Sheffield 3-9QA.

● **WANTED** Urgently – Owners Manual for Hallicrafters SX100, or 100 Mk2 – must be complete. Good price paid – Details J. Tilley 55 Town Close, Little Harrowden, Wellingborough, Northants NN9 5BD.

● **EXCHANGE** Sankyo sound cine camera (XL400S) and projector (Sound 500), boxed as new. Takes sound/silent super or single 8mm. Wanted 70 CMS Multimode Transceiver mobile/portable FT 790 why or similar. Thame 5121

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● **ARMY WIRELESS** SETS FOR SALE No 19 with HP Amp No 2 various control boxes. No 31 sets, No 38 sets. All complete with aerials, headgear, etc. Genuine collectors items. Would be interested in swopping for similar items. Mike Buckley, 12 Ranmore Avenue, Croydon, Surrey CR0 5QA. Tel. 01 654 2582

● **FT101E** in excellent condition complete with cooling fan £330 ono. Buyer collects or carriage fwd. Also offers for Hokushin HS-HF-5 5 band trap vertical antenna with HF5 R 5-band radial kit. Hardly used. Tel Boston 61952.

● **FOR SALE** 3-ELE Spit Fire Beam £25 or will exchange for a power ATU unit. Please call Garry on Tunbridge Wells 25318.

● HALLICRAFT S40 vintage communication receiver. Good condition. Will exchange for rotator. G6IGH, 30 Glebe Rd., Cogenhoe, Northampton NN7 1NR.

● **WANTED:** Communications Receiver, 500Kc/s-30MHz, will collect. Also for sale, unused Harvard 2 channel hand held CB. £15.50. Also surplus components. Send s.a.e. for list: J. Peck, P.O Box 201, Aylesford, Kent ME20 6TQ.

● **SALE.** Amstrad TS33 hi-fi tower system.Deck, tuner amp, tape-deck in cabinet. As new cost £165. Sell £100 o.n.o. R. W. Hall, 23 Whitehouse Court, Ushaw Moor, County Durham. 3 months old, hardly used.

● **WILL SWAP** Harrier CBX 40 CH FM CB Gap27 ½ antenna 5.5dbg (new). 16 metres 50 coax with PL259s (new) 23ft steel pole. Cossor oscillograph, working order wanted, good receiver or scanner for 2m band. Mr Stuart Tucker, 43 Mayorlowe Ave., Brinnington, Stockport. SK5 8DF. Tel. 061-494 2453.

● **FDK MULTI-750E** 2 metre FM transceiver, in excellent condition. Will exchange for Nato 2000 CB radio or good general coverage receiver. Mr A. Mcmahon, 9 Farley Road, Stoneygate, Leicester LE2 3LD. All letters answered.

● **BIRD 43** Thruline Wattmeter any elements/frequency inserts wanted cash or barter for ex-army equipment. M. J. Buckley, 12 Ranmore Avenue, Croydon, Surrey CR0 5QA. Tel. 01-654 2582.

● **FOR SALE** or exchange, little used Konica T4 35mm SLR camera, auto/manual shutter, priority, lots of accessories, too many to list. £200 o.n.o. Would exchange for good general coverage receiver with S.W. 1.6 to 30MHz. Tony, South London: 01-231 7576.

● **WANTED:** Any two-way radio receiver or transceiver. Must be Pye mobile or portable with aerial. Alaistair Graham, 27 Crichoon Rd, Pathhead, Midlothian, Scotland. Tel. 0875 320 642.

● **EXCHANGE** complete movie outfit, Chinon 809 8 to 1 zoom lens, dual gauge projector, dual gauge editor, motorized splicer, beaded screen, wanted, multimode receiver or transceiver. Cash adjustment if required. Anything considered. Mr Angus Mcleod, 87 Kirklandneuk Road, Renfrew, Scotland. Tel. 041-885 0709.

● **LOWE SRX 30D** receiver, H.F., AM-USB-LSB, as new £120. Also 50 channel scaner, realistic Pro-2002 2 metre – aircraft etc. £150. Lincoln 22524.

● **VINTAGE WIRELESS** sets for sale, Kolster Brandes KB11, Cosmos receiver VR3, Cosmos amplifier A5, Brownie crystal set No. 2, valves, components, crystal amplifier and 45 popular wireless 1930/35. Particulars, offers: Tel. Teignmouth (06267) 4480.

● **FOR SALE:** Datong Multimode Filter FL2 £45, Amtech 300 ATU £20. Both boxed as new. Scopex 4D 10 oscilloscope £125. Wanted FC707 and FP707. Uxbridge 65116, Middx.

● **WANTED:** Two Pye PFI's xtalled for RB14 and RB11. Good price paid for two good working sets. Also wanted, charger and nicads for PFI. Please phone Leigh (Lancs) 0942 675445.

● **SHACK CLEAROUT:** Cossor oscillograph Model 1052, excellent working order, mint condition. Collectors item. £40 o.n.o. Collaro "Studio" tape deck, valve stereo preamp. £10 o.n.o. Phone Bob Mctait, Stevenage 721418.

● **ACORN ATOM** 8K ROM + 3½K RAM via P.S.U. All leads bus socket believed good working order but no guaranties. £100 o.n.o. Might swop. Pete Stephens, 49 Kings Court, Bishops Stortford, Herts. Tel. (0279) 52719 (after 9 pm).

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Impressive new products but the best is yet to come . . .

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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● **THE LEXTON** 20 amp power pack, good condition. £55 or near offer. Phone Ben: 01-316 1224.

● **EUROPA** Transverter with control box, cables, manual, £45 o.n.o. plus postage. G41EY, QTHR. Tel. Cheltenham (0242) 36715.

● **YAESU FT901D.** Recently retubed, now surplus. £550. Receivers Yaesu FR50B £50, Eddystone 740 general coverage £50, Datong Morse Tutors sell or exchange for GDO/Wavemeter or W.H.Y.? Martyn Bold (G45UI), 112 Leeds Road, Mirfield, W. Yorks. 0924 495916.

● **FALCON CB,** Persuadea antenna EA 78/1 SWR meter £35. R. C. Willis, 24 Elizabeth Avenue, Abingdon, Oxon. Tel. Abingdon 27853.

● **SWAP C.B.** Mustang 1000 FM, power supply, S.W.R. meter, power mike, matcher, extension speaker, P.A., test meter, mag mount, antenna, half breed. For a YAESU FRG7 General Coverage Receiver ring (0934) 25512, Weston-Super-Mare, Avon.

● **FOR SALE:** Zetagi BU131 linear 200W SSB, 100W FM/AM, Kc shift fitted, 10 watt. Tel. 0234 711865 or P.O. Box 17, Olney, Bucks Mk46 4JH.

● **TRIO TS120V.** Mint, boxed with manual, H.F., T.X., R.X. 80M-10M £325. Tel. 02934 2210 (Horley).

● **ICOM IC-R70** Receiver with FM board, three weeks old, new cost £529, genuine reason for sale at £470 with manual and original packing. Super performance. Yaesu FRT-7700 ATU brand new, cost £42.55, bargain at £30. Tel. Bulls Green 219 (Herts).

● **MICROWAVE** modules MML 144/25 25W out for 2½in linear «10dB gain preamp, suit FT290R etc. Mint condition, reason for sale. QRO £40 ono. Tel: 01-247 6097 day 01446 4932 evenings. Ask for Dean G6RBY.

● **INTERESTING** vintage wireless items: tuning condensers, chokes, etc. £10. the lot. Also 1920's telephones. SAE to 8 Grafton Road, Cheltenham, Glos. GL50 2ES.

● **DRAKE TC2** 144MHz transverter £150; IC260E £230; Sony ICF2001 £80; Arcos KZRIW 432MHz KW kit, silvered anode circuits, all brand new components including EIMAC 8930's, bases cost £500. Sell £350. G3NSM. Tel: 0865 56321.

● **WANTED:** communications receiver, 1.5-30mcs transistor type. Disabled listener. Telephone Wolverhampton 20636.

● **WANTED:** Good HF VHF equipment plus accessories, for complete portable video outfit JVC S100E camera, Ferguson 3V24 3V23 recorder, tuner 3 hr battery aluminium cases value £2,500, 4 months old. Tel. 0262 78270. May split with cash adjustment.

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● **FOR SALE.** Racal units RA17 REC, RA98, SSB, RA237B converter LF, 168B. Good condition complete with manuals. Lot, £235. Quad E.S.L. speaker. Mint. £100. H. Aston, 103 Westfield Road, Ealing, London W13 9JD.

● **EDDYSTONE 770/R3.** Rx 19-165 mhz CW AM, NBFM & FM 240 Volts £150 o.n.o. B40/D Gen Comm RX 30.5-0.6 mhz modes X-Tal Cal RT SSB FSK £80 o.n.o.
Tel. J. Faulkner 061-969-0785.

● **YAESU FT1** transceiver complete with all accessories and extras. Later version little used £950.00. Phone 0277 823434. 11 Steeple Way, Doddinghurst, Essex.

● **FOR SALE** Eddystone 750 with matching speaker and 'S' meter nice condition. General coverage and amateur bands receiver £85. Tel: G4TBM Lewes 6099.

● **FOR SALE/EXCHANGE.** Yaesu FRG7700. 3 months old £275. HRO £60. BC 348 £50. Trio 9R59DS. £55. Wanted VHF/UHF 770R, 770U. Good preselector, and A.T.V. Milton Keynes 0908 566222 ex 35 8am-2pm. Dave.

● **WANTED** by 'ham' off the air for 34 years. Any extras suitable for FT101ZD, e.g. ATV VFO VSWR scope transverts etc. Sensible prices please. Dennis GW2BLW Llandudno 0492 78325.

● **WANTED** manual for 1132A receiver photostat copy acceptable. Will pay cost and postage on receipt. R. Lees, 134 Raven Court, Bold Street, Old Trafford, M15 5QA.

● **CREED** 15 teleprinter. Good condition with tape perforator. The modern version of the creed, 7B £35 ono. Tunbridge Wells 0892 23458.

● **SALE KW204TX** and KW202RX. Mint condition, seldom used. £200 pair. G4FVR QTHR. Tel. (0723) 74539.

● **FOR SALE:** R.C.A. R155GB 75 k/c-30 MHz. Good condition, ex Govt. Works well. £65 o.n.o. Tel. Bill: 01-597 6116.

● **KW202** Amateur Bands RX, 160-10m, SSB, AM, CW with Q-mult, notch filter, matching speaker and handbook. Excellent condition £135.00. G4KKG QTHR Tel. Yeovil 0935 25327.

● **STANDARD C58** hand portable 2m multimode, spare set nicads, recharger plus wood and Douglas, I.O.W. F.m. linear. Can split. Any reasonable offer: M. Fincher, 11 Chapel Street, tring, Herts. Tel. Tring 5087 evenings.

● **PYE POCKET** phone's transmitter and receiver. Good condition, crystalled on RB10DY £25.00 for the pair. Telephone 0283 815295 after 7pm.

● **KW ATLANTA** 500 Watts PEP with remote V.F.O. Just serviced by KW £200. G3WMU Telephone Brighton 688105 (day); 605704 evenings.

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● **VALVES FOR SALE:** A major collection in two lots. 1) transmitting: 813 2); 832 8); QQV06-40A 4); 8907 2); 4CX250 B 4); £35. 2) About 2000, mostly boxed, ½-¾ probably new; mostly obsolete types from about 1935 to 1950s. £150. Buyers to collect please. G4AXS QTHR. Tel: Barham 381 (E. Kent).

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● **WANTED.** All mode general coverage receiver. Reasonable price or ex-Army equipment working or not. Send details E.D. 218 P.O. Box No. 1 Downpatrick, Co. Down, N.I.

● **COMMUNICATIONS** receiver Tandy DX-302 10KHz to 30MHz quartz synthesised, digital frequency display. As new in original box. Cost £289. For sale £180 ono. M.S. Birkin, 2 St. Mary's Close, Attenborough, Nottingham NG9 6AT. Telephone 0602-259359.

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				GAIN	N.F.			
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10W	50W		MML432/50	12dB	<2dB	13.8V @ 8A	✓	INPUT BNC OUTPUT N
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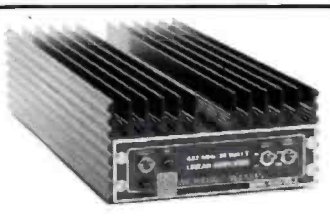

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