# HRT
## HAM RADIO TODAY

Incorporating SCANNERS INTERNATIONAL

MAY 1991 £1.60

# HF SPECIAL
Warm up the Ionosphere

## TOKYO HY-POWER HL-2K AMP REVIEW

Working the World on VHF/UHF

Construction Projects
HF SSB TX Processor,
RX Audio Processor
G3XTT HF Happenings

9 770269 826024 05

AN ARGUS SPECIALIST PUBLICATION

NOVICE • PACKET • REVIEWS • PROJECTS • SATELLITES

# HRT HAM RADIO TODAY

# CONTENTS

VOLUME 9 NO 5 MAY 1991

**Editor**
Sheila Lorek, G8IYA
**Consultant Technical Editor**
Chris Lorek BSc (Hons) AMIEE G4HCL
**Technical Illustrator**
Jerry Fowler
**Editorial Address:**
PO Box 73, Eastleigh, Hants, SO5 5WG
Tel: 0703 262105
(Mon-Sat, 9.30am-8.30pm)
Fax: 0703 263429 (24 hrs)
**Creative**
**Design Manager;** Peter Kirby
**Designer;** Sally Stray
**Photographer;** Manny Cefai
**Advertising**
**Advertisement Manager;** Kaye Ellis
**Advertisement Sales;** Donna Wells
**Classified Sales;** Sarah Church
**Advertisement Copy Control;**
Anne-Marie Quilter
**Management**
**Managing Director;** Terry Pattison
**Circulation Manager;** Debra Stupple
**Group Editor;** Mark Webb
**Group Advertising Manager;**
Paul D'Inverno
**Advertising & Reader Services**
ASP Ltd, Argus House, Boundary Way
Hemel Hempstead, Herts HP2 7ST
Tel: 0442 66551
Fax: 0442 66998
Printed in Great Britain by
Acorn Web Offset, Bradford

**Subscriptions and back issues:**
Ham Radio Today Subscription Dept, Select Subscriptions Ltd, 5 River Park Estate, Berkhamsted, Herts HP4 1HL
Tel: (0442) 876661/4
**Subscription rates:**
UK £19.20, Europe £24.00
Middle East £24.35, USA $48.00
Far East £26.70, Rest of World £25.75
Airmail rates available on request.
**USA Subscription Agent:**
Wise Owl Worldwide Publications,
4314 West 238th Street,
Torrance CA90505
Tel: (213) 375 6258

Member of the Audit Bureau of Circulation



## REGULAR COLUMNS



## REVIEWS



## FEATURES



## PROJECTS



## NEWS AND VIEWS



***STOP PRESS: VK3 QSL Bureau.*** *In last month's HRT, Terry VK3DWZ told us the VK3 QSL bureau was non-operative, and asked readers not to send cards via the bureau to VK3 calls. After checking ourselves with the WIA, they tell us their QSL bureau is in full and efficient operation, and that the letter from VK3DWZ is incorrect. We're not the only magazine to have published this, the letter was simply reproduced in good faith. We're sorry if this has caused any problems.*

# CQ de G8IYA

## *Amateur Radio Newcomers*

Right now, the Novice licence training program is under way, and following the first City and Guilds Novice exams in June we should hopefully be hearing some new '2' prefix callsigns on the air. Chatting to one Novice licence instructor it appears that out of a multi-class group of 12 course students, only one of them could be called a 'child', others being teenagers and older. Hence it looks as if my comments in earlier HRTs of Novices not all being children could be right. My 10-year old however was looking forward to attending the Novice course for his area, so he'd be able to use the 70cm rig he's been promised if he passes the subsequent multiple-choice exam.

### Loadsamoney

Now for him to attend the fourteen sessions of our nearest Novice course plus the accompanying Morse course it would cost him £133 (course fees plus petrol cost only in travelling — bus fares would be higher) plus the purchase of course books at £12.11, the City and Guilds exam fee at a relatively modest £8.95 makes this a sub-total of £154.06, I don't yet know what the Morse exam will cost. As the cost for him to attend the Morse course running alongside is £56, (the Novice course costs him £77) he decided against this for the time being, as all he wants to do at the moment is to communicate through satellites, chat with the occasional Space Station Cosmonaut and have Worldwide error-free communication on packet (he knows the latter can cost him less than £50 for a complete station). Fortunately, he won't need to pay the Radiocommunications Agency a licence fee, at least until he's a lot older. But the fact remains it's still a lot of money for a typical 10 year old to find. Also, did you know there are some counties with **no** instructors at all, making it even more expensive or even impossible for some to travel to their nearest course. Remember, don't shoot the messenger.

Maybe we can find a way to make it more economical for youngsters or others without much in the way of cash to join in. One way could be club-sponsored courses with their running costs provided by fund-raising efforts such as that currently done by radio club rallies and junk sales. Yes, I know there's enough of these events already, so what other methods can you suggest? As always we'll welcome your constructive comments. But could there be another reason for the lack of instructors in some areas? Maybe it's when the 'commitment' aspect combined with suitable premises and the like comes into play that some potential instructors and clubs get frightened off. OK, so the hobby in their area will decline and they won't have anyone new to talk to on the air. So what? . . . . . "let someone else do it" comes the cry!

### Teach your Friend

But how about one-to-one teaching of potential Novices who are the neighbours or friends of current amateurs, with flexible times/locations to suit rather than a fixed time/location? We at the HRT Editorial office have sent in our Novice Instructor registration requests, we're arranging to help out at a local school in an after-hours Novice course. But now for a revelation. Did you know (we didn't) there's nothing to stop **you** registering **just** to teach your youngster/partner/the lad next door if they're interested. Maybe a couple of your friends who you never thought could be interested would like to join in? After a while on the air they might even 'graduate' and eventually register themselves to teach others become Novices.

Hey wait a minute. Very soon if this carries on we'll be having loads of newcomers coming into the hobby. Can't have that can we? We're going to teach our youngsters and our friend across the road as a start, now what are **you** going to do?

### Novice Morse

Following our meeting with the Radiocommunications Agency as reported last month, where they stated they wouldn't accept any mandatory assessment made on the use of Morse code forming part of the Novice training course, the RSGB have kindly written to us to clarify the matter. Prior to this, we at HRT had received a flood of letters from prospective Novices concerned that they must learn the code and "pass" rather than "successfully complete" the assessed course including this, even if they only wanted a Class 'B' Novice licence. The RSGB have now told us that students *"will be introduced to the ways of CW, abbreviations and procedure signals etc. and will be* ***encouraged*** *to try their hand at it. They do not need to learn the Morse code or how to use a key although it may be that some students decide that CW is the thing for them. In the assessment at the end of the course the instructor will merely confirm that the students have completed the listening exercise".* In a subsequent letter they said it was perhaps unfortunate that no distinction had been made by them, and that this would be clarified by the RSGB in a variety of ways in later publications. Our thanks go to the Chairman of the RSGB's Training and Education Advisory Group for this clarification, it's good to see that no un-necessary obstacles are being put in the way of potential newcomers to our hobby, but that an 'all round' approach to the training is still being provided. We echo the RSGB's sentiments to invite anyone interested in becoming either a Novice Licence student or a registered instructor to get in touch for further information. At the time of writing, there are no Novice instructors in the counties of Somerset, Powys, West Glamorgan, South Glamorgan, Dumfries and Galloway, Borders, Western Isles, Orkney, Shetland, Armagh, Fermanagh, Londonderry and Tyrone. So if you're interested, get in touch with the RSGB, you'll see their contact details in our 'Club News' section, and let's help to show newcomers what a great hobby amateur radio is!

### Next Month

Guess what's happening next month? You're going to have a higher quality HRT! All the usual articles and names are going to be there, but you'll find the paper quality is rather a bit better! We listen to what you say.

# LETTERS

## Letter of the Month

Dear HRT
Your remarks on page 5 of the February issue 1991 about the kind of welcome you get at some radio clubs are true, I had the same kind of greeting. Having passed the second paper towards obtaining my B licence, the lecturer advised us to go and join our nearest club, what a farce it turned out to be. I eventually went to whom I thought was the secretary and spoke my mind, returned to my two friends, gathered my coat, explained to them what I had said and we walked out, like you no one said goodnight. I have remained loyal to my CB club since then, I meet several amateur radio operators there who also refuse to join any radio clubs or societies.

I have written many letters to HRT and quite a few have been published. I would like to say to the gentleman in Yorkshire who berated my last epistle that I have passed my exam, as for CW, with all the technological advances that are being made I think, like the youth of this absorbing hobby, it will eventually die a sad but lingering death, no tears will be shed in it's passing, it has served its purpose.
Yours sincerely,
J.H. Clifton, G7IOU.

**Editorial comment**
**I'm glad it wasn't just I who received a 'cold shoulder' at my local radio club. With the need to introduce, and more importantly welcome, newcomers of all ages to our absorbing hobby of amateur radio, we can't afford to dissuade interested people. That's why in our club section we only list active clubs, those who tell us they're actually doing something, because these enthusiastic clubs are often seeking new enthusiastic members to make their club thrive. Other clubs who choose to take a 'private' attitude can then of course remain private, it's their choice of course and we can't force their members to do what they don't want to do! Maybe we both went to one of these?**

Dear HRT,
It is nice to see Chris continuing his excellent series of PMR conversions. Without him (and ex-PMR equipment) I don't think VHF would have had any interest for me, or should I say my pocket. Similarly without the encouragement of people like him and the QRPers (SPRAT etc), I think my 'visit' to amateur radio after 12 years as a professional HF operator and a break almost as long, would have been brief. As it is I have self tutored my way to an 'A' licence in just over a year.

Perhaps you would ask him to apply his skills to the 'P' band Wessie in a future issue. I know you have to clean a pile of low band Europas etc. out of the car after each rally, but I for one aren't so lucky!

Also a survey of the whole ex-PMR market would, in my opinion, be of great interest to many readers. I find the snippets of background info in Chris's book fascinating.
73's Ian Wye G0OKY.

**Editorial comment**
**Thanks for your constructive comments Ian, Chris tells me he's often so busy in promoting amateur radio (in his spare time he's also writing a professional land mobile book) that he overlooks the obvious, and we'll be pleased to feature a 'roundup' of ex-PMR rigs known to be available and capable of conversion. We're also looking for new rigs as well and he'll certainly be covering the 'P' band rig when he gets his hands on some! Right now, we've got a pocket pager (around the size of a credit card) 70cm receiver conversion on the go — very cheap of course, plus a couple of synthesised rigs — so watch this space — amateur radio needn't be expensive!**

Dear HRT
I am a radio ham from the USSR. I have got some HRT magazines and enjoy reading them, I'm upset very much that I could not be subscriber of the HRT. Unfortunately Soviet money is not convertibility currency. I do hope Perestroika will make it possible soon.

I have paid attention to 'Free Readers Ads' column, so I wonder if it is possible to publicise my letter. I would like to exchange a big collection of stamps for different radio things i.e. callbooks, handbooks, aerial books, IRCS, including even receivers, transceivers, linear amplifiers etc. My direct address is USSR 332608, Zaporozhskaya Oblast, Energodar, P.O. Box 34, Nicolai Davidchenko.
73s, 88s and God Bless
Nicolai, RB5GRM

**Editorial comment**
**Thanks for the letter Nicolai, and we hope many of our readers will get in contact with you. For our part, we're sending on a small bundle of books and HRTs, with the hope that you'll soon be able to receive HRT every month as some other USSR amateurs do.**

Dear HRT
I endorse Mr Bradshaw's view on repair charges (HRT February 1991).

When my dual band hand held ceased to function I telephoned the main dealer and talked to one of the engineers. I was told that although it was impossible to diagnose the fault at a distance there was a good chance that the CPU needed replacing and if so the rig was beyond economic repair. Furthermore, labour charges were £35 per hour and one hour's labour was chargeable for diagnosis of the fault, refundable if a repair was subsequently carried out. This was small comfort in view of the possibility of the rig being a write off. £35 plus carriage plus VAT was, in my opinion, a little too much to pay for such confirmation!

I decided to look elsewhere and found a much more reasonable package was offered by another firm. I was told that labour charges were £18 plus VAT per hour, no charge was made for fault diagnosis and that normally most repairs could be done within an hour.

Happily the result was that only minor repairs were neccessary and the total bill, labour, parts and carriage, was a little more than the main dealer's charge for one hour's labour.

As a relative newcomer to the hobby

## £10 for the Letter of the Month

Do you have something constructive to say on the state of amateur radio today? Perhaps you'd like to put your viewpoint to the readers, get some discussion going, or give an answer to one of the issues raised? We'll pay £10 for the best letter we publish each month. So write in with your views, to HRT, P.O. Box 73, Eastleigh, SO5 5WG.


I am dismayed at the apparent uniformity of prices of equipment between retailers. I am, however, pleased that there is competition that benefits amateurs in the repair field and I hope that my experience will encourage others to shop around.
Yours faithfully
Morrice G7HDQ.

**Editorial comment**
**Well you said it, we have a choice and we can vote with our feet. Remember though that there's a lot of people out there who have the idea it's easy to make money, and as such don't count overheads such as regular engineer training and adequate test equipment — be careful to compare like with like, long established firms don't become so through offering poor and expensive service. Like the 'back street car repairer' who can often undercut a main dealer, a very good job often results, at other times it can be a different state of affairs due to lack of specialised information and test gear.**

Dear HRT
Thank you for a great radio magazine, I look for it on my local shop shelf each month.

I have after more than 20 years thinking about it, decided to take the RAE, and am looking forward to making full use then of the many aspects of Ham Radio.

The reason I am writing is to say that I feel something is slightly wrong somewhere with the RAE exam, as I cannot completely see how it stops all hell breaking out on the bands. Look at it this way, you learn what a transformer does, what coax cable looks like and learn what the resistors do inside your fab TX/RX, OK no problem so far. But then after passing your test you can go out and buy say the latest TX on the market, like the Yaesu FT-736 full of buttons etc. which does everything apart from launch the latest amateur satellite, it looks so complicated to use that you could be doing something wrong like wiping out stations within a 50 mile range of you. What I am saying then is where do you learn to get the very best, safely and wisely, from your brand new TX, without snags? I am now wondering if the reason why the VHF bands are so quiet is because the radio gear is so hard to use these days, and not as I was thinking the high cost of gear.
David Webb, Spalding.

**Editorial comment**
**Well David not *all* gear for VHF is hard to use, in fact the use of one of the HRT ex-PMR conversions really couldn't be simpler with just a volume control, a squelch control, and a channel switch, how much simpler can you get? Certainly there *are* sophisticated do-everything transceivers for the enthusiast amateurs who want a variety of operating modes, such as automatic 2m/70cm satellite tuning and the like (listen to Oscar 13, it often sound like 20m with all the activity floating around!), but for normal 2m SSB use something like a Liner 2 (remember those? - there's still plenty around second hand) or even an FT-290 can't really be classed as being so difficult to use as to put people off operating.**

**There are plenty of books which give details of operating on the bands, and you'll soon see that in our monthly 'Novice Notes' we periodically 'un-fathom' the mysteries of up to date gear complete with all it's bells and whistles. However, you're quite right in that the RAE does not currently test one's knowledge of operating a radio, unlike for example the current UK test for a VHF Maritime Certificate where you have to undergo a couple of simulated contacts which include the use of several front panel controls on a 'mock-up' transceiver.**

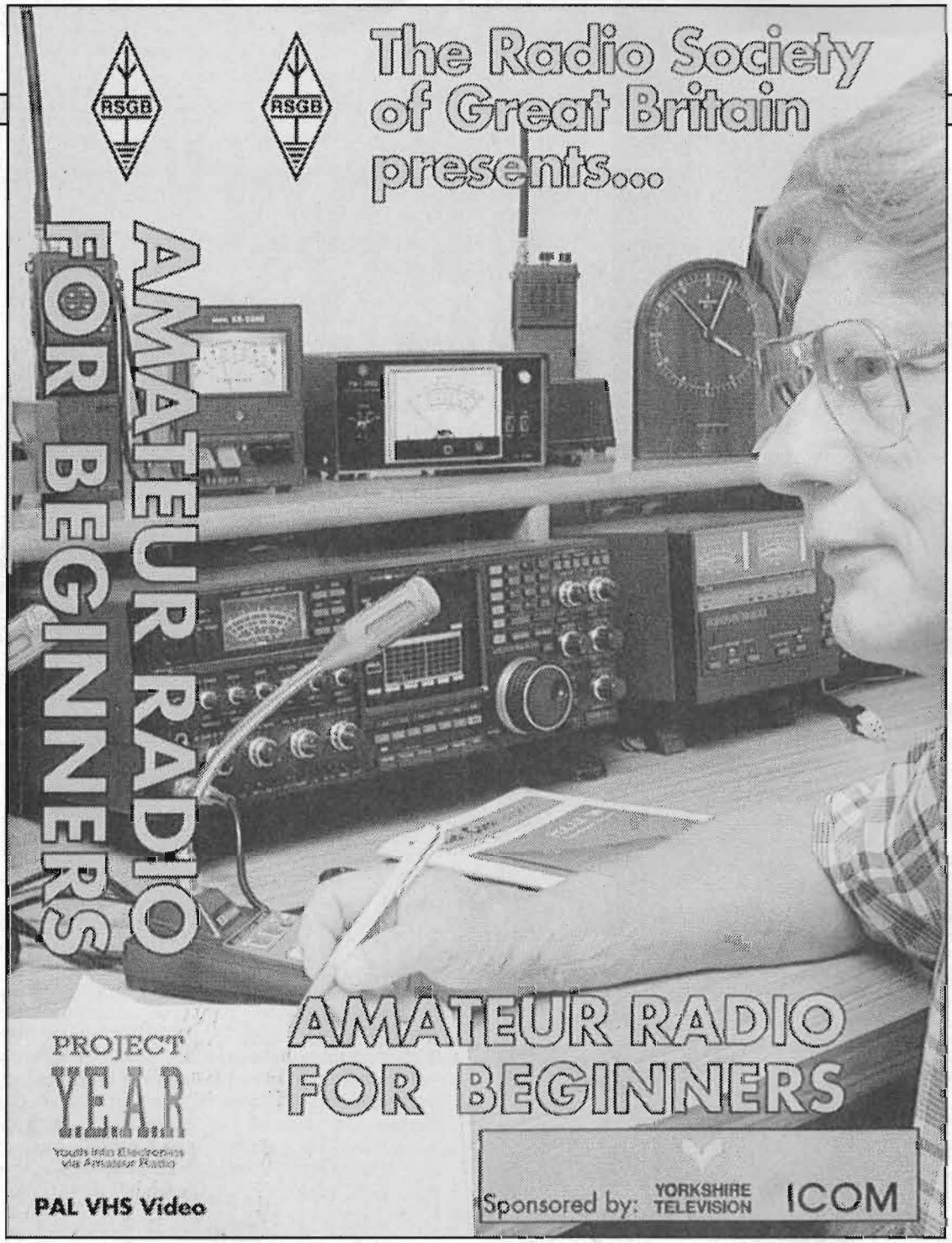
Dear HRT
As a long time reader of Ham Radio Today, I must say how much I enjoy your 'new look' magazine. As you rightly say, not all is rosy in amateur radio and I would like to comment on repeater abuse. This is not a new problem, but I am concerned that not much seems to be done to stop it. However, it would be folly to leave it to the RIS, who could decide to ban repeaters altogether, then perhaps satellite operation, or Packet Radio, neither of which are free of the 'Wallies'.

Radio Amateurs must either show a large degree of responsibility to the licensing authority or risk having restrictive legislation passed for their 'benefit'. They can assist the RIS in finding the culprits, after all they are on site so to speak and often may have some idea of the identity of these idiots.

Penalties must include confiscation of all radio apparatus, a substantial fine (which can be used to fund further investigations) and a ban on holding a transmitter licence, or revocation of an existing licence if one is held. (Other less pleasant punishment could include being forced to listen to some of the inane chatter on the LF bands, but I digress!!).

Finally, after having split vitriol, good luck to anyone involved in getting young people interested in our hobby. These people deserve all the help they can get, and I am pleased to see that HRT seem committed to providing it. Keep up the good work.
Larry Stringer, G4GZG

**Editorial comment**
**Some abusers of the radio spectrum, including amateurs, *do* get caught *and* convicted, *and* get fined, *and* get their gear confiscated. But like the Police, the RIS division of the RA do need the help of the public, i.e. us, don't expect them to do everything. Also, abuse isn't just confined to VHF by any means, just listen to the frequencies of amateurs calling some HF DXpedition stations and you'll soon see. In the USA, amateurs are even being taken to court by other amateurs for allegedly causing deliberate interference on HF. Why should someone restrict abuse to their locality when they can spread it worldwide for the same outlay?**



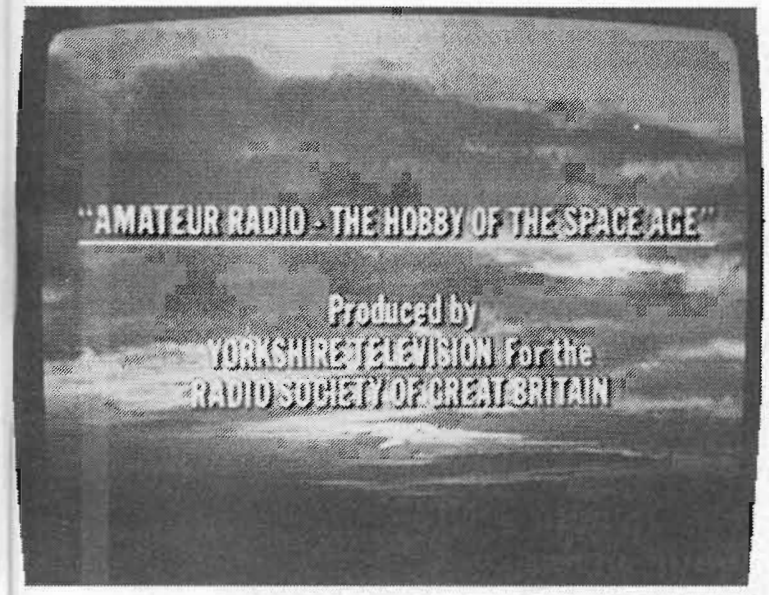

## RSGB 'Amateur Radio for Beginners' Video

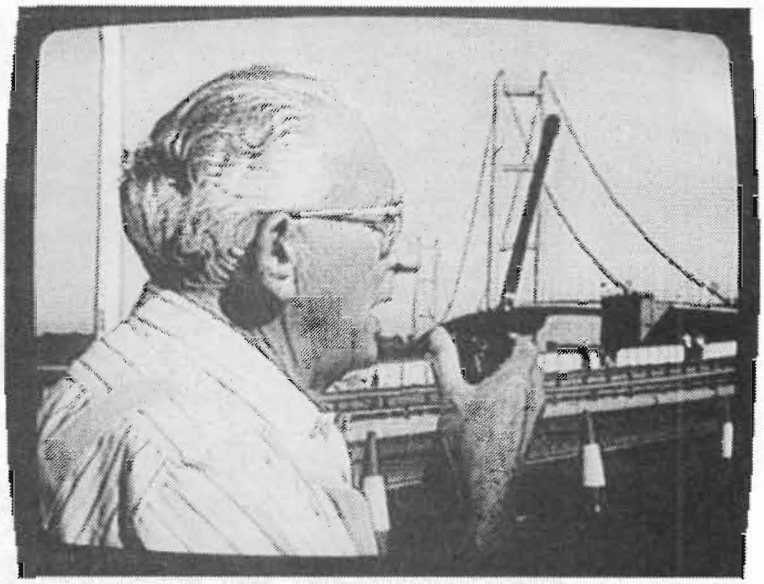
Recently at HRT we were pleased to receive a copy of the RSGB's Project YEAR (Youth into Electronics via Amateur Radio) video tape, into the video it promptly went!

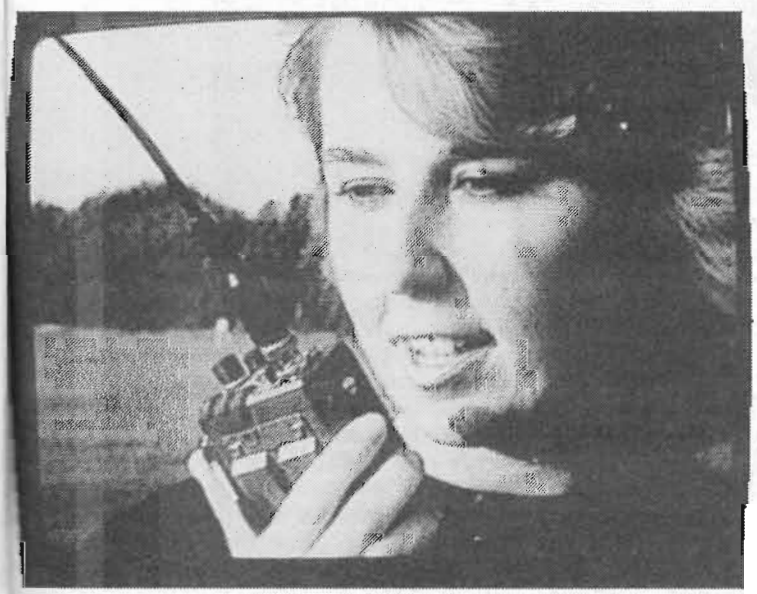
As briefly detailed last month the video is in two parts, each of just over 20 minutes. The first part is the 'appetiser' giving an enthusiastic presentation of amateur radio as a pastime that can be enjoyed by any age group, the second part being the 'how to get going' section giving viewers an introduction to the practical aspects of the hobby, operating, and how to go about becoming a radio amateur. The production features amateurs of all ages, newly-licensed teenagers through to retired and disabled amateurs all enjoying their hobby to the full, with the 'commentator' (if you could describe him as that!) being that well-known TV weatherman Jim Bacon G3YLA. Even the memorable background music with a 'hint' of a 'CQ' message was specially produced for the video.

Virtually every type of amateur activity is shown, QRP, HF, VHF, SSB, CW, FM, Packet, Satellites, Contests, Space Communication, Raynet, you name it, there it was! We're amazed how they fitted so much in. Teenage amateurs chatting on both HF SSB and VHF FM, young ladies operating around the world through Oscar 13, Scouts watching instructors showing them 'how it's done', mature amateurs participating in a Raynet exercise, packet operators downloading messages from a local BBS, even Jim Bacon showing how a Pye Pocketphone 70 ex-PMR rig can get you on the air cheaply, it was all there!

The 'White Rose' radio club is featured together with several other amateurs and groups, together with giving the viewer a quick 'tour' around a radio rally and showing a selection of offerings, both cheap and expensive, from typical amateur radio dealers. Speakers from professional radio communications firms and a college detail how an interest in the hobby can lead to a successful career, as well as increasing one's knowledge of geography and the like. An on-air school classroom session is also featured showing younger viewers how they can enjoy amateur radio as well.

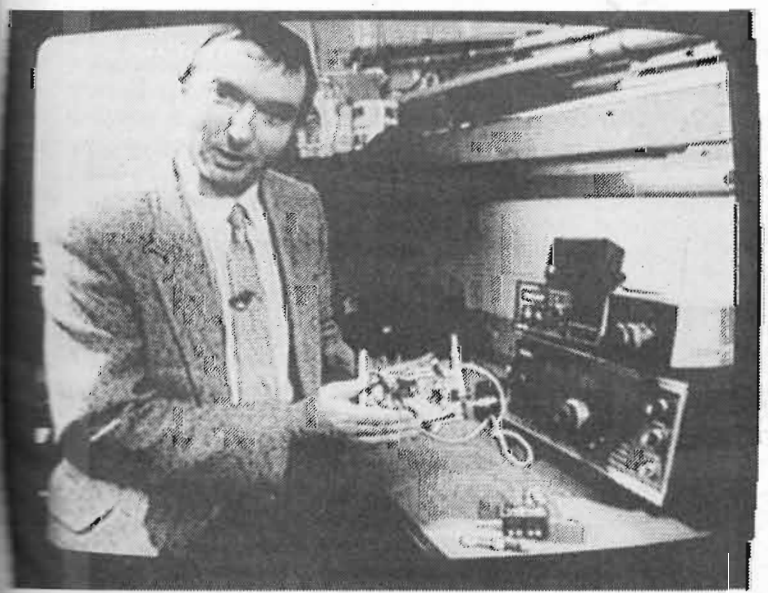


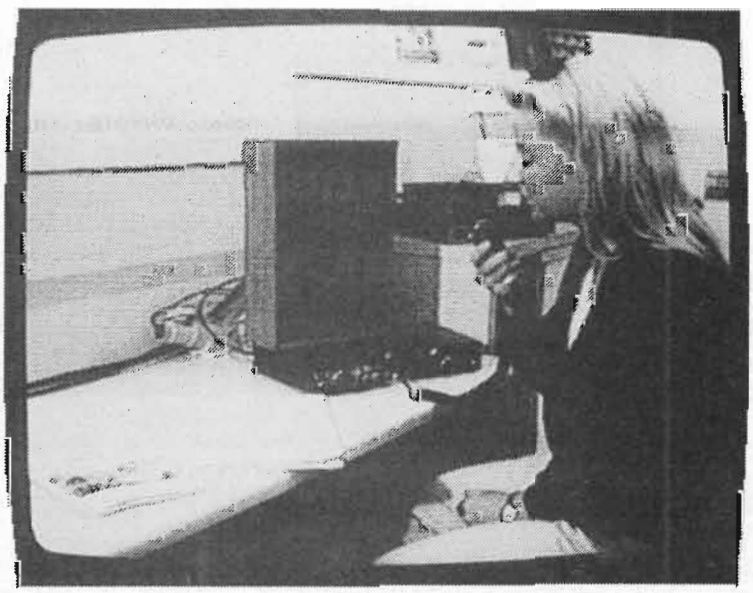





The video was initiated by David Evans G3OUF of the RSGB, and following a visit by him and the then RSGB president Joan Heathershaw G4CHH to Yorkshire TV, the TV company generously offered to sponsor and produce the video. *(A little bird tells me that three of the YTV production team became so interested that they now plan to take the RAE!).* Once it was made, it had to be duplicated and distributed of course, here's where Icom UK came in with their offer to sponsor the manufacture of hundreds of duplicate videos which are being sent out to RSGB affiliated clubs, free of charge, as part of the Project Year initiative.

We at HRT congratulate all involved with the Project YEAR video, especially the scriptwriter Victor Brand G3JNB. It's a great introduction to the hobby, one which we're sure will give amateur radio a great boost. Why not go down at watch it at your local club? Better still, take your non-amateur friends along with you. The RSGB tell us the video will not be sold, but copies will be made available to those who care to make a donation of not less than £10 to the Project YEAR fund. As for the HRT copy, right now that's being used by our teacher friend at a large Southampton school to introduce our hobby to his students, and with the help of HRT the school is now considering running an amateur radio introductory course for it's pupils!



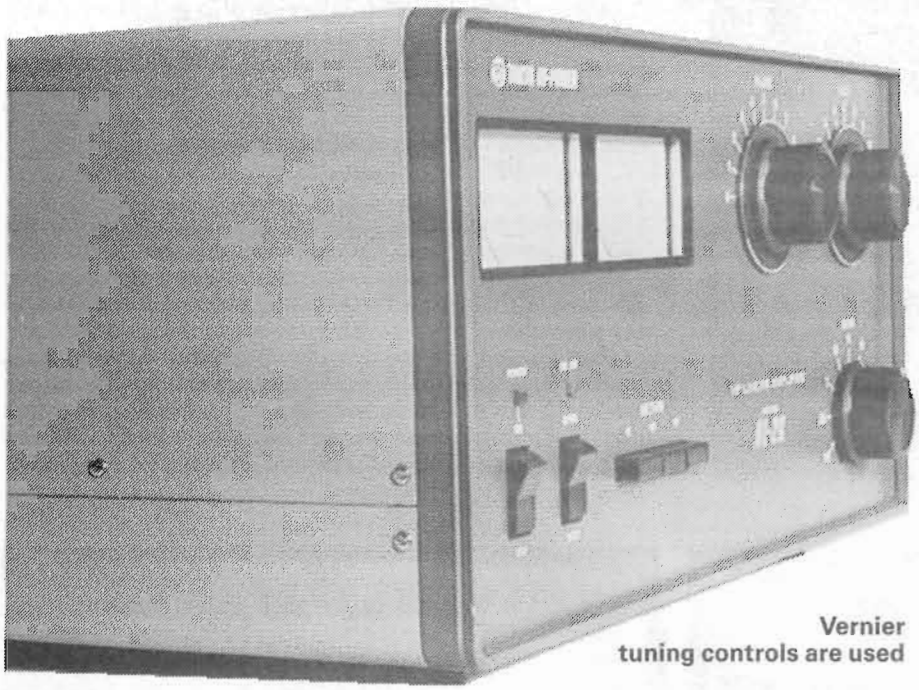


# HL-2K HF Linear Review

Ask many self-respecting HF DX chasers what they use in their 'finals', and the answer you'll probably get is the 3-500Z triode or indeed a pair of them. Few hardened DXers run 'barefoot' or QRP, and although the latter can prove a challenge, to many the way to 'punch through' on HF is to use a linear amplifier.

***Chris Lorek G4HCL warms up his shack as well as the airwaves***


The HL-2K Linear



Vernier tuning controls are used

## Twin Triodes

In true form the Tokyo Hy-Power HL-2K runs a pair of Eimac 3- 500Zs to provide a maximum power output of 1.2kW PEP from a nominal drive of 60-120W, the inherent valve linearity and robustness allowing a very 'clean' 400W PEP output at your aerial terminal to be achieved with ease. The amplifier operates on all bands from 160m to 10m, with switched positions for each frequency range including the WARC bands (10.1MHz, 18.1MHz and 24.9MHz).

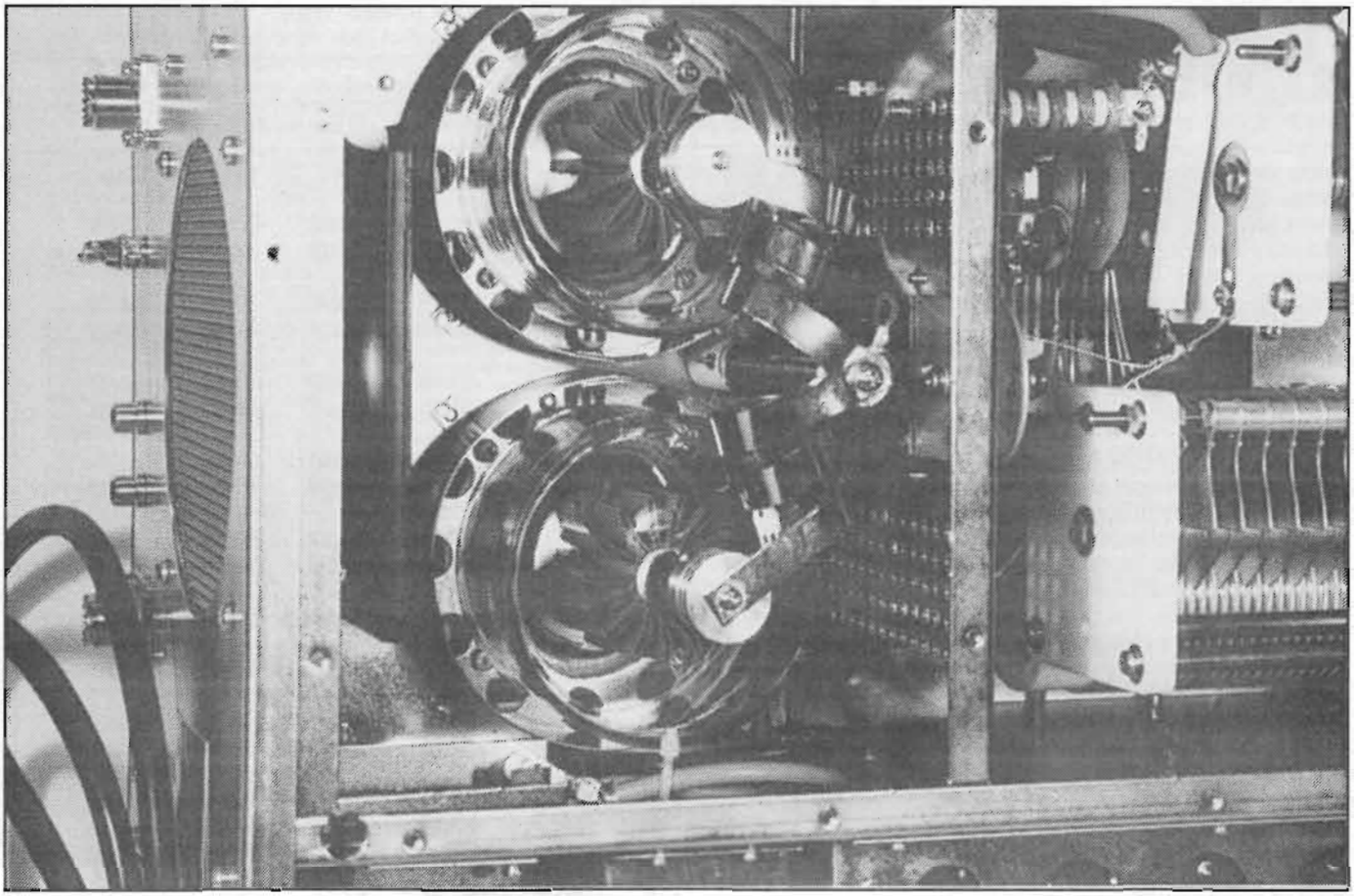
The amplifier comes well packaged in a very large box, the valves being housed separately in foam-padded boxes (they otherwise tend to make lovely smashing noises in transit!). The first thing the manual tells you to do is to install the valves, however I'm informed from the UK suppliers that each amplifier is tested in their service workshop prior to UK dispatch, hence for personal callers they're happy to simply leave the valves installed after testing.

## In The Shack

After nearly getting a hernia lifting the box out of my car (with the unit weighing 35kg, the suppliers sensibly used a trolley!) I got it up to the shack and connected up. As only RF input, RF output, and TX key lines were needed this was a simple job, an ALC output was also available to provide a variable negative-going voltage to the driver transceiver if required to prevent overdriving. Switching on gave me rather a surprise, why couldn't I hear anything? The fan was extremely quiet, my shack- resident single 3-500Z amplifier making far more noise! (I'm looking forward to trying the unit's 'little brother' the HL-1K with it's single 3-500Z at some future date).

So I selected my external dummy load and fired up on 20m to get a 'feel' of the tuning, with vernier drives employed for both the Plate and Tune controls, tuning-up was very nice. Following the usual low drive test I applied 100W drive, a quick touch-up of the controls, and my load was getting nicely warm with the measured 1500W coming out of it — very nice! I found the tuning controls were very broad on 160m, lesser so on 80m, and on other bands well defined peaks were achieved. Two large meters are fitted, the first shows the anode current (0-1A with a red marker above 800mA), the second allowing selection of grid current (0- 500mA), anode voltage (0-5kV), or output power (0-2kW), I found the latter power indication to be very accurate in use.

Connecting the rear mounted ALC connector to my transceiver's ALC input then allowed me to adjust the rear panel mounted pot to achieve exactly 400W maximum, so now for some fun on the air.



The 3-500Z Triodes

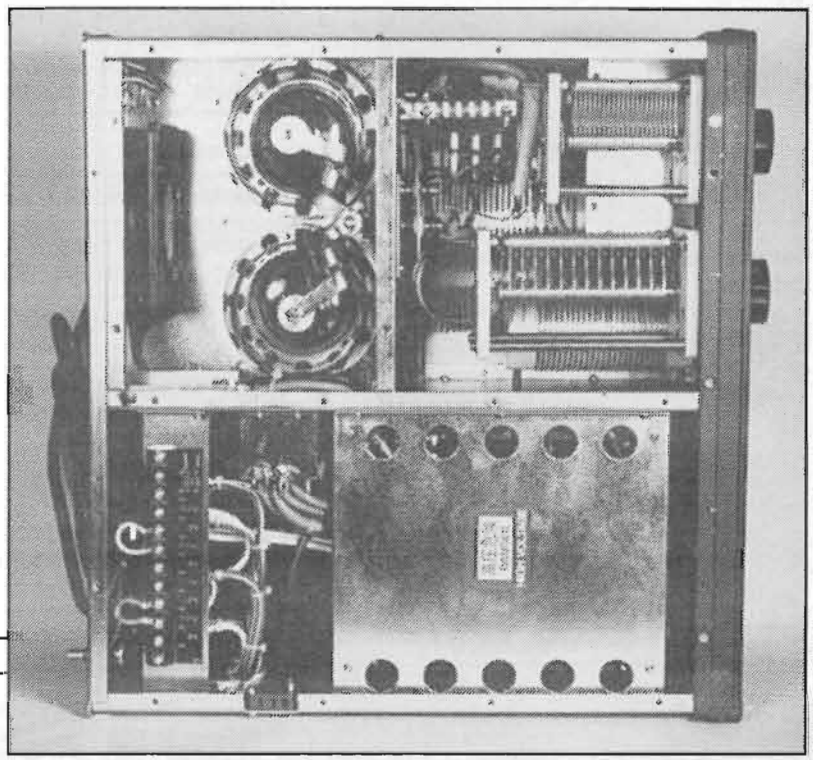
## CQ DX, CQ DX

In use the amplifier performed without fault, the expected several dB in signal strength increase being evident at the far end in each case. In use I tended to turn my maximum output power down to around 40W to prevent hitting the ALC, with this I found there to be no difference in report of signal 'width' with the amplifier switched in or with it out with the rig at maximum power, with a typical report of 'you're just a lot louder now OM!'.

Despite the fan being very quiet it was certainly shifting some air, the shack warming up nicely from the golden glow of the 3-500Zs I could see through the top panel ventilation slots (what a wondrous sight!), the metal front panel also becoming quite warm in use. After switching off, the fan stayed on for a couple of minutes or so to ensure the valves cooled sufficiently, a nice touch which should hopefully prolong their operating life somewhat.

## Insides

The HK-2K uses the 'classic' grounded grid arrangement with pi-section input tuned circuits, the valves operating in class AB2. Opening the unit up showed a double-screened construction, removing the top lid revealing a further screened panel, removing the many screws on this then allowing access to the PA compartment, further lids screening the HT supply section. A 3.4kV HT is derived from a large HT transformer and bridge rectifier (no voltage doubler is used), with a separate heater and LT transformer used. Removing the inner screen enables a safety cutout, which as well as shorting the HT supply to chassis also open circuits the input mains supply to prevent nasty accidents. The amplifier came supplied with 'proper' three core UK mains cable, the amplifier linked for 240V AC operation, however it may also be internally linked for lower voltages such as 120V if required. An 18 page manual comes with the unit, detailing installation, operation, tuning hints and faultfinding information together with a full circuit diagram.



Inside the unit

## Laboratory Tests

Firing the amplifier up in the lab gave the accompanying results, as with other 3-500Z amplifiers I've tested the linearity was quite good, with plenty of output power available. Harmonic levels were well suppressed due to the inherent pi-section output matching arrangement, and throughout the measurement I found the amplifier would happily run a constant 1kW+ output without complaining — the only thing getting too hot was the large attenuator feeding the spectrum analyser!

## Conclusions

An amplifier built like the proverbial 'battleship', weighing nearly as much it needs to be! It worked well, uses a 'classic' design similar to other well-known HF amplifiers, and it looks smart with its grey facia nicely matching most rigs nowadays. With a very quiet fan, I hardly even noticed it was switched on, apart from putting a much stronger signal out across the globe of course.

*My thanks go to South Midlands Communications Ltd. for the loan of the review amplifier.*

**Service department tests before delivery**

## LABORATORY RESULTS

**Two Tone SSB IMD Products**

*Measured at full output, figures shown as dB below PEP.*

| Freq. | 3rd | 5th | 7th | 9th | 11th | 13th |
|---|---|---|---|---|---|---|
| 1.9MHz | -31dB | -39dB | -50dB | -52dB | -54dB | -53dB |
| | -32dB | -39dB | -53dB | -54dB | -60dB | -54dB |
| 3.5MHz | -30dB | -38dB | -51dB | -43dB | -55dB | -54dB |
| | -31dB | -36dB | -54dB | -46dB | -60dB | -56dB |
| 7.0MHz | -34dB | -37dB | -51dB | -48dB | -58dB | -52dB |
| | -34dB | -35dB | -52dB | -51dB | -59dB | -54dB |
| 10.1MHz | -31dB | -38dB | -49dB | -48dB | -54dB | -53dB |
| | -32dB | -38dB | -50dB | -49dB | -58dB | -53dB |
| 14.0MHz | -31dB | -36dB | -49dB | -50dB | -53dB | -52dB |
| | -31dB | -35dB | -50dB | -53dB | -55dB | -55dB |
| 18.1MHz | -32dB | -33dB | -53dB | -48dB | -53dB | -53dB |
| | -32dB | -33dB | -52dB | -52dB | -58dB | -54dB |
| 21.0MHz | -33dB | -32dB | -58dB | -48dB | -53dB | -53dB |
| | -30dB | -33dB | -52dB | -50dB | -59dB | -55dB |
| 24.9MHz | -30dB | -35dB | -63dB | -48dB | -52dB | -51dB |
| | -32dB | -34dB | -53dB | -55dB | -55dB | -52dB |
| 28.0MHz | -31dB | -45dB | -58dB | -52dB | -51dB | -53dB |
| | -34dB | -41dB | -58dB | -54dB | -53dB | -55dB |

**Harmonics**

| Freq. | 2nd | 3rd | 4th | 5th | 6th | 7th |
|---|---|---|---|---|---|---|
| 1.9MHz | -49dBc | -69dBc | -76dBc | <-80dBc | <-80dBc | <-80dBc |
| 3.5MHz | -51dBc | -66dBc | -74dBc | -75dBc | -66dBc | <-80dBc |
| 7.0MHz | -49dBc | <-80dBc | <-80dBc | <-80dBc | <-80dBc | <-80dBc |
| 10.1MHz | -52dBc | <-80dBc | <-80dBc | <-80dBc | <-80dBc | <-80dBc |
| 14.0MHz | -56dBc | <-80dBc | -78dBc | -69dBc | -77dBc | -47dBc |
| 18.1MHz | -55dBc | <-80dBc | -63dBc | -61dBc | -64dBc | -65dBc |
| 21.0MHz | -55dBc | -70dBc | -55dBc | -45dBc | -48dBc | -67dBc |
| 24.9MHz | -61dBc | -67dBc | -73dBc | -58dBc | <-80dBc | <-80dBc |
| 28.0MHz | -58dBc | -60dBc | -59dBc | <-80dBc | -73dBc | <-80dBc |

**Input Match and Output Power**

*Standing Wave Ratio at amplifier input terminals, and single tone output power, measured with 100W drive power.*

| Freq. | I/P SWR | O/P Power |
|---|---|---|
| 1.9MHz | 1.1:1 | 1.25kW |
| 3.5MHz | 1.1:1 | 1.35kW |
| 7.0MHz | 1.0:1 | 1.50kW |
| 10.1MHz | 1.0:1 | 1.50kW |
| 14.0MHz | 1.1:1 | 1.35kW |
| 18.1MHz | 1.1:1 | 1.40kW |
| 21.0MHz | 1.3:1 | 1.30kW |
| 24.9MHz | 1.3:1 | 1.25kW |
| 28.0MHz | 1.3:1 | 1.20kW |

# UHF Pye Olympic Conversion

*G4HCL shows how the M212 UHF Olympic can find a new lease of life on 70cm*


**The M212 Olympic**

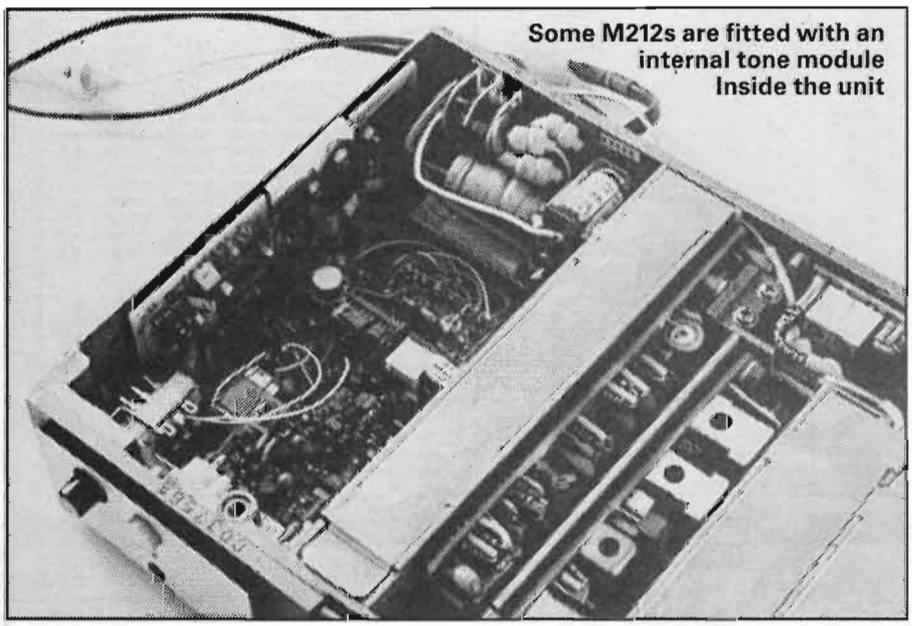
Following on from last month's conversion on the VHF Olympic, here's details on the UHF version together with a few modification hints and tips.

The UHF Olympic (model type M212) can most easily be distinguished from the VHF version by the BNC aerial connector on the rear, VHF models instead having a chassis-mounting SO-239 socket. The rear panel frequency label will probably also show the original frequencies of operation. The M212 comes in single, 6, and 12 channel versions, operating on one of the following frequency ranges;

*T1 Band; 405-440MHz*
*U0 Band; 440-470MHz*

'U' band transmitters will normally tune perfectly but the 'U' band receivers will be at the extreme lower edge of their tuning on 70cm and hence sometimes will 'just about' stretch, but they should still be adequately sensitive. All UHF Olympics were built for 20kHz or 25kHz channel spacing, hence making them suitable for amateur use without crystal filter changes.

Many ex-PMR M212s come with a tone unit plugged into the left hand side of the facia, often for 'community repeater' operation around UK cities. You'll need to remove this module by inserting the end of a small screwdriver into the hole on the lower front of the unit's facia, then withdrawing the tone unit from the front of the transceiver, you'll find this easier to do with the case lids removed.



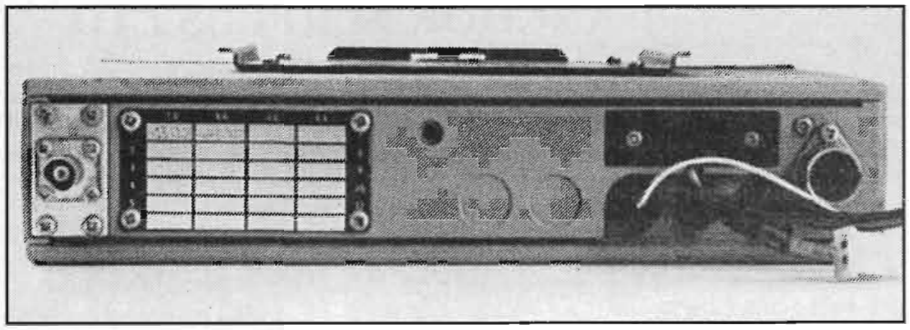
**Some M212s are fitted with an internal tone module Inside the unit**

## Preliminaries

First remove the facia by pushing the latching On/Off switch upwards, then with a suitable object pressed into the small hole at the right of the front panel, hinge the panel forwards and remove it. Now undo the two screws at the front of the top lid and remove this also. You won't need to unplug any of the sub- boards apart from the crystal oscillator board, but you may find some tin plate screens above the boards, remove these and place them to one side. If you have a tone facility board fitted, remove this and link pins 8 and 12 on the 15-way connector at the rear of the internal socket, pin 1 being the pin nearest the case side. Some units may also need a PTT Link between pin 7 and mic connector pin 3.

## Connections

The microphone socket is wired as;
Pin 1; Mic live,
Pin 2; Screen,
Pin 3; +10V for TX,
Pin 4; Earphone Audio,
Pin 5; +10V
Note this socket is wired with pins 1-5 in a logical sequence, rather than the wiring standard used on DIN sockets. You'll need to connect an external 3-8 ohm speaker to the flying lead connector from the rear panel (with blue/brown insulated wires), the larger Red/Black wires being the 13.8V supply leads. You may find a thinner white wire — this is for 'ignition switching' and you'll need to connect this to the positive supply to power the set on. If you see a 15-way D-type socket on the rear panel, this is linked to the internal facility socket to allow other tone units to be connected so don't worry about connecting anything here.



**Rear Panel Connections**

## Packet

The M212 is ideal of course a single-channel packet rig,
all connections to your TNC being available on the microphone connector. If you'd like a 'squelch open' signal, pin 2 on the facility board connector is a 'busy' lamp control, this point being 0.5V squelched, 1.5V unsquelched, and may be fed via. a resistor to control the base of an NPN switching transistor for squelch detection.

## Crystals

The crystals used are HC25/u size, the commercial specification being T64JO for both TX and RX. The crystal frequencies required for 70cm are;

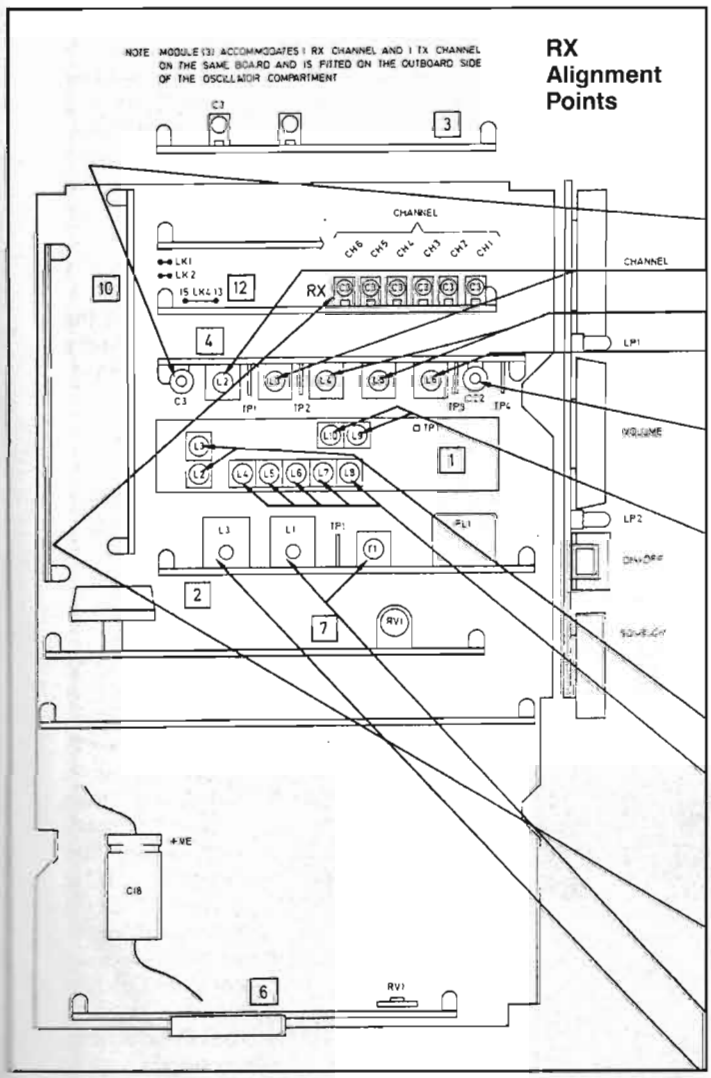
$$\text{TX Xtal Freq} = \frac{\text{TX Freq}}{27}$$

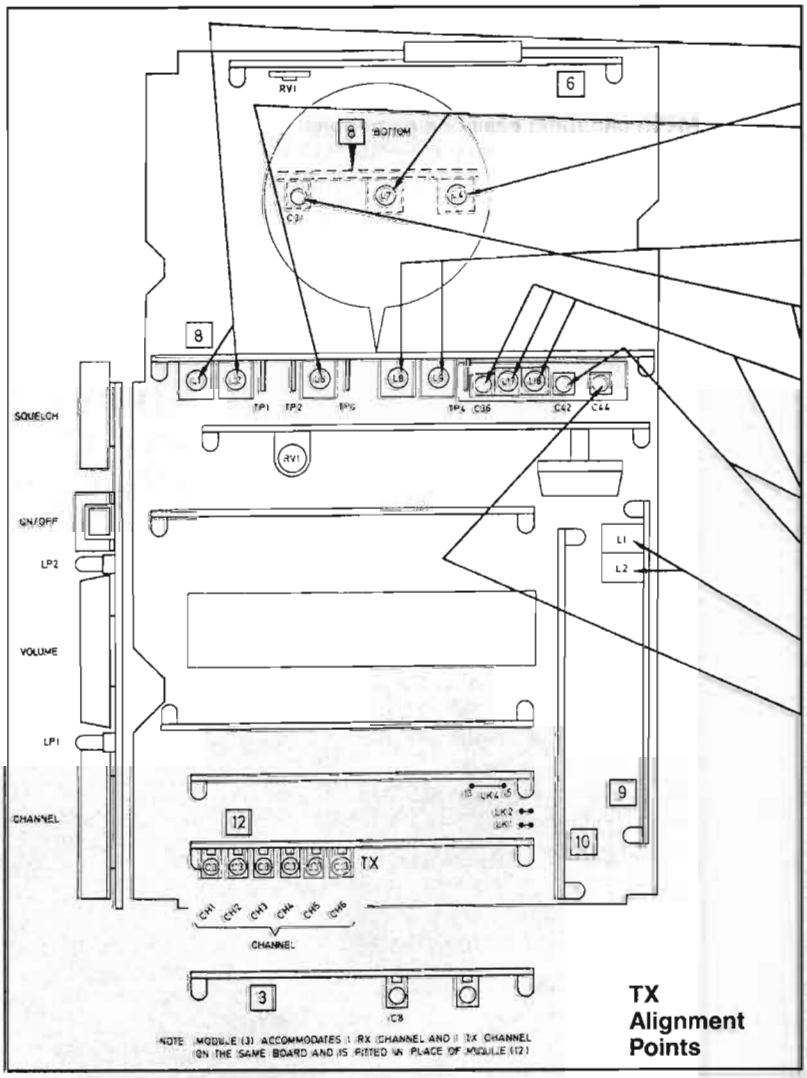
$$\text{RX Xtal Freq} = \frac{\text{RX Freq} + 21.4\text{MHz}}{27}$$

In single-channel sets, you'll find a single PCB with a couple of crystal sockets are used, with two wire links LK2 and LK4 being used on the motherboard in the oscillator compartment to bring this in operation. On multi-channel sets two boards are used, one each for TX and RX oscillators, with a single link LK1 used instead of the two other links.

## RX Alignment

You'll need a non-metallic tool to adjust the various cores in the receiver and transmitter, **don't** use a metal tool — you'll easily break the fragile ferrite cores! On the Oscillator- Multiplier PCB (board 4) first adjust the ferrite cores so they stick up around 3mm above the tops of their formers. Connect power and switch on. Switch your multimeter to the 2.5V DC range, connect the negative meter lead to DC supply negative and the positive lead to TP1 on the Osc-Mult board, and on your crystalled channel tune C3 on this board for maximum reading. Transfer your multimeter positive lead to TP2, and tune L2 and L3 for maximum reading, choosing the tuning point with the core at its inner position.



Transfer to TP3, and tune L4 and L5 for maximum, again choosing the tuning point with the core at its inner position. Transfer to TP4, and likewise tune L6 for maximum. Keeping your meter lead connected to TP4, re-tune C3, L2, L3, L4, L5 and L6 again for absolute maximum, then adjust C22 at the end of the PCB for minimum reading on your meter.

Now with your meter set to its lowest DC range (you'll be reading around 0.2V peak) connect the meter positive lead to the set chassis, and the negative lead to TP1 on the front end PCB (board 1). Using your non-metallic trimming tool tune the cores of L9 and L10 for maximum reading, then re-tune C22 slightly for absolute maximum.

If you're using a 'U' band set, first adjust the remaining front end coil adjusters so they're at they're about one turn above their lowest positions, you'll find this brings them almost onto 70c, but leave them at their original positions if yours is a 'T' band set. While receiving an off-air signal, adjust the crystal trimmer first for best reception, then on the front end tune L2, L3, L4, L5, L6. L7 and L8 in that order for best signal, reducing the signal level as needed as you progress. Re-tune for absolute best quieting on a weak signal, then slightly re-tune L9 and L10 as needed. Re-check your crystal trimmer adjustment, re- adjusting on each channel if you have more than one selected, and that's it for the receive side.

## Transmit Alignment

For this need to remove the lower case lid to get to some of the tuning points, so do this and then apply DC power, remembering to connect the aerial socket to a suitable 50 ohm load — don't tune up into an open circuit! Connect your multimeter negative lead to the DC supply negative, switch to the 10V DC range on the meter, and connect the positive lead to TP1 on board 8, this is the TX multiplier board just to the right of the facility module housing.

With the set in transmit mode (short pins 3 and 5 together on the microphone socket for this), tune L1 and L2 on the multiplier board with your adjustment tool for maximum voltage reading. Transfer to TP2, and tune L4 for maximum (from the case underside), then re-adjust L1 and L2 again slightly for maximum. Transfer to TP3, and tune L6 and L7 for maximum (L7 from the underside), re-adjusting L4 slightly for absolute maximum again. Transfer to TP4, and tune L8 and L9 for maximum, then go back and slightly re-tune all these again for absolute maximum reading on TP4.

Now if your is a 'U' band set, first adjust the cores of L17 and L18 almost to be bottom of their travel, otherwise with a 'T' band set leave them in their original positions. We with a diode probe (if you haven't got one see the next paragraph) connected to the metal adjustment slot of C36, tune C31 (from underneath) for maximum reading. Transfer the diode probe now to the metal adjustment slot of C42, and tune C36, L17 and L18 in that order for maximum reading. The coil pair of L17 and L18 are a band pass filter, when tuned these two will be in around the same positions in their formers. Now connect your diode probe to the adjustment slot of C44 and tune C42 for maximum reading, and keeping your diode probe on this point, slightly re-tune C31, C36, L17, L18, and C42 as required for absolute maximum reading.

No diode probe? Well don't worry too much (remember you can easily make one of course), because you can tune the initial stages by listening on an adjacent receiver (e.g. handheld or scanner) for maximum received strength of the 'leakage signal', followed by maximum current drawn with your ammeter in line with the DC supply to the set.

Now keeping an eye on your RF power meter (or DC current in- line meter), tune L1 and L2 on the rear panel mounted PA board for maximum RF power, re-tuning C44 for absolute maximum. Finally, set your crystal trimmer as needed to put you spot on channel, then set your peak deviation using RV1 on the audio board alongside the TX driver board. That's it, you now have a fully working UHF transceiver.

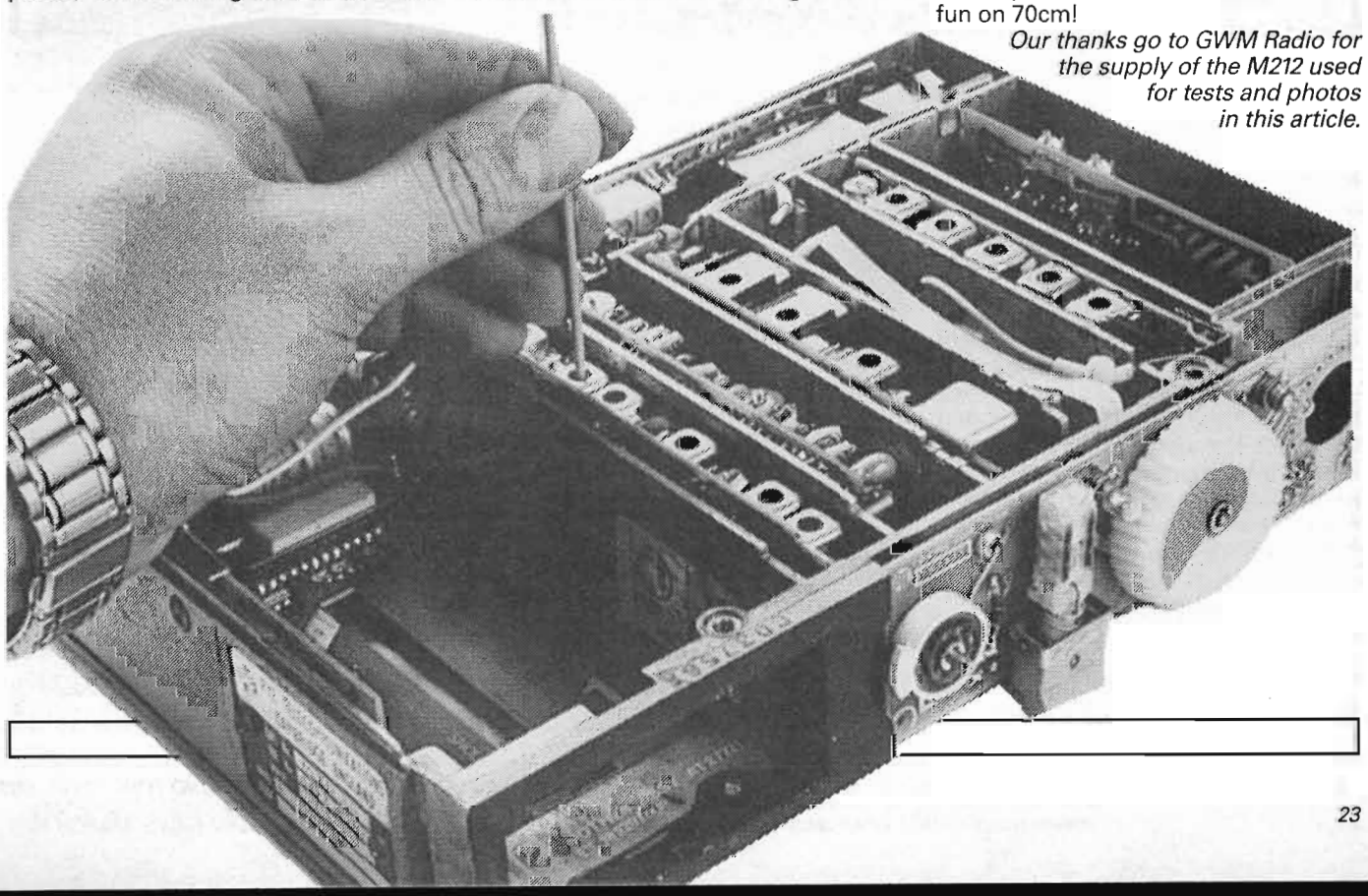
## Problems?

On transmit, sometimes you may find the small coax link between the driver and PA stages gets broken, watch out for this if you get no transmit power. If you have a problem on the driver PCB, then you may still 'salvage' the block PA unit to use as an amplifier for your handheld, 0.25W in gives you around 12W output, but remember you'll need to add TX/RX coax switching.

Other faults are sometimes caused by corroded motherboard pins linking to the sub-boards, use a spray 'contact cleaner' for these — don't try any abrasive methods as you'll introduce future problems! Good luck, and have fun on 70cm!

*Our thanks go to GWM Radio for the supply of the M212 used for tests and photos in this article.*

**Use a non-metallic trimming tool**



# Starting on Sat

*Arthur Gee G2UK presents the final part of his three part series*

Having considered some of the basic principals of satellites themselves, this month we'll take a look at the equipment needed for using them. We need a radio receiver, a transmitter to cover the frequencies used for satellite operation, and an aerial system to receive and radiate signals up and down from the satellite.

## Tuning In

Most radio amateurs and SWLs will already have a receiver which will tune into at least one of the amateur radio satellites operational at present. The Russian satellite designated RS10/11 transmits signals down to earth in the 10m amateur band and this can be heard using a receiver with 10m coverage. The actual frequencies are a beacon on 29.357MHz, and communication downlink frequencies from 29.360MHz to 29.400MHz. A good receiver will receive these when using a normal multi-band aerial. Listen for satellite signals on these frequencies at times when the satellite is in range of your QTH, ascertained from your orbital calendar and Oscalator, and you should hear signals without difficulty. Most of them will naturally be CW, but you may hear some voice transmissions on SSB if conditions are good.

If your receiver is a bit 'deaf' on the 10m range, which some of the less sophisticated 'communication' receivers may be, you can use a 10m pre-amplifier between the aerial feeder and the aerial input socket on the receiver. These pre-amplifiers can be obtained built up and ready to use, or you can obtain kits which are not too difficult to make up thus saving yourself a bit of money and having the satisfaction of having built a piece of gear yourself. If your receiver does not cover 10m, you can buy or build a 10m converter which converting these into frequencies which your receiver *can* tune, e.g. 21MHz, 14MHz, or even 7MHz or 3.5MHz. So with this setup you can at least get started 'listening to the satellites'. Once you've managed this, you're well on the way to becoming a *satellite enthusiast.*

When you hear a satellite for the first time, it really is quite fantastic! You calculate the time it should appear over your 'satellite horizon' and then set your receiver on its frequency and listen. And if you have done everything correctly you'll hear its CW signal come up on the beacon frequency, very weak at first and then gradually increasing in strength as it approaches your QTH overhead or nearly so, and then it fades away again, to disappear below your radio horizon just about the time you predicted. It's quite fascinating!

## Reception

If the 10m band happens to be open for HF propagation, you may find it very difficult t sort out the satellite signals from all the other ones that will be around, as the satellite signals are quite weak because the transmitter on the satellite is pretty small and of necessity of low power. You may find too that the satellite signals fade in and out in a regular manner due to the *spin*, i.e. the rotation of the satellite in its travel through space. This fading is due to the rotation of their aerials, although it is often not obvious with RS10/11 and some other of the more established satellites because they have stabilised quite well with time. Those like RS10/11 which are in a fairly low orbit may also fade due to ionospheric influence, this fading is irregular. SSB transmissions are frequently severely distorted due to the above causes, which is why it is often better to use CW for satellite communication in

**Typical computer print out showing predictions for the RS10/11**

| MON 3-DEC-1990 | | RS10-11 | | REV | No: 17264 | | |
|---|---|---|---|---|---|---|---|
| TIME | RANGE | EL | AZ | SQ | R-R | MA | MODE |
| 06:45 | 3205 | 5 | 96 | * | -2.8 | 28 | * |
| 06:48 | 2904 | 8 | 72 | * | -0.4 | 36 | * |
| 06:51 | 3077 | 6 | 47 | * | 2.2 | 43 | * |
| 06:54 | 3654 | 1 | 28 | * | 4.0 | 50 | * |
| | | | | | | | |
| MON 3-DEC-1990 | | RS10-11 | | REV | No: 17265 | | |
| TIME | RANGE | EL | AZ | SQ | R-R | MA | MODE |
| 08:27 | 2603 | 12 | 160 | * | -5.8 | 21 | * |
| 08:30 | 1665 | 31 | 141 | * | -4.2 | 29 | * |
| 08:33 | 1313 | 46 | 78 | * | 0.9 | 36 | * |
| 08:36 | 1916 | 24 | 31 | * | 5.0 | 43 | * |
| 08:39 | 2923 | 8 | 18 | * | 6.0 | 50 | * |
| | | | | | | | |
| MON 3-DEC-1990 | | RS10-11 | | REV | No: 17266 | | |
| TIME | RANGE | EL | AZ | SQ | R-R | MA | MODE |
| 10:12 | 2950 | 7 | 221 | * | -5.7 | 21 | * |
| 10:15 | 2004 | 22 | 238 | * | -4.6 | 29 | * |
| 10:18 | 1471 | 38 | 282 | * | -0.8 | 36 | * |
| 10:21 | 1786 | 28 | 336 | * | 3.8 | 43 | * |
| 10:24 | 2656 | 12 | 358 | * | 5.5 | 51 | * |
| 10:27 | 3690 | 0 | 7 | * | 5.9 | 58 | * |
| | | | | | | | |
| MON 3-DEC-1990 | | RS10-11 | | REV | No: 17267 | | |
| TIME | RANGE | EL | AZ | SQ | R-R | MA | MODE |
| 12:03 | 3109 | 6 | 289 | * | -2.5 | 36 | * |
| 12:06 | 2852 | 9 | 313 | * | -0.2 | 43 | * |
| 12:09 | 3033 | 7 | 339 | * | 2.1 | 51 | * |
| 12:12 | 3578 | 1 | 359 | * | 3.8 | 58 | * |
| | | | | | | | |
| MON 3-DEC-1990 | | RS10-11 | | REV | No: 17269 | | |
| TIME | RANGE | EL | AZ | SQ | R-R | MA | MODE |
| 15:45 | 3709 | 0 | 5 | * | -1.4 | 66 | * |

# ellites

these cases.

RS10/11 is the only amateur satellite which has a downlink on 10m at present, so we must turn our attention to some of the others which are also easy to find and listen to, such as UoSAT1 and 2 and DOVE which transmit on 2m. They do not have transponders as they are intended for scientific and educational purposes, rather than communication between radio amateurs. I gave a description of the UoSATs in part 1 of this series of articles, but I would add that these satellites are good ones to 'try your hands on', as a start in acquiring experience of satellite reception. DOVE is a good strong signal and is sending standard AX.25 packet data at present, but it is also intended to use recorded digital speech on it in the future. These satellites all transmit in the 2m band on 145.825MHz, and are easily receivable on any good 2m tunable receiver. They all have orbits which pass overhead at some time during their daily passes, so they can be easily heard on a 2m dipole or ground plane aerial.

## Communication Satellites

Coming onto those satellites which are intended for communication, such as Oscar 13 and the Japanese satellites, these accept signals from ground on one frequency and retransmit them back to Earth on another. The frequencies mostly used for this are in the 2m and 70cm bands. Some have an uplink in the 2m band and a downlink on 70cm, and others an uplink on 70cm and a downlink on 2m. This sometimes presents difficulties with aerials and switching between receivers, transmitters, and aerial arrays when you want to go from one type of satellite to another, but it's the way things are in this imperfect world! For the Russian RS10/11 we listen for it on 10m and transmit up to it on 2m. With Oscar 13 we transmit up to it on 70cm and listen for it on 2m, and for the Japanese ones we listen for them on 70cm and transmit back on 2m. The frequency of your uplink transmission must be variable so that it can be moved onto the channel used by the satellite for its downlink.

## Procedures

The procedure is to listen for the satellite and when you hear it you tune your transmitter so that you hear its returned signal and then zero beat your VFO until you are on frequency. It's as simple as that! The point to note however is that your transmitter *must* have a tunable frequency oscillator, not be a switched channel one.

The required output power of your transmitter depends on the aerial system you decide to use. It virtually becomes a question of low power and a high aerial gain, or a simple aerial array and higher transmitter output, there are one or two other considerations however. If you have a high gain transmitting aerial, i.e. a multi-element yagi, the beamwidth of your uplink signal will be narrow and you will need an accurate rotator system to direct it at the satellite. If you use a simple yagi or even a dipole or ground plane, the accuracy of directing it at the satellite does not become so important as the width of the beam is very much broader. I used a 2m ground plane uplink aerial very successfully for quite a long time for overhead passes of some of the earlier Oscar satellites, with a 10m dipole for the downlink. When later I used a 9 element yagi with a rotator, the results were obviously very much better, particularly with orbits not overhead, but the simple ground plane certainly enabled me to get going with the minimum of expense and aerial erection difficulties.

## Equipment

With the multiplicity of VHF transceivers on the market these days, it is impossible for me to recommend any particular type. With a bit of ingenuity, you can press pretty well any VHF transmitter or transceiver into satellite usage, provided it is tunable and has an RF output of 25-50W and can be used for CW and/or SSB. If you do not have a VHF transmitter, you can of course use your HF transmitting equipment. The 10m band output can be used to drive a 2m transverter, which in turn can be used to drive a 2m linear amplifier to 25W or so output.

When we come to use satellites such as Oscar 13 which are in an elliptic orbit, going right out into space and back again to a low orbit as they pass round the Earth, things get a bit more complicated. Here we do need to be able to direct our aerial system pretty accurately at the satellite we require. Furthermore, due to the great distance out into space to which the orbit goes, rather more RF power is required into the aerial. It helps with this type of orbit to be able to direct the aerial array in both azimuth and elevation, this needs two rotators, one to cope with the horizontal direction and the other to adjust its elevation. The con-

**Computer print out showing typical kepler's elements**

```
SATELLITE  ........DOVE

Epoch Year.........  1990
Epoch Day..........  266.410390
Inclination........  98.697800
R.A.A.N............  342.382400
Eccentricity.......  0.001090
Arg. of Perigee....  225.723600
Mean Anomaly.......  134.306600
Mean Motion........  14.288781
Drag Factor........  7.25000E-0006
Revolution Number..  3489
Semi-Major Axis....  0.000

SATELLITE  ........OSCAR13

Epoch Year.........  1989
Epoch Day..........  356.842258
Inclination........  57.106500
R.A.A.N............  176.604400
Eccentricity.......  0.685617
Arg. of Perigee....  217.644500
Mean Anomaly.......  65.299300
Mean Motion........  2.096944
Drag Factor........  1.76000E-0006
Revolution Number..  1170
Semi-Major Axis....  0.000
```

struction of such an array is much more elaborate than for a simple yagi for ground-based communication, although the system can be simplified by the use of a combined azimuth/elevation rotator unit which are now available commercially. Your choice will depend on your ability to construct these elaborate aerial arrays and the facilities you have for mounting them.

## Computers

Finally a few words about the use of the computer in the satellite field. They are of course primarily used as a means of calculating orbital predications, and are also extensively used to analyse the telemetry data down from satellites, they can even automatically control your azimuth/elevation rotator system.

All amateur radio satellites send down data about the various parameters they monitor, and these are decoded within the computer. They do this with the aid of software which is specific for the functions they are designed for.

In the case of orbital predictions, use is made of what are called *Kepler's Elements*. These are astronomical units based on Kepler's Laws, which were first propounded by the astronomer Kepler in 1609 relating to the characteristics of the planets orbits in space. They apply also to artificial satellites in space, but we need not go into the laws in detail as they are somewhat complicated, readers who want to go deeper into this topic will find all they need to know in most textbooks of astronomy.

Once in orbit, an artificial satellite is observed by Space Observatories and its Kepler Elements determined. A sample of the determined DOVE and Oscar 13 elements are shown in the tables herewith and it will be seen they are quite different for each satellite, as these two satellites have very different orbits. By entering these element values into your computer and using appropriate software, you can get out a list of figures showing the time of the orbit at which the satellite is within range or your QTH as well as other parameters such as the EQX, the time the satellite crosses the Equator, its elevation from the horizon at your QTH, its azimuth, and much other information depending on the software you may care to use. A typical set of figures is also shown here. This is certainly a most useful way of obtaining orbital data. As the satellite changes its orbital oath during its lifetime, ultimately burning up as it re-enters the Earth's atmosphere, its Kepler's Elements change and these changes are regularly notified to the satellite users community. So you do have to update these elements in your computer from time to time, hence the regular HRT listings in the monthly *Satellite Rendezvous*.

## Further Information

I could spend a lot of time describing computer programs and various aerial systems for satellite use, and various lineups for receiving equipment and transmitters, but these are projects for the experienced satellite enthusiast and I cannot go into details in a short series of articles such as this. By the time you need to get into the more advanced projects you should have become familiar with the specialist literature now available. You will certainly need to join an organisation such as Amsat-UK, when you will be able to gain access to much of the literature available to help you keep up to date with the latest techniques, which are changing almost month by month.

With satellites you can engage in amateur radio operating, experimenting, building equipment or just buying suitable gear from commercial sources. You can study spacecraft techniques and the computer programming of orbital trends. With amateur radio satellites a whole new world of amateur radio activity opens up before you. **So, the choice is yours.**

# SCANNERS INTERNATIONAL

## Sources of Information

We may not always be able to get up to our local airport observation area, but because the various *mopping up* operations combined with the ever present security *sentinel* measures are in hand, there's still a lot of interesting communication going on! Many communications occur on HF as well as VHF Military Fleet Satcoms (as Peter Rouse detailed in an earlier issue of Scanners International), and the UHF airband scene is currently a hive of activity.

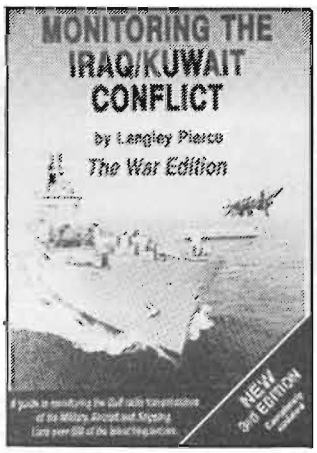
Last week I paid a visit to Waters and Stanton Electronics, and there on display they had the very latest edition of the book *Monitoring the Iraq/Kuwait conflict*. Inside the 62 pages of this A5 sized paperback there's an unbelievable amount of information, I honestly don't know how they get away with it. Military Air Command frequencies together with location designators used in *Operation Desert Storm*, Global Control and Communications centres, Strategic Air Command operation details and frequencies together with typical message formats, RAF frequencies and channel designators, together with those used by the French, Belgian and Royal Saudi air forces together with Gulf civilian aviation frequencies.

Not only this but Royal Navy HICOM (High Command) channels, US ships calls, names, types and operation frequencies, Belgian Navy, US Army, Gulf shipping, and even CIA (Central Intelligence Agency) communication frequencies together with Palestine Liberation Organisation and the Israeli *Mossad* intelligence agency frequencies. As I said, I don't know how they get away with it. The book publishers didn't seem to want to send me a review copy despite several phone conversations, however my thanks go to Waters and Stanton for the timely provision of the review copy.

## New Scanner Catalogues

Another handy document which literally arrived at the editorial office today was the large catalogue from the Hampshire based scanner suppliers of Nevada. 66 A4 pages make up the catalogue which details all types of scanners, aerials, communications receivers, transceivers and accessories. I'm still reading through it! A copy will cost you £2, (contact Paul at Nevada, he's a very helpful chap), and you'll even find a £2-off voucher inside the catalogue.


Specialising in Military and Civil airband scanning are Javiation, their 26 page A4 catalogue being filled with details of virtually every type of handheld and base scanner for airband use (as well as other frequencies of course), together with discone aerials and the like, this firm also produces a nice couple of airband frequency guides as reviewed in Scanners International a few months ago. Contact Jonathan at Javiation for your copy.




## The Best Reviews

All this of course compliments our ever-popular scanner reviews, this month we've got the latest Shinwa scanner, a new name to many, next month we plan to feature the Yupiteru MVT-7000 (we've got the only one in the country here!), also on the shelf is the latest Realistic PRO2006 with *hyperscan*, watch this space!

## Frequency Finder

The always seems to be little published information on PMR (Private Mobile Radio) frequencies in use in the UK, this knowledge often being handy for example if you're trying to track down some interference for example to your radio equipment. It's all been a bit 'hush hush' in the past, however as it's generally published information we at Scanners International are changing all this. Here's the bands where PMR users operate, all bands use 12.5kHz spacing:

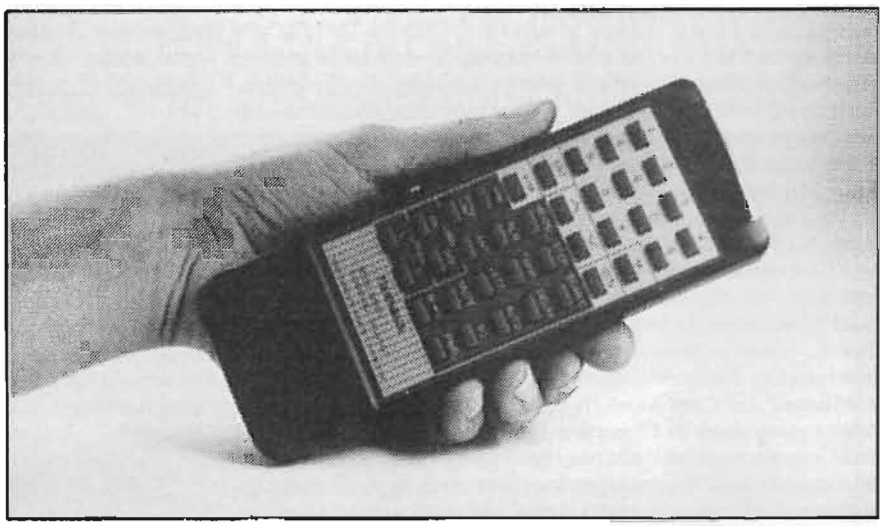
| BAND | SERVICE | FREQUENCY RANGE |
|---|---|---|
| LOW | Mobile TX | 71.5125-72.7875MHz |
| | (Two Freq. Simplex) | 76.9625-77.5000MHz |
| | Base TX | 85.0125-86.2875MHz |
| | (Two Freq. Simplex) | 86.9625-87.5000MHz |
| | Single Freq. Simplex | 86.3000-86.7000MHz |
| HIGH | Base TX (Two Freq Simplex) | 165.0500-168.2500 |
| | Mobile Transmit (Two Freq. Simplex) | 169.8500-173.0500 |
| | Single Freq. Simplex | 168.9500-169.8500 |
| BAND III | Mobile Transmit | 184.5000-191.5000 |
| | (Two Freq. Simplex) | 192.5000-199.5000 |
| | Base Transmit | 176.5000-183.5000 |
| | (Two Freq. Simplex) | 200.5000-207.5000 |
| UHF | Base TX | 453.0250-453.9750 |
| | (Two Freq Simplex) | 456.0000-456.9750 |
| | Mobile Transmit | 459.5250-460.4750 |
| | (Two Freq. Simplex) | 461.5000-462.4750 |
| UHF (London) | Base TX (Two Freq Simplex) | 448.00625-448.99375 |
| | Mobile Transmit (Two Freq. Simplex) | 431.00625-431.99375 |
| UHF (Cities) | Base TX | 445.5250-445.9750 |
| | (Two Freq Simplex) | 440.0250-443.4750 |
| | Mobile Transmit | 425.0250-425.4750 |
| | (Two Freq. Simplex) | 425.5250-428.9750 |
| | Single Freq. Simplex | 446.0250-446.4750 |

# Shinwa SR001 Scanner

**Tested by Chris Lorek, G4HCL**

I first saw the *Shinwa SR001* in a Japanese magazine over a year ago, and in October 1990 I was fortunate enough to be given one of only a couple in the country for exclusive review in Scanners International. Before I even got it home, a group of vandalistic radio amateur thieves (the police have names) decided Scanners International readers wouldn't get to hear about it, however another was obtained nicely in time for this review to appear just as the sets start to become available on general sale - we do try!

The Shinwa receiver is about the size of a car radio, it's dimensions of 178 (W) x 50 (H) x 150 (D) mm allowing it to fitted into a typical car radio slot, the set operating from an external 13.8V DC supply. It covers the range 25MHz - 999.995MHz, and you can tune and scan in 5kHz, 10kHz, 12.5kHz 20kHz, 25kHz, 50kHz and 100kHz steps on AM, FM and wideband FM (WFM). What's unique about the scanner is that the front panel remains very uncluttered through the use of a handheld remote control to operate the set - just like a TV or video! A 36 key infra-red controller comes as standard with the set, letting you do all sorts of wonderful things such as program the auto-timer on/off (use the receiver as an alarm clock?), program frequencies, memories, mode, scan status and the like, even switch the set on and off. A degree of *future proofing* has also been built into the scanner by allowing the selection of up to two *options* from the remote control. If that's not enough, then guess what - by adding an internal plug-in board you can even control the set through your computer's RS-232 serial port, where does it end?



*The remote control makes this system unique among other scanners. It has 36 keys which allow you to program the auto-timer, frequencies, memories, and mode*

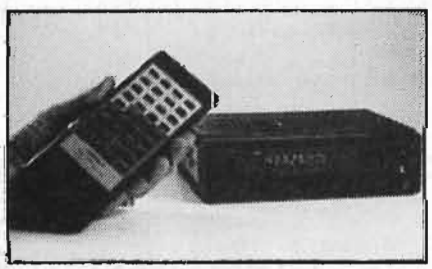
*The front panel comprises a multi-colour backlit LCD panel, control buttons, power/volume & Spuelch knobs*

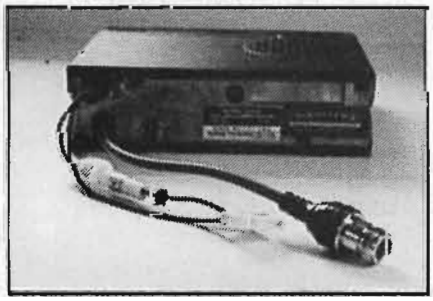
## Front Panel

The front panel of the set comprises a large multi-colour backlit LCD panel, plus a row of buttons beneath this used to manually enter frequencies or select search banks. Up/Down buttons allow manual frequency change, a V/M button changes between VFO and Memory operation, the adjacent Scan button being self-explanatory. The two small On/Off/Volume and Squelch knobs are backlit for nighttime use, and in true hi-fi fashion a quick push recesses them into the front panel to prevent accidental changes. The LCD gives a large frequency display, together with a lower alpha-numerical section showing the reception mode, channel spacing, scan mode and the like, a signal strength *bargraph* on the right showing you the relative signal level in a novel *widening* bar-indicator fashion.

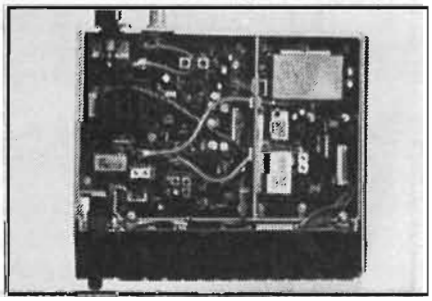
## Memories and Scanning

A storage capability for 200 memory channels is provided, these being arranged into 10 banks of 20 channels each. As well as this, 10 frequency range banks may be programmed for *search tuning*, banks 1, 2 and 3 come pre-programmed with Japanese FM broadcast, TV sound and personal communication bands, however these and the other banks you can pre-program to the frequency ranges of your choice. You can scan each bank range, or a selection of any number of ranges, at a rate of 35 channels/sec in VFO mode or 25 channels/sec in memory mode, with the search halting on either a carrier, audio, or a 'timed' halt where the scan resumes after a preset period. You can vary the scan resume delay in 1 second increments up to 19 seconds, the interval being shown on the display with this *counting down* in seconds when the scan halts.





***Left:*** *The remote control and scanner together*
***Below Left:*** *The rear panel connections*
***Below:*** *Inside the Shinwa SR001 - by adding an internal plug-in board you can control the set through your computers RS-232 serial port*



## In Use

The set has two aerial sockets on the rear, one a flying lead terminated in an N-type socket as *Ant 1*, the other a chassis mounted BNC socket as *Ant 2*. This allowed me to connect my vertical omnidirectional aerial to one, and my high-gain beam to the other, easily switching between the two using the remote control - no manual aerial switches needed here! On air I found the set performed fairly well on the VHF and UHF ranges, although it seemed a bit insensitive in the upper-UHF range above 900MHz (but most people would be receiving strong signals in this range through). At the lower edge of the frequency range, around 30MHz, I found the set picked up some wideband internal noise even with the aerials disconnected, this probably coming from the set's control circuitry, but again in typical on-air usage external noise would normally be the limiting factor here. The suppliers tell me that this set was an early prototype, even though I know they've been available for some time, but this could be worth bearing in mind. Opening the set up for a quick peep showed it was very well made, with very neat construction methods combined with a very solid and robust cast chassis.

I found the reception quality, i.e. the capability to reject unwanted signals rather than hi-fi qualities, quite good compared with some other scanners I've tried. The internal switchable attenuator controlled from the remote handset was often useful when operating with my rooftop aerial, this overcame the odd overload problem from the fire station transmitters a couple of km away from my location. The squelch I could set to raise on very weak signals, but rotating this right up to maximum didn't stop the scan halting on weak carriers - here's where the audio squelch came in useful.

I found the display was very readable when I looked at it head on, but viewing from above as I normally did with the set on the table, caused all the unlit segments to be displayed as well. The set also became rather warm, even when ventilated all round, and I'd suggest caution if you're thinking of putting it in an enclosed car radio slot or the like.

## Laboratory Results

The lab results generally confirmed the on-air results of good performance around the VHF/UHF range, the sensitivity figures at lower frequencies resulting from effects of the internally generated noise. The first IF (Intermediate Frequency) used is in the 1GHz range (it actually varies between 995.5 and 1000.5MHz) hence providing good image rejection, the second IF being 45MHz also helping here, very few double reception problems like you get with cheaper handheld scanners. I found a bit of a spur 10MHz away when testing the blocking but even this was well suppressed. In all the set gave a very good technical performance apart from at the extremities of its tuning range.

## Conclusions

The set is a unique departure from the norm, its very smart appearance combined with remote control features I'm sure will appeal to many scanner enthusiasts. The technical performance in terms of receiving the wanted signal in the presence of other strong signals was quite good, and although the review set tested did have a couple of teething troubles these should cause few problems in reality.

*Our thanks go to Martin Lynch of the Amateur Radio Exchange Centre for the kind loan of the review scanner.*

## LABORATORY RESULTS

### Sensitivity

Input level in uV pd required to give 12dB SINAD

| Freq MHz | AM | FM | WFM |
|---|---|---|---|
| 25 | 5.20 | 2.51 | - |
| 30 | 2.05 | 1.03 | - |
| 50 | 0.61 | 0.37 | 1.36 |
| 75 | 0.54 | 0.33 | 1.43 |
| 100 | 0.73 | 0.44 | 1.71 |
| 120 | 0.77 | 0.45 | - |
| 145 | 0.68 | 0.36 | - |
| 170 | 1.08 | 0.49 | - |
| 250 | 1.02 | 0.47 | - |
| 430 | 1.07 | 0.54 | - |
| 450 | 0.94 | 0.43 | - |
| 500 | 1.30 | 0.73 | 3.14 |
| 810 | 1.66 | 0.88 | 5.15 |
| 934 | 4.32 | 2.15 | - |
| 960 | 5.80 | 2.94 | - |

### Adjacent Channel Selectivity

Measured on 145MHz FM as increase in level of interfering signal, modulated with 400Hz at 1.5kHz deviation, above 12dB SINAD ref. level to cause 6dB degradation in 12dB on-channel signal;

| | |
|---|---|
| +12.5kHz | 29.5dB |
| -12.5kHz | 22.5dB |
| +25kHz | 53.0dB |
| -25kHz | 53.0dB |

### Image/IF Rejection

Increase in level of signal at first IF (1GHz) and second IF image (+/-90MHz) frequencies, over level of on-channel signal to give identical 12dB SINAD signals;

| RX Freq. | 1st IF Rej. | 2nd Image Rej. |
|---|---|---|
| 435MHz | 48.5dB | 34.5dB |
| 934MHz | 21.5dB | 48.0dB |

### Blocking

Measured on 145MHz FM as increase over 12dB SINAD level of interfering signal modulated with 400Hz at 1.5kHz deviation to cause 6dB degradation in 12dB SINAD on-channel signal;

| | |
|---|---|
| +100kHz; | 76.5dB |
| +1MHz; | 88.5dB |
| +10MHz; | 96.5dB (87.5dB - see text) |

### Intermodulation Rejection

Measured on FM as increase over 12dB SINAD level of two interfering signals giving identical 12dB SINAD on-channel 3rd order intermodulation product, 145MHz, 50/100kHz spacing;

| | |
|---|---|
| Att Off; | 50.5dB |
| Att On; | 68.8dB |

### Squelch

Measured on 145MHz FM

| | |
|---|---|
| Threshold | 0.20uV pd (5dB SINAD |
| Tight | 0.33uV pd (10dB SINAD) |

### Maximum Audio Output

Measured at 1kHz on the onset of clipping

| | |
|---|---|
| 3 ohm load | 1.08W RMS |
| 8 ohm load | 630mW RMS |
| 15 ohm load | 385mW RMS |

### Current Consumption

| | |
|---|---|
| Scanning, no signal | 1.10A |
| Receive, mid volume | 1.11A |
| Receive, max volume | 1.12A |

### Attenuator Level

| | |
|---|---|
| 25MHz | 16.4dB |
| 145MHz | 17.7dB |
| 432MHz | 18.4dB |
| 934MHz | 16.9dB |

# Pile-Up!


**High ham-density factor**

An article giving advice on how to behave in a pile-up is usually written from the point of view of the supposed majority of readers. That is those of us who live in regularly worked call areas with a high 'ham density factor', and who are interested in pulling the DX out of the pile-up. I thought it would be an interesting exercise to research and write this article from the point of view of the quarry! A piece on how to respond to a pile- up directed at you, may well be useful to operators at either end of the process.

***Paul Thompson G6MEN takes a lighthearted look at DX Pile-Ups***

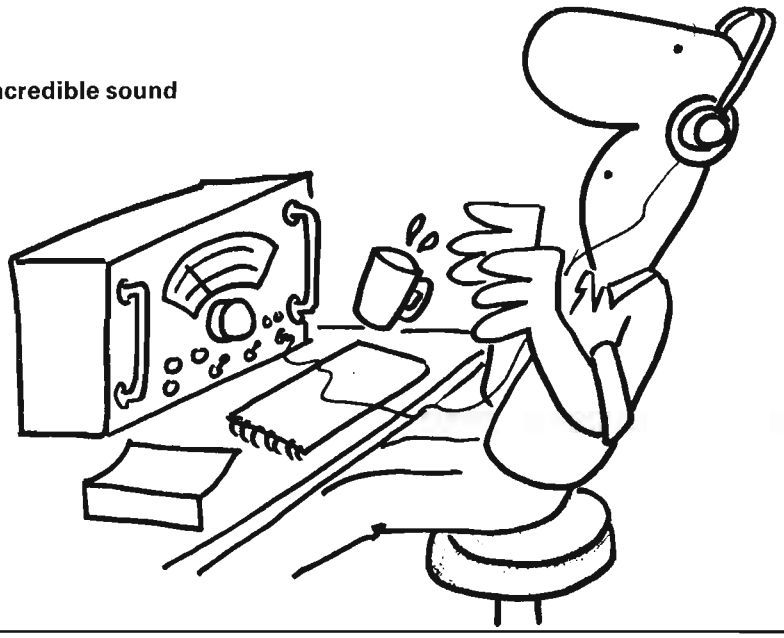
My first experience of hearing a pile-up was back in SWL days, what an incredible sound! It took some time to figure out what was going on, but after some experience, I began to appreciate that there was often an underlying order to the chaos. Licensed at last myself, I got the chance to participate in a few. I made all the usual mistakes of course, including losing my temper and having an on-air row — I mention this sort of thing because it is going to happen when *you* are operating. Don't be thrown by it; it doesn't happen as often as we think, it's just that it always stands out when it does.

## The Receiving End

In case anyone is wondering, yes, I have been on the receiving end of a couple of small pile-ups myself. One was when I took a special call-sign onto Oscar 10 and was chased by a pile of VKs! However I have never been to an exotic location nor taken out a rare prefix, so this article is based mainly on two sources. Firstly on the experience of other amateurs who have operated rare stations, and secondly from the evidence of my own ears.

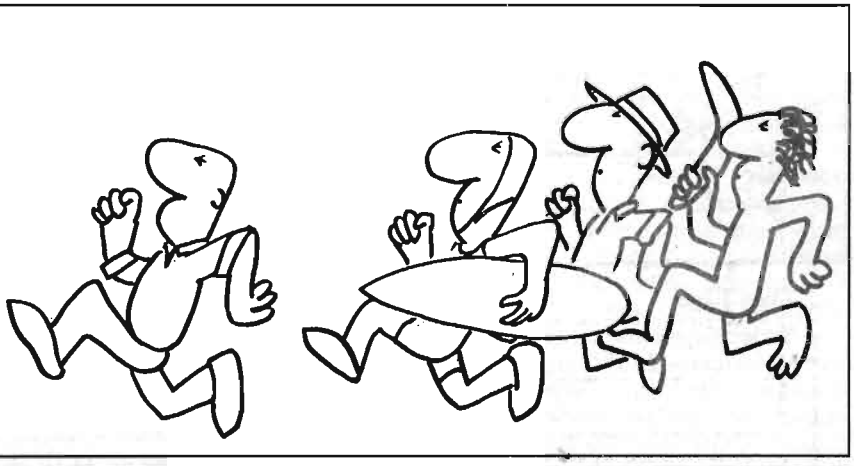
Whichever method you use, having sabbatical leave from work, and I'd have written a book! So let me run through the main ways of 'managing' the stations calling you in a pile-up one by one. Each way has its advantages and disadvantages, and by the end of the article I hope you will be able to see ways of using them and combining them to good effect.

**An incredible sound**



To simplify things, take it for granted that this article refers to SSB operation. Other modes have other tricks, such as VS6WU's dodge when he is on the receiving end of CW pile-ups, of using a wide filter, and being able to pick up weaker signals slightly off-frequency. To include all these I would need a year's reams of A4 notepaper to hand is essential. A good idea is to rule a thick line down the centre of each leaf, and use one side for the informal log, which you will copy later into your logbook, and the other side for scribbling notes. I have seen a logbook belonging to someone who tried to keep up with rapid operating. It isn't pretty.

**Being chased by a pile of VKs**

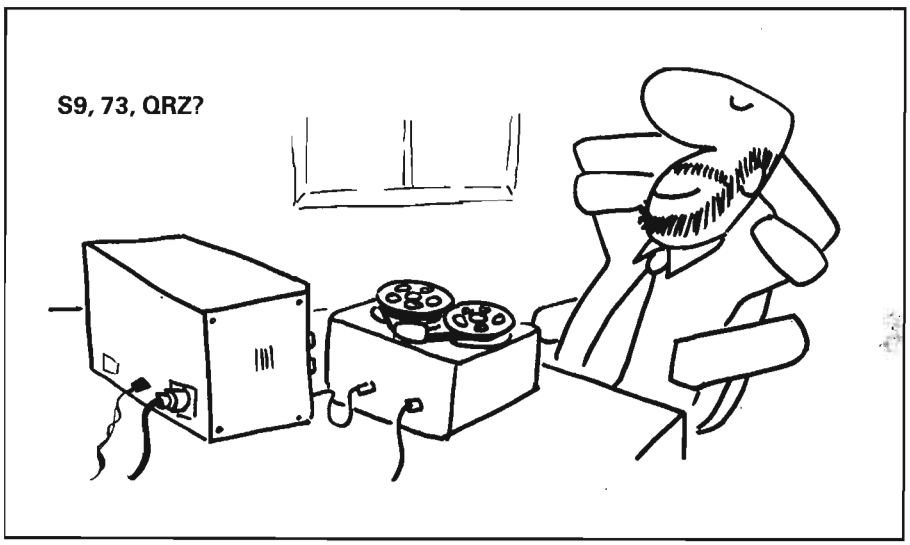


## The Simple Queue

Perhaps the most straightforward way of working is this. You simply call CQ and go over. Then you pick the call-sign of the station which you can make out most clearly from the pile-up, wait for him to go over, and call him. This method involves you in very little work, you simply 'pick the closest peaches on the tree' until propagation fades or your period of operation closes. At that point you will find (if you care) that you have worked all the QRO stations in all the obvious places. Fair enough, they have a right to operate QRO and as much right to get DX contacts as anyone. Don't forget, you have made the ground rules, and have in fact chosen the type and location of people you worked.

The 'choice' you made, consciously or unconsciously, can be affected further by factors such as the manner and speed in which you conducted each QSO. The very fact that you are using the quickfire '59, 73, QRZ?' format means that you are already favouring pure prefix-hunters. Some of these might drop off the queue if your QSO is a couple of short overs longer and includes, say, name and a quick weather report, to be replaced by a few more operators who like a personal touch. And so it goes.

You've probably gone too far in the other direction if you attract one of these guys who gives you his inside leg and granny's birth sign, and wants to know yours. I do urge patience in such a circumstances, and your reputation will grow. It does not hurt to say 'Thanks for the very interesting info, but I really must press on with the other stations. 73. QRZ?'.




## The List

A modification to working stations by simple queue, is to try to put together, during your stand-by, a list of say ten stations heard. Or at least the 'last three', i.e. callsign letters only. You then announce clearly, when you think most of the shouting has died down, 'OK gentlemen, I am now working down a list', and proceed to call the first station. After each QSO, slip straight from your final with one station to the call for the next, until you have gone right through your list. Then another 'QRZ?' from you will give you another pile to sort into another list.

The main advantage of list working is that your ears get a rest between overs. You are bound to find that some operators, either wilfully or through ignorance, will not know what you are doing, and will give long, excited calls as soon as they hear someone say '73', but by and large as long as ***you*** are in control this will not proliferate.

In fact it is often a lack of will or gumption on the part of the operator at the DX station which brings about losses of temper and poor operating in the guys who are trying to catch him. If the DX man takes an opportunist caller out of turn, through laziness, then he will encourage such things as 'premature tail-ending', and people interjecting their 'last three' between the overs of an on-going QSO. Or even during the pauses for breath! On the other hand I have heard a decisive 'Gentlemen, *only* give your call-sign twice and then *listen!* bring about parade-ground discipline to a pile-up!

## Timed Call/Stand-By

To modify queue or list operation I have often heard a technique used which could have been inspired by meteor scatter operation. In this case the DX operator, at the end of each CQ call, announces 'This is VP*** listening for thirty seconds. QRZ?' This actually seemed to work. Some people repeated their call-signs non-stop for the whole thirty seconds, but very few indeed continued to call after the specified period. The result is that all the DX station's responses were heard by everyone. So often, of course, they are lost in the cacophony.

Naturally if you choose to try this method, you will need a good clock, and to keep one eye on it while you are making your notes. If you don't come back snappily on the 30 second (or whatever) limit, you will find people begin to push beyond it. This is due to a common tactic nowadays of delaying one's call in a pile-up, with the hope of being heard in the clear. It often works.

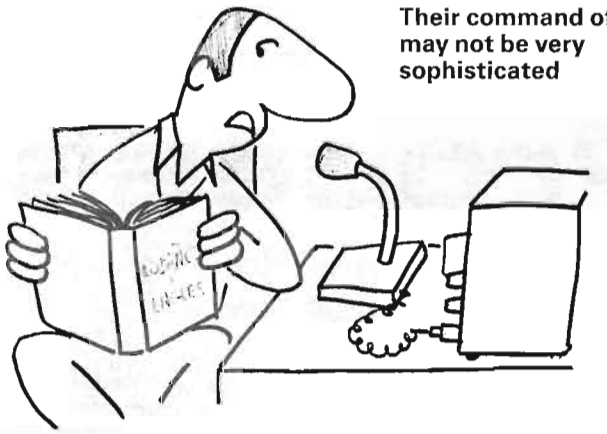
## Calling by Numbers

A good way of 'filtering' out the intense QRM is to pick some limiting factor in the callsign of your pursuers and use it to specify those from whom you want to hear. Picking the number from a call-sign is the easiest and best-known way. Do I need to say that it is a good idea to start at 0 and work through to 9? This method has a subtle way of letting through some interesting DX for you. Most non-DX countries configure their call-signs 'letter-number-letters', but some of the smaller, rarer ones have a 'number-letter-number-letters' configuration. Perhaps you are on Tristan Da Cunha, but you may never have worked Malta. A canny 9H1 will call in when you ask for ones or nines!

A disadvantage sometimes, is not knowing where to draw the line, when it comes, on how many calls of each number to pull out. If there are a lot of callers, then may I suggest ten, fifteen, or twenty, depending how quickly you are working them. As you leave number 0, sure that there are still scores of callers in PA and G who are disappointed, there is nothing to stop you mentioning that you will go back to the beginning again after going through the whole sequence, and that they will all get their chance eventually. You will always get a few who continue to call when you have gone on to the next number. Patience!

Also you will get a few charlies who just don't get the point at all. Their command of English may not be very sophisticated, apart from anything else. In those cases, a few foreign phrases up your sleeve should help. Such as: 'Aspetate per favore. Io voco soltanto il numero due.' (if that is not 100% Italian, it should at least get you by!)

Of course you can choose criteria other than call numbers. If you want a specific country or square yourself then tell everyone to stand by, and jolly well call for it. On the other hand your reputation as a sympathetic operator will increase if you ask occasionally for QRP stations, or for people who need you for a new country.



**Their command of English may not be very sophisticated**

If that last statement surprises you, let me say that **many** people in pile-ups already turn out to have worked your country. You will find one or two people who will say 'Nice to work you again. We had a QSO last week. Won't hold it. Many stations wanting to work you. 73.' This usually happens just before the propagation goes. I have no doubt that the offender gets blasted by stations at his end of the skip!

## Listening Up

You may often hear DX stations say that they are 'listening up', 'listening high', 'listening down', 'listening low'. This is another dodge to spread out the QRM and make it more manageable. It simply entails tuning bit by bit with your RIT, away from the frequency on which you are transmitting. It really works! It attracts the canny operators to you, and leaves the rest marking time.

If you specify that you are 'listening up', the canny operator will adjust his TX frequency up a few hundred hertz and call you. He will note the frequency of whichever station you work, if it is audible to him, and next time tune just to the high side of that. And so on. It may be my imagination, but it always seems to me that QSOs under these circumstances take on a different flavour. Caller and DX both know a little extra technique and seem to be winking at each other.

A disadvantage of this method comes from the fact that you will have started your period of operation by asking 'Is the frequency clear?', and by encouraging movement away from the centre frequency you may encroach on someone else's operating. As we all know, you can steal an amateur's wife, burn his house down, but no way will he let you come on to his frequency, Old Man! I have heard some people say 'listening HF' and 'listening LF'. It's confusing. A station about to join a DX pile-up on 2m was heard to ask 'Which HF band is he listening on?'.

## Split Frequency

Very similar to 'listening up', this dodge shares its disadvantages. Mainly how do you know your split is not right on top of an established QSO, which may be inaudible to you but within skip range of your callers? Also it filters out people with single VFO rigs! You are left with people with separate transmit and receive (very old equipment), or with two VFOs (expensive equipment). As always, it's up to you who gets left out.

If you are going to use this method please be sure of the band plan. This means swotting up the band plan not only for your own area but also the areas from which your callers will come. Have a chart in front of you, if you are in any doubt.

**Appoint a chairman**

## Appoint a Chairman

By sked or on the spur of the moment, many DX operators ask a third party to control the calls. This is usually a station who is well placed to hear calls in both directions. This means you relinquish control of the QSOs, but on the other hand someone else does the hard work.

I have heard some good work done using this method, QRP and badly placed stations can be led in by the controller. On the other hand, you must realise that skip distances will be limiting what goes on. The controller will be feeding you stations he can hear. He may be feeding you no one but his mates, for all you know!

## Dos and Don'ts

Inevitably we all get into bad habits. If you are a DX station it makes life frustrating for the rest of us, so here are a few pleas.

**Do** give your call-sign regularly. This avoids people calling you, giving you '59', and then saying 'Just repeat your callsign'. They aren't being totally stupid, OK they haven't waited to hear the call-sign, but on the other hand *you* haven't given it. For all they know it could be 'QRZ?', because those are the letters you have been repeating most of all! You know you are falling into this trap when you hear people calling across the proceedings such things as 'What's the DX?' or 'Callsign please someone!'.

**Do** give your callsign in the Geneva alphabet, this encourages your callers to do the same. You can then dispense with the 'erYokohama — erWashington — erHonolulu' brigade, they waste time!

**Don't** forget to give your receive frequency if you are operating split frequency or cross-band. I once heard a station go for half an hour without. Then he wondered why he spent half an hour working only stations within each other's groundwave!

**Don't** forget that *you* are in charge, you can be firm with wallies. I have heard DX operators resort to 'IK0*** No QSO!', and 'G4*** Get lost!'. You run the risk of the disgruntled lid causing deliberate QRM, so I leave it entirely to your own judgment. More often than not an operator will feel ashamed to hear his callsign mentioned like this and pretend he isn't there at all. You have to be sure that he is a genuine wally, not just someone who has not grasped what is going on. Next day, forgive and forget. If he turns up and behaves well, work him, remember amateurs are human, some are subject to extremes of mood. Patience!

## Good Luck

Most readers of this will be convinced that they will never be in the situation of having to cope with a pile-up. Well not many of us will get offered a trip to the Galapagos, true, but on the other hand, a few weeks ago I was chased on 6m simply because I speak French!

Contributing to this article, although they may not know it, are several amateurs whose DXperiences may have appeared in letters and articles in Ham Radio Today and other magazines. I would like to thank G3SXZ, VS6WU, G3AAG, G3TXF, and many others. I sincerely hope I spark off correspondence through the HRT letters page and thus promote further ideas for discussion around this subject.

# Audio Processor Project

*G4NLA completes the construction and testing of the processor*

The project may be constructed, and subsequently tested on a module by module basis, all component values are shown on the circuit diagrams with the description of each module in previous issues. Each board also has a suggested Veroboard layout and track break table. I am assuming that the constructor has a range of tools at his/her disposal, the only item of test equipment required is a multimeter or perhaps a reasonably calibrated oscilloscope.

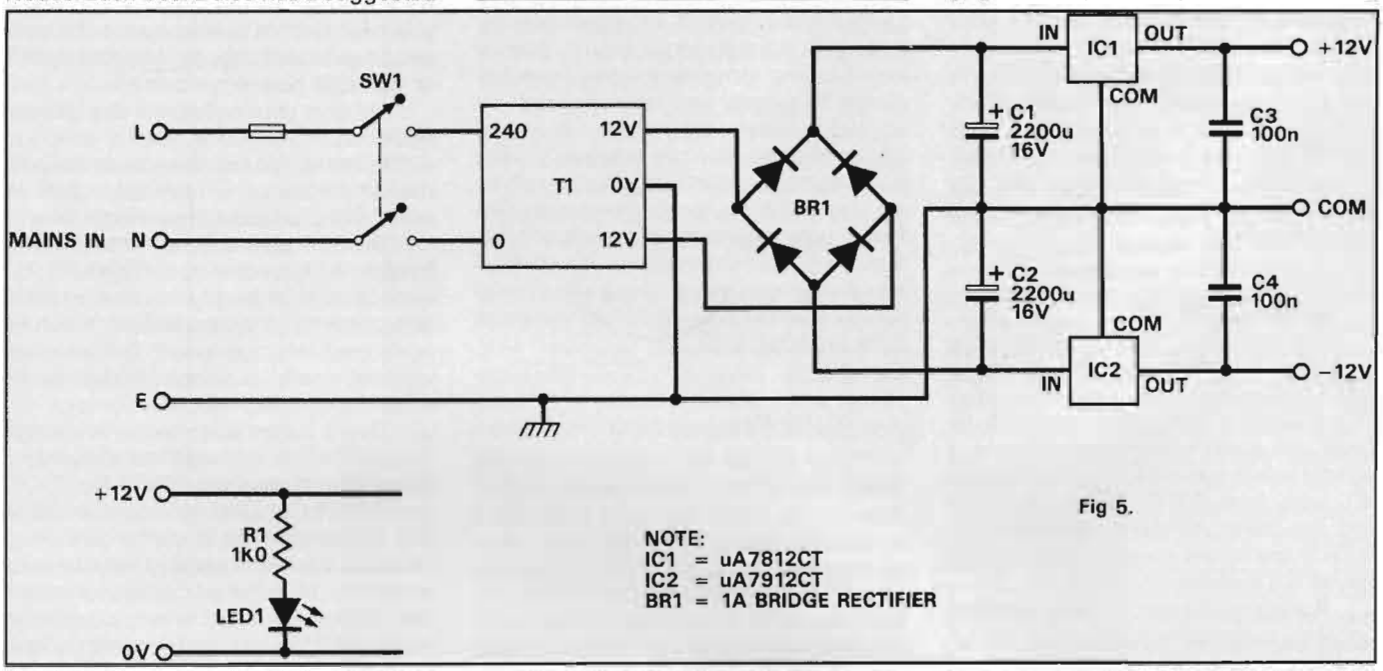



Fig 5.

## The Mains PSU

Before proceeding with a description of the mains power supply I must issue a vital warning, particularly to younger constructors. This section of the unit has 240V AC supplied to it, this voltage can kill and is not at all discriminating.

If you are at all unsure about the construction of this section of the module, and cannot get expert advice, then complete the construction of the project and test it with a battery power supply. Subsequently, send the project inclusive of the case and transformer, *with return postage,* to my QTH as given at the end of the article. I will fit and test the PSU with pleasure for free. *(Note — I won't sort out the rest of the project for you, that's your job!).* Dire and serious warnings completed, let's have a look at the PSU.

The 240V mains is connected to the 20VA transformer via FS1 (100mA fast blow) with both phases switched by SW1. The transformer will require a centre tapped 24V winding giving 12V-0-12V, note that whilst the 0V tap is connected to the mains earth, both of these should be securely bonded to the chassis. The two 12V outputs are fed to a bridge rectifier, the resulting DC is smoothed by the two 2200uF 16V electrolytic capacitors C1 and C2. Note the polarity of these devices, they can go bang if you connect them reversed. IC1 and IC2 are standard 1A 12V regulator packages, and C3 and C4 ensure the stability of these ICs. RI and LED1 are used to indicate that the unit is powered on.

Unlike the other modules, this particular section of the project may be built and tested within the constructor's chosen box or case. Due to the screening requirement the case should be all metal, this can also be used to earth the project via the mains lead.

The mains lead should be fed through the case through a rubber grommeted hole, to prevent the chassis from cutting through the mains lead insulation and causing a risk of shock. The mains lead should also be clamped with a strain relief fitting to prevent the cable from being pulled. The Live (brown) cable should be routed via a 100mA fast blow fuse holder to one pole of a DPDT 250V AC rated switch on the front panel, the Neutral (blue) cable should be routed directly to the other pole of this switch, the switch mounted so the toggle is in the **up** position to switch **on.** The switched Live and Neutral should then be routed from the switch to the 250V winding of T1. The mains earth lead should be furnished with an eye connector as shown in **Fig 7,** the free end of this earth strap being tinned and soldered to the 0V terminal on the secondary windings of transformer T1.

All exposed connections carrying 250V should now be insulated, using terminal 'boots' or heat-shrink tube. Insulating tape will do at a pinch, but make sure the exposed areas are properly covered. Now for the first test! Connect an earthed mains plug furnished with a 3 or 5A fuse to the mains lead. Connect your multimeter, switched to an AC range of around 15V, between the chassis and one of the 12V taps on the secondary winding. Initially set the On/Off switch to 'On' and plug into the mains. The meter should read 12V, now disconnect the mains supply. Connect the multimeter probe to the other 12V tap and proceed again, this tap should also read 12V. Leaving the mains on now, test

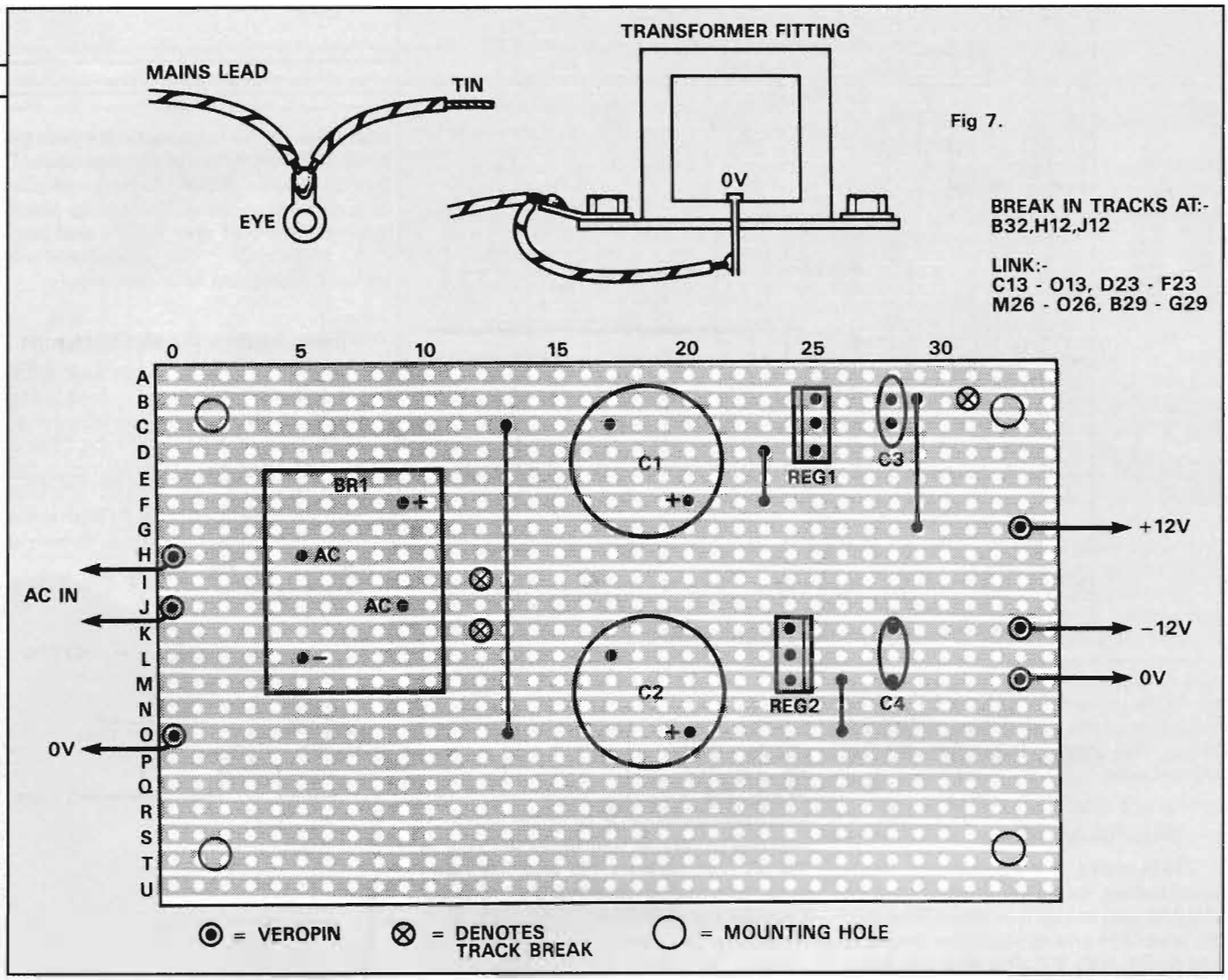



Fig 7.

the On/Off switch. It would be well to leave the unit on 'soak' for around 30 minutes to check for any overheating or the like. Now onto the regulator board.

First check the AC delivered by the AC IN pins are connected to the correct pins of the bridge rectifier package, and that the electrolytic capacitors C1 and C2 are mounted with the correct observation of polarity, i.e. C1 +ve to the +12V rail, -ve to 0V, and C2 +ve to 0V and -ve to the -12V rail. Check also that the correct regulator ICs are fitted, i.e. the UA7812CT to the +12V line and the UA7912CT to the -12V line, note the pin usage for both packages are different.

Having assembled the board, and inserted the appropriate Veropins, connect the LED OUT pins to a red LED mounted next to the On/Off switch. To test the board, temporarily connect the 0V and two 12V AC lines to the appropriate input pins on the board. Now attach your multimeter on a suitable DC range to measure +12V, between 0V and 12V out on the boards. Switch on, and check for 12V. Now set your meter to read 24V DC and move the negative probe to -12V, checking for a reading of 24V. If the LED isn't lit, try swapping the connecting wires around at the board. The regulator board should now be permanently fitted on stand-offs to prevent the underside of the board shorting to the chassis.

The main board has several different functional blocks, each will be assembled and tested individually.

## Input Buffer Amplifier

First inspect the board layout given in Fig 8. Insert and solder the +12V and 0V input pins and subsequently insert and solder the bias components R4, R5 and C4. Make the appropriate breaks in the Veroboard tracks and mount an IC holder for IC1, this will help you orientate the remaining connections and components. Now install the link wires for; 1) 12V (to pin 7), 2) 0V (to pin 4), 3) Bias (to pin 3), and 4) two wires connecting pins 6 to 7 as the feedback line.

Now install R1, C1, C3 and C4, remembering to check the orientation if the electrolytic capacitors (C3, C4). Finally add the Veropins for BUF OUT and AF IN. To test this module, connect AF in to an appropriate AF source i.e. your receiver, and connect a pair of headphones across BUF OUT and 0V. Power up the main module and turn up the audio gain control of the rig or alternative audio source. It should be possible to hear the output of the rig in the headphones albeit at a reduced level.

## The Post Buffer Amplifier

Prepare your board links etc. and fit and solder C5 (observe polarity), C6 and C8. Testing this circuit is pretty straightforward, temporarily connect VR1 into the circuit, linking the top end of the potentiometer to BUF OUT, and the earthy end to 0V. Connect the headphones across the (as yet) unconnected end of C6. Again power the unit up, and check that the RX audio can be heard. Adjusting VR1, VR1 will alter the level of audio heard in the headphones.

## AF Level Meter

Install the IC and link wires, then fit C6, R5, R6 and C7. Note that the present resistor used in the prototype was a multi- turn cermet type, although any other type will electrically suffice. Install R7, R8, TR1 and the Veropins for meter M1 connections. Temporarily connect M1 into the circuit, turn the unit on and ensure that a reasonable signal from the rig will cause movement in the meter. It is also worth checking that RV1 in the circuit is working, to do this tune your receiver in SSB/CW mode until a beat note of around 1KHz is obtained. Now

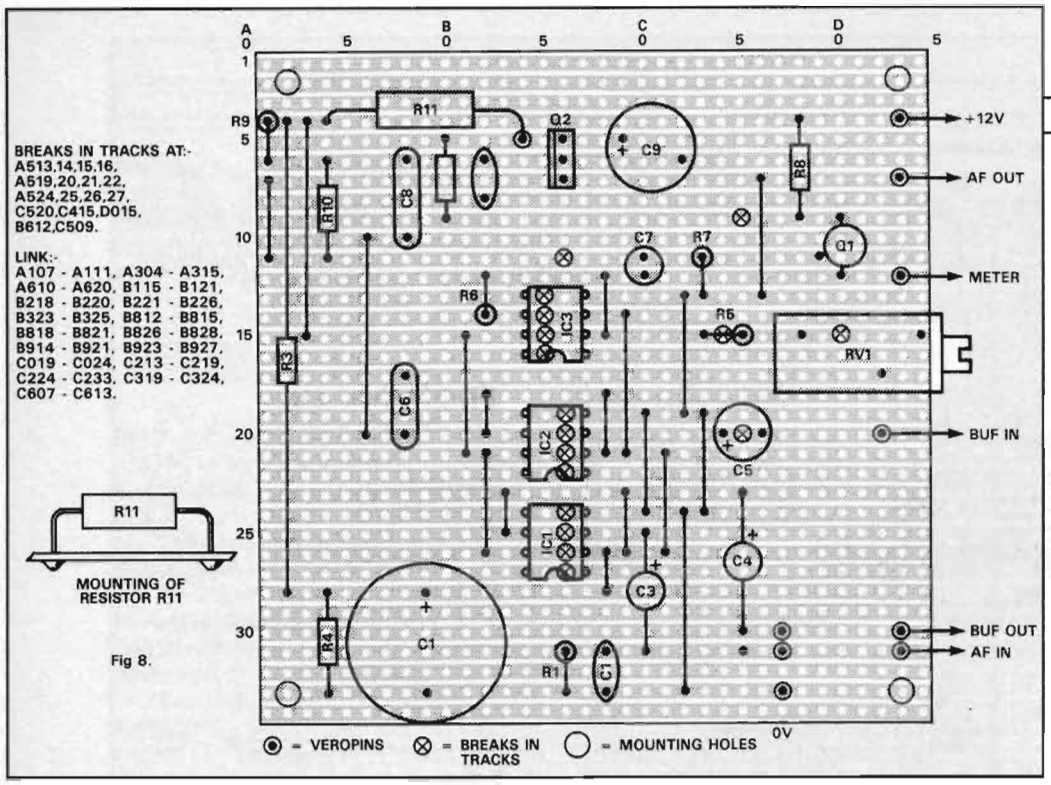



Fig 8.

adjust the value of RV1, checking that the deflection of the meter changes in sympathy. This meter indication will be aligned later.

## The PA Module

First make the appropriate Veroboard breaks, locate the correct holes for VN66AF and solder it in place. Now add the wire links and appropriate Veropins, and fit R9, R10, R11, R12 and C10. Note that R11 is a 5W device and should be mounted above the board as shown in **Fig 8** to ensure adequate ventilation. Finally install C9 with due regard for its polarity.

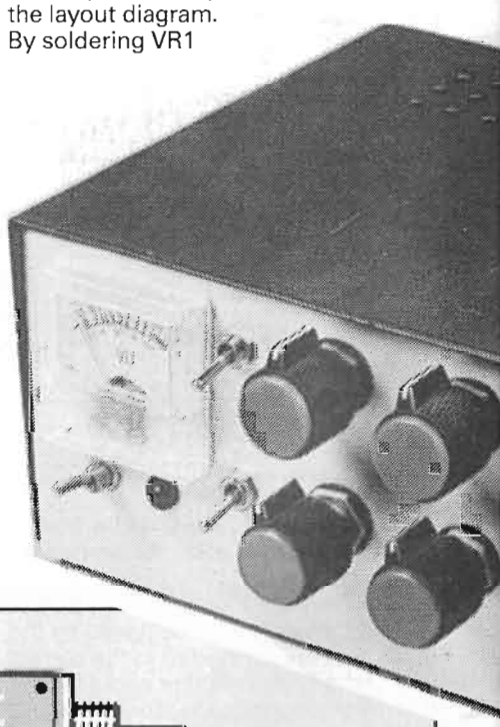
Temporarily connect an 8 ohm speaker across the output pins, switch on, and with any luck wonderfully clear audio will emanate from the loudspeaker! However, it is quite possible that due to varying tolerances within the VMOS bias network (R9 and R10), the audio may sound distorted. If this proves to be the case, remove R10 from the bias network and replace it with a 500k preset resistor, adjusting this for best audio quality.

Once you have the circuitry working, disconnect the temporary interconnections and mount the completed board inside the prepared case with its apertures for the meter, volume control, jack plug and a phone loudspeaker output on the rear apron. Solder two patch leads to BUFOUT and BUFIN, and lead them outside the case. These leads will be used to test the filter modules.

## The Audio Peak Filter

The component layout and track break table for this unit are shown in **Fig 9**. Now fit the IC, then the link wires onto the board, then C1, R1, C2, C3, C4, C5 and finally C6. Next install the Veropins for Filter In, Filter Out, +12V, 0V and -12V, VR1 and VR2 will be fitted later. Fit both units in their prescribed positions as shown in the layout diagram.

By soldering VR1



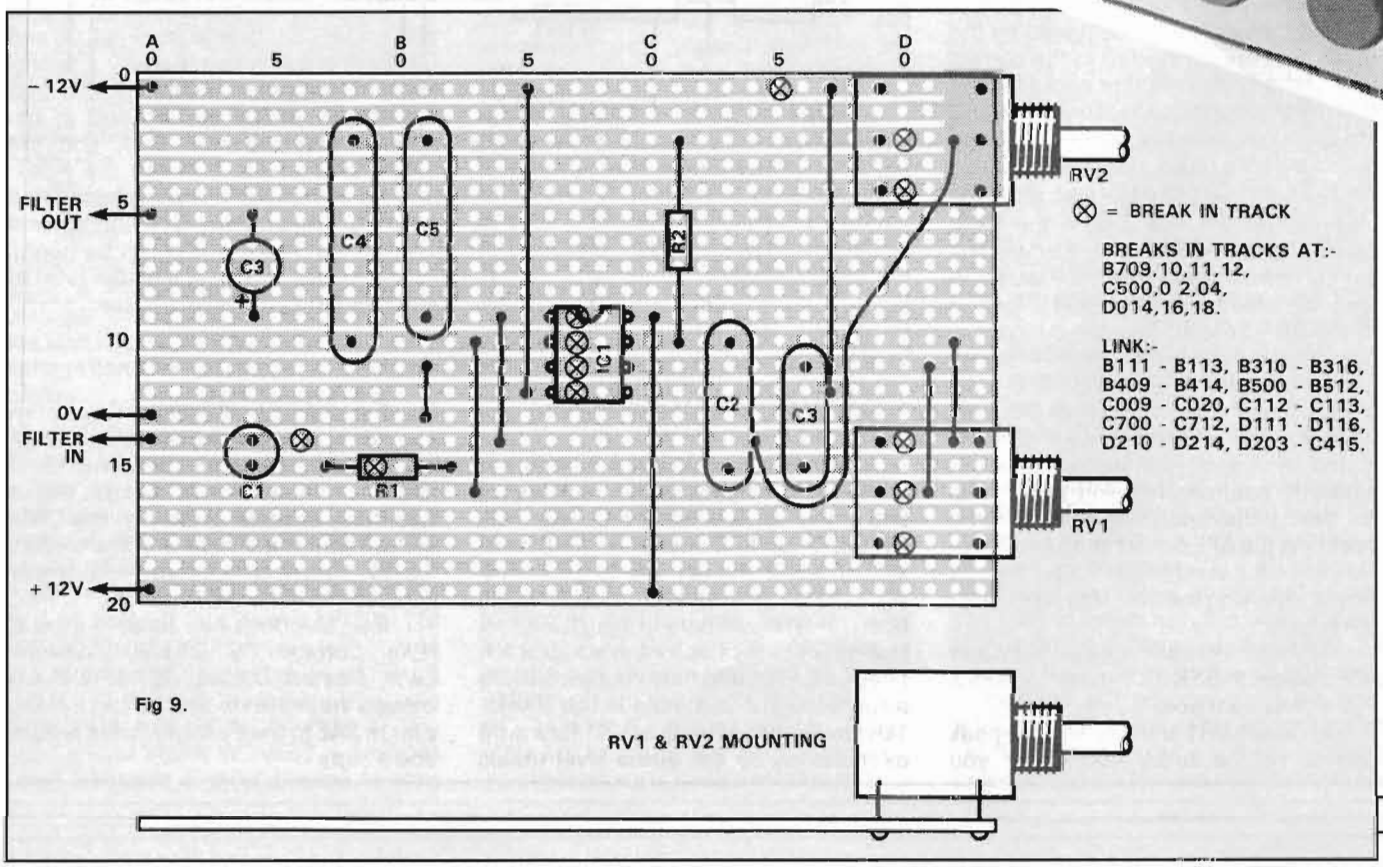



Fig 9.

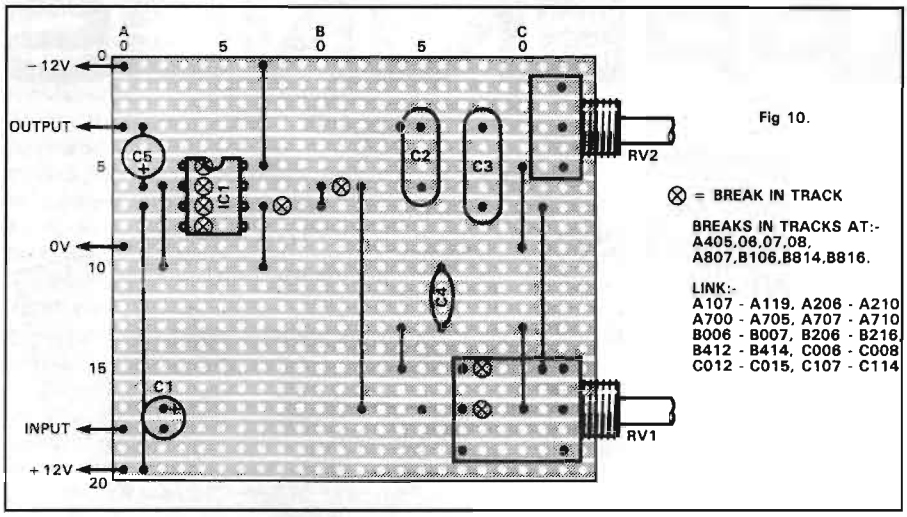
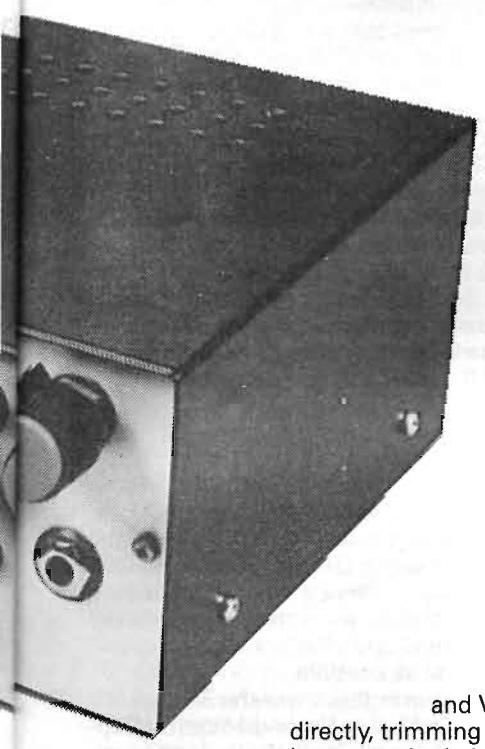



Fig 10.



and VR2 directly, trimming the pins as required, these may be used to physically mount the board onto the front panel. To test the APF unit, connect the supply lines, the lead from BUF OUT and the main board to Filter In, and Filter Out to the BUF IN lead. Turn the AF control fully counter clockwise, switch on and gently turn the AF gain up. This may result in the unit whistling or 'clicking', or issuing the characteristic 'ghostly' sound of a narrow filter, in any event adjust the controls of the APF to get a feel for their behaviour. Note that in some positions the APF can act as an audio signal generator, in others as a filter. A good way of checking the overall selectivity of the filter is;

1) Switch the calibrator on, or find an AM station. In SSB/CW mode, obtain a 500-800Hz beat note.

2) Adjust VR1 and VR2 to get a peak reading on the audio level meter, you may need to adjust RV1 on the main module to get a usable peak.

3) Tune across the carrier or calibrator signal and observe the sharpness of the peak.

4) Now find an SSB signal. Adjust both VR1 and VR2 and observe the effect on the received audio, it should go from perfectly readable to unintelligible as the Q (and hence bandwidth) is decreased.

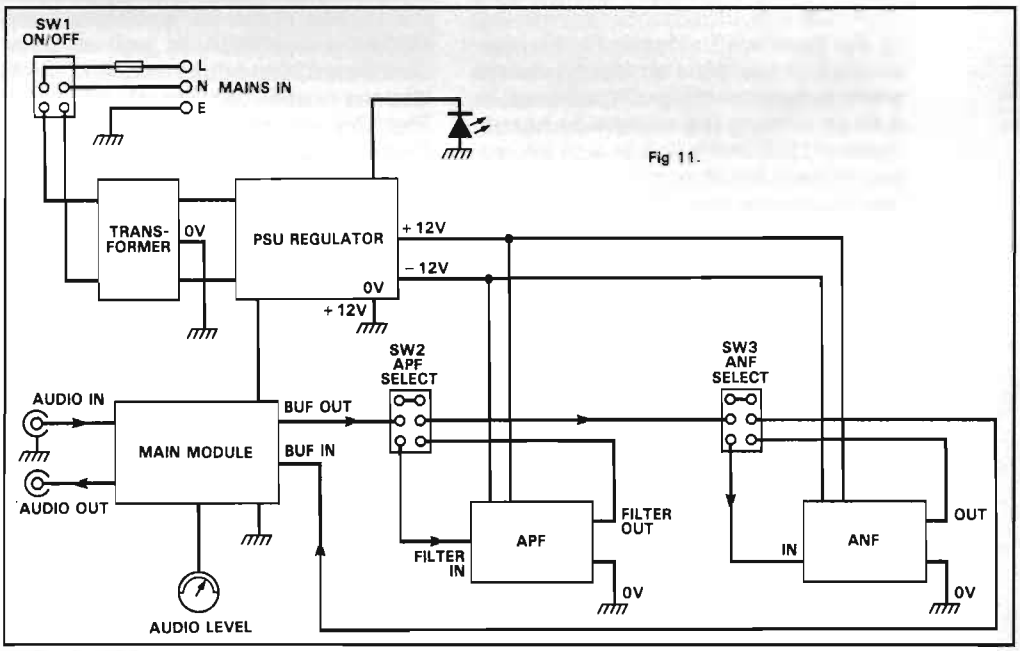



Fig 11.

## The Adjustable Notch Filter

A suggested layout for this is given in **Fig 10.** Having made the track breaks and added the link wires etc., install C1, C2, C3, C4 and C5, then trim the pins of VR1 and VR2 and fit these to the board. Again these will be used to mount this board on the front panel. Using the same testing procedure as for the audio notch filter, switch on and tune your receiver to a carrier with a beat note in the 300Hz-1kHz range. Initially adjust VR1 for a drop as indicated by the audio level meter, then adjust VR2 (Phase) to achieve a still deeper notch.

This completes the board level work, now all we need to do is drill a few holes for variable resistors and switches and we'll have finished.

## Final Wire-Up

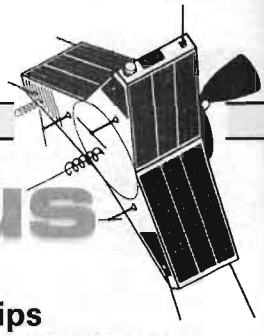
Make suitable holes in the front panel to accommodate the two filter bypass switches and the threaded portions of the variable resistors on the APF and ANF boards, wire the switches as illustrated in **Fig 11.** Install the ANF (Audio notch filter) as the lower board on the front panel, using the threaded neck of the potentiometers to support the board. Now connect the wiring to the ANF which is mounted as the upper unit.

There is very little alignment needed apart from adjusting RV1 on the main module to give useful peak and notch readings on the incoming signal. Having accomplished this final task, the covers may added to the completed unit which may now of course be used in anger!

My very first QSO with the unit in line was with a JA on 40m CW, the peak and notch filters were both in circuit during the QSO. The JA had called me after I had issued a general CQ call, his signal was really struggling through the QRM and without this simple unit the contact wouldn't have taken place — I simply wouldn't have heard him reply!

*Gee Goodrich can be contacted at Holly Cottage, 35, Shipley Common Lane, Ilkeston, Derbys, DE7 8TQ. If you missed the previous circuit descriptions, a large SAE to the Editorial Office will get you a copy.*

# Satellite Rendezvous



*Richard G3RWL of Amsat-UK gives advice on software as well as the new Russian satellites.*

Following on from last month's feature I gave details on Rudak transponders on the latest 'Pacsat' Oscar 21, you'll probably know the two Russian satellites RS14 (Oscar 21) and RS12/13 (which comprises two transponders on the same satellite) were launched in early February.

## RS12/13

Leo UA3CR tells us the amateur radio payload on RS12/13 will be powered up in orbit 8 and the telemetry beacon will be switched on for a short period to allow a first check of the systems. The accompanying transponder list gives frequency details, and here's a brief overview of the satellites configuration;

*Orbit Configuration;* Polar circular orbit with an average height of 1000 km, inclination 83 degrees and period 105 minutes.

*Auto-Answer Robot;* operates in modes A, K, T, KA and KA.

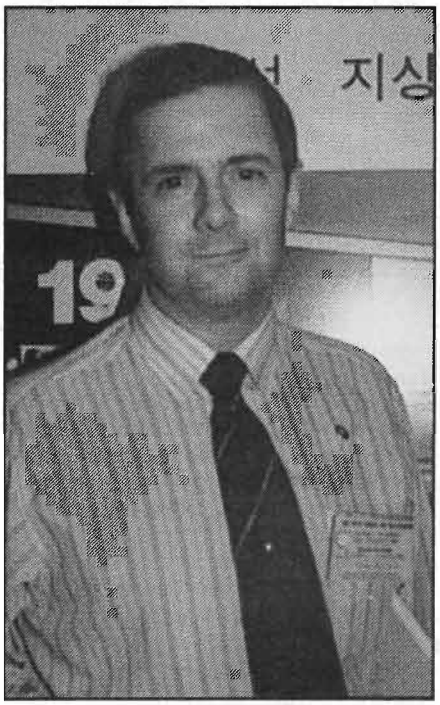
*Transponder Data;* beacon and robot RF output power, 0.45W(l)/ 1.2W(h), transponder transmit power, 8W approx., 29MHz or 145MHz, these figures identical for RS12 and RS13.

## Rudak

Version 1.00 of the Rudak-II (RBBS) will be loaded into Radio-M1 as soon as the initial in-orbit checks are completed. It will be a preliminary release, capable of storing personal mail and messages of general interest. Take a listen for the satellite, the RM1 CW telemetry beacon can be heard on a downlink frequency of 145.822 or 145.948 MHz. Space precludes a full description of the BBS commands here but this month's *Packet Radio Roundup* has full details of this.

## Pacsat Software

An update to PG.EXE should be out by the time this appears, it's currently being tested at the University of Surrey as I write this. The new revision will fix some of the shortcomings of previous versions. For those not familiar with



PACSAT operations, PG is the IBM-PC program which allows users access to files stored on the Pacsats for downloading, the user can also upload files to a Pacsat using PG.EXE. One new feature is the capability to examine partially downloaded file directories. Previously, unless the user received the entire file directory before the pass was over, it was not possible to 'view' the directory file, but partially received directory files can now be examined.

In an effort to reduce heavy QRM problems caused by the earlier versions of PG, it waits to see if the *BBSTAT* indicates if there is an open channel, and only then does it attempt a connect. Another QRM reducing feature which will also improve efficiency is the display of *keywords* in files. The idea behind a keyword feature is to allow the user the opportunity so see if a file stored on a PACSAT is what they want. For example, one might look for the keyword *DX* in order to find a file which contains the latest DX activity on AO-13.

For those who just want to read their personal mail, or bulletins of general interest to all PACSAT users, the new options of *List Mine*, the *List Bull*, and the *List All* have been introduced. Those who just want to read files addressed to them can choose the 'List Mine' option for example, the same with bulletins and general interest messages. By implementing these new features, operations on the Pacsats should be much more efficient for all users.

## Software Tips

A tip for PK-232 users of the ground station software PG, you must set the parameter DCDCONN to *ON*. The default is *OFF* so you need to do this otherwise PG won't load.

For Atari and Apple Mac users, there's now some software available allowing use with the Pacsats. PE1CHL has successfully implemented the Broadcast and FTL0 Protocol on the Atari ST, and the Mac offering has a PG 'look-alike' and a telemetry decoder. The Atari executable file is currently being carried on UOSAT3 and is some 150k long in an Arc file. Called NET.PE1CHL ATARI BROADCAST FTL0 TCP/IPNET/ROM MBOX. The Mac programs are called BCAST2.SIT (= PG) and KISSTIL.SIT(= tlm). BCAST2 is about 90k and KISSTIL is about 31k.

## Software Needed

Amsat hardware and software development runs entirely on the volunteer efforts of its members, amateurs like Harold NK6K, Bob N4HY, Tom W3IWI, Jeff G0/K8KA and others have done much work in the past to make the Amateur Satellite Program what it is today. Right now, there's an need for individuals who are fairly competent software developers and who have an interest in porting Pacsat software originally written in MS-DOS to other computers, this way they may be able to get software available for several machines such as the BBC, Amiga, Atari, ZX Spectrum and such. The only way anything is accomplished by Amsat is when people step up and volunteer for a piece of the action, Amsat engineers can help with advice and even source codes, so get in touch if you feel you can help. I'm still waiting to hear about the ground station code, the University of Surrey have been somewhat busy getting the satellites right, and once they have some time to spare they'll send C source code out into the public domain.

## MicroSats

The University of Surrey have armed the automatic high/low power switching on UO-14. This turns high power on when the batteries are fully charged and have been fully charged for 5 minutes, it returns to low power when the batteries discharge by 20% of their capacity. Because the signal strength could vary drastically with the new bat-

tery algorithm, users should not be surprised by this, especially if UO-14 has been in eclipse for a long period and has also seen heavy usage. The advantage of this new battery management algorithm is that it will aid in extending the life of the batteries and ultimately the life of UO-14.

Perhaps unknown or unnoticed by users is the fact that UO-14 has been flying upside down for a considerable length of time. Well, in the week I write this it was 'flipped' upright. Although users may not have found UO-14's inverted attitude a problem, it did produce concern with the controllers as they saw high battery temperatures. Now that it's flying upright, users should see an improvement in signal strength with the antennas earth-pointing.

In the continuing tradition of Amsat's 'Wednesday Experimenter's Day', Amsat and the Pacsat command team have announced the routine operation of AO-16's S-Band (2401.143 MHz) and Raised Cosine (437.050 MHz) PSK transmitters. Since the operation of these transmitters is currently under ground control, the start and stop of their operation won't occur exactly on Wednesday UTC but will vary a few hours either way.

## Webersat WO-18

Weber State University engineers spent most of Christmas experimenting with the camera iris settings on WO-18, to find the right combination of iris settings for particular light levels. Another task in hand is to find a way to tell when the camera was earth pointing. A celestial 'spanner' was thrown into what is a very complicated spacecraft attitude motion problem when they noticed that something very strange was happening to WO-18, its Z- axis spin rate was slowing down — contrary to what was happening on the other Microsats. This unexplained phenomenon has caused much scratching of heads! They think they've found the answer in a rather ancient NASA document on spacecraft electrostatic charging, but they're still wondering what all those pages of equations mean. In the meantime it is still theoretically possible for folks with images stored up to figuratively twiddle the brightness and contrast knobs by altering software parameters, if you hit the right value please let us know at Amsat-UK.

## Short Bursts

With the commencement of full-time BBS operations on the Pacsats, amateurs now have a highly reliable way to receive the Amsat bulletins and orbital elements as soon as they are available, those able to monitor the Pacsats will then be able to capture the bulletins and Keplers easily. Because of the orbit of the Pacsats, their global coverage makes it possible to see a Pacsat pass at least six times a day.

Remember the Amsat-UK Colloquium *(the UK amateur satellite 'Event of the Year' — Tech Ed)* is over the long weekend of 25th - 28th July, held as usual at the University of Surrey. Just send an SAE to Ron Broadbent if you'd like booking information, overnight accommodation is also available. You'll probably find me in the bar in the evenings with the HRT Consultant Technical Editor plying me with refreshment!

For further information about Amsat-UK contact: Amsat-UK, c/o Ron Broadbent G3AAJ, 94 Herongate Rd, London, E12 5EQ. A large SAE gets you full membership info, and listeners as well as transmitting amateurs are most welcome.

**KEPLERS**

| SAT: | OSCAR 10 | UoSat 2 | AO-13 | UO-14 | LO-19 | FO-20 | RS-10/11 | DEBUT |
|---|---|---|---|---|---|---|---|---|
| EPOC: | 91017.23522100 | 91021.12883954 | 91012.58308178 | 91020.20421620 | 91020.54499127 | 91014.00153565 | 91025.06630241 | 91024.44466569 |
| INCL: | 25.9088 | 97.9228 | 56.8342 | 98.6788 | 98.6849 | 99.0174 | 82.9275 | 99.0194 |
| RAAN: | 165.0333 | 71.2854 | 115.9835 | 100.4921 | 101.1820 | 25.4880 | 164.6013 | 33.9455 |
| ECCN: | 0.5975208 | 0.0011696 | 0.7102346 | 0.0010602 | 0.0011599 | 0.0540619 | 0.0010983 | 0.0540075 |
| ARGP: | 209.5353 | 278.8268 | 244.7572 | 240.9907 | 238.6806 | 291.0398 | 218.4988 | 267.2471 |
| MA: | 96.4473 | 81.1583 | 28.8440 | 119.0208 | 121.3239 | 63.3713 | 141.5392 | 86.6733 |
| MM: | 2.05878895 | 14.66081278 | 2.09694183 | 14.28850219 | 14.29157014 | 12.83165137 | 13.72137691 | 12.83168463 |
| DECY: | 5.4E-07 | 1.263E-05 | 2.21E-06 | 3.45E-06 | 3.41E-06 | 6.2E-07 | 7.1E-07 | 3.1E-07 |
| REVN: | 2914 | 36789 | 1979 | 5185 | 5191 | 4378 | 17995 | 4512 |

| SAT: | UO-15 | PACSAT | DO-17 | WO-18 | Mir | Cosmos 1686 |
|---|---|---|---|---|---|---|
| EPOC: | 91022.72368890 | 91023.18960385 | 91021.07695549 | 91021.19288106 | 91025.11775628 | 91024.74362767 |
| INCL: | 98.6841 | 98.6840 | 98.6856 | 98.6866 | 51.6105 | 51.5888 |
| RAAN: | 102.9339 | 103.7048 | 101.6297 | 101.7879 | 292.4283 | 237.5860 |
| ECCN: | 0.0009577 | 0.0010751 | 0.0010728 | 0.0011295 | 0.0025819 | 0.0001823 |
| ARGP: | 232.1844 | 229.6354 | 237.4076 | 237.5816 | 159.5960 | 238.1859 |
| MA: | 127.8459 | 130.3901 | 122.6061 | 122.4280 | 200.6442 | 121.6590 |
| MM: | 14.28522620 | 14.28949031 | 14.29009017 | 14.29083541 | 15.62997154 | 16.11551103 |
| DECY: | 2.21E-06 | 3.32E-06 | 3.74E-06 | 3.21E-06 | 4.7914E-04 | 4.5616E-03 |
| REVN: | 5220 | 5228 | 5198 | 5200 | 28276 | 29125 |

**RS12/13 Frequency Guide**

| | | RS 12 | RS 13 |
|---|---|---|---|
| Mode A | Uplink | 145.910 — 145.950 | 145.960 — 146.000 |
| | Downlink | 29.410 — 29.450 | 29.460 — 29.500 |
| Mode K | Uplink | 21.210 — 21.250 | 21.260 — 21.300 |
| | Downlink | 29.410 — 29.450 | 29.460 — 29.500 |
| Mode T | Uplink | 21.210 — 21.250 | 21.260 — 21.300 |
| | Downlink | 145.910 — 145.950 | 145.960 — 146.000 |
| Mode KA | Uplinks | 21.210 — 21.250 | 21.260 — 21.300 |
| | | 145.910 — 145.950 | 145.960 — 146.000 |
| | Downlink | 29.410 — 29.450 | 29.460 — 29.500 |
| Mode KT | Uplink | 21.210 — 21.250 | 21.260 — 21.300 |
| | Downlinks | 29.410 — 29.450 | 29.460 — 29.500 |
| | | 145.910 — 145.950 | 145.960 — 146.000 |
| | Beacons | 29.408 — 29.454 | 29.458 — 29.504 |
| | | 145.912 — 145.959 | 145.862 — 145.908 |
| **Autoanswer Robot** | | | |
| Uplink | | 21.129 and/or 145.831 | 21.138 and/or 145.840 |
| Downlink | | 29.454 and/ or 145.958 | 29.504 and/or 145.908 |

# Packet Radio Roundup

While one nation makes a 'big thing' about occasional packet from space, packet operators around the world were surprised to see Musa U2MIR's packet station aboard the permanently orbiting USSR Mir space station come into operation!

## Packet from Space

Veteran Cosmonaut Musa Manarov U2MIR, (his own callsign being UV3AM when he's at home in Moscow) has placed a packet station on 2m on board Mir, and it's reported that Mission Commander Victor U9MIR will be sharing the station as time permits. According to the Soviet co-ordinator Boris Stepanov, UW3AX, the new packet equipment was launched to Mir on a Progress M6 resupply 'space truck' on January 14, docking with Mir a couple of days later.

UW3AX tells us the packet equipment on Mir consists of a PacComm HandiPacket unit and Icom IC-228A 2 meter FM transceiver together with a laptop computer. Musa familiarised himself with the equipment at the Cosmonaut training facility at Star City near Moscow, prior to his launch to orbit late last year. Although the IC-228A can run as much as 25W RF output power, UW3AX suggests Musa will probably keep the power levels below maximum.

The HandiPacket TNC on Mir also has a built-in Personal Message System, and according to PacComm President Gwyn Reedy W1BEL the software on the flight unit is off-the-shelf. Some new software with features tailored for the space environment may be sent to Mir soon, meanwhile some configuration changes to the existing unit, such as allowing for up to 10 simultaneous connects, will be made shortly. Other changes to increase QSO/QSL- ability will also be phased in says Gwyn.

Initial reports of packet activity from Mir were made on Sunday January 20, and it's reported that active satellite packet pioneer Peter DB2OS made the first 'connect' with U2MIR. Operation has been heard on 144.675MHz (the Moscow VHF packet frequency) and more recently a beacon/personal mailbox on 145.550MHz. Some consideration is being given to using split frequency operation to improve operation. Remember 145.550MHz is a European simplex frequency, and Musa can indeed grab the mike for a 'real time' FM contact if he's free — so before issuing a 'connect' or whatever **check** the frequency first!

*G4HCL gets connected to the Mir Space Station Packet system*

With the station orbiting at a height of only around 400km, with the external ground plane aerial used the signal strength is excellent, just like a local station! The U2MIR call is apparently the 'MYCALL', with U2MIR-1 as the personal mailbox, some stations have also been heard digipeating through U2MIR-1. A message typical listing from U2MIR-1 is shown here, looking at the prefixes this certainly makes a difference to a 'usual' 2m packet mailbox! Beacon messages from U2MIR-1 ask that only personal messages be uploaded, no third party messages.

UW3AX also reports that the next Mir crew (expected to be launched next month) may also have another ham or two on board, and together with the AREM experiment things packet is really hitting the space age! UA6HZ is handling QSLs for both U2MIR and U9MIR, the address is: Valery Agabekov, UA6HZ, Box 1, 375600 Yessentuki, USSR. Use of this address should obtain a faster turnaround than through Box 88 Moscow.

## AREM Update

The equipment for the Austrian Amateur Radio Experiment on Mir (AREM) is nearing completion. In a telephone interview for the South African Radio League program 'Amateur Radio Mirror' the President of AMSAT-OE, Wolf Hoeller (OE7FJT), said that integration of the equipment is nearing completion. The packet radio station consists of a TNC2 and a 2m handheld built into a case, with external connectors for the aerial and laptop computer.

He told Hans van de Groenendaal (ZS6AKV) that the TNC and radio will be delivered to Moscow by mid January for a month of testing, with the equipment will be sent to Mir during early March.

## Rudak

As well as packet operation from the Mir space station, by the time this appears Oscar-21 should be in operation with its Rudak BBS (see this and last month's *Satellite Rendezvous*). After connecting to RUDAK, you'll get a log-on message similar to that shown in Table 2.

The following commands are supported on Rudak:

**H (Help)** *Outputs a short summary of available commands.*

**L call m-n** *Shows the list of messages addressed to 'call'. m-n (e.g.1-5) determines a range of message numbers. Messages are numbered individually for each addressee starting with 1 for the newest message. Either 'call' or 'm-n' or both can be omitted, the default values are your callsign for call and 1-5 for m-n.*

**R call n** *Read message n addressed to call. The default value for call is your callsign.*

**E call n** *Erase message n addressed to call. The default value for call is your callsign, n is mandatory. If you get the message 'File busy: Try later!' somebody else is currently reading or listing the message.*

**S call subject** *Send a message to call. 'Subject' can be any text string delimited by a <CR> (carriage return) describing the message content.* It will be printed by the L command and show up at the beginning of the message. 'Call' and 'subject' are both required. They alternatively can be entered in separate lines in which case they are prompted as follows:

*S*
**To>** *ALL*
**Subject>** *Important News!*

A message can be ended in one of sev-

eral ways;
1) By disconnecting (or by timeout after Loss of Signal)
2) By entering <CR><CTRL-Z><CR> (i.e a line containing a single CTRL-Z, hex 1A, as on 'normal' BBSs), or
3) By entering <CR>.<CR>

## Amstrad PCW Packet

Back to Earthly matters, many amateurs use the Amstrad PCW series of computers, i.e. the PCW8256/8512/9512 for packet radio, indeed yours truly used one for several years. As the PCW is marketed mainly as a word processor, for connection to a TNC you'll need to plug in an optional Serial/Parallel interface to the rear panel, several companies as well as Amstrad market these units, and of course you'll need an RS-232 connecting lead between the interface and your TNC.

Now many amateurs are unaware of the 'MAIL232.COM' program that is 'bundled in' as a file on the provided CP/M start-up disk with the PCW, there's no need to purchase additional software to get you going! Unfortunately the supplied documentation makes no mention of its facilities, however you'll find that after loading the program by simply entering 'MAIL232' on the keyboard, the function keys F1-F8 are used in conjunction with a 'pop-up' menu to let you set user parameters (the cursor keys are used to alter these), upload and download files, exit the program and so on. The only problem you may find with this is that the 'CTRL-Z' function also causes you to exit the program, so you'll have to use '/EX' or whatever to terminate messages on BBSs. You can of course use other communications programs, such as the terminal emulator in 'Mini Office Professional', but I've always found MAIL232 to do most things I've needed.

## No Node Charges

With the recent controversy about yearly charges for beacon and repeater stations, a message from the Chairman of the RSGB Datacommunications Committee, Ian GM4AUP, tells us that at the moment at least, there's no charge being applied to any holder of a GB7 call. This sounds a relief, as many node and BBS sysops have already devoted much time and expense in setting up their stations for the free use of others, and understandably may not appreciate being charged for the privilege. Unlike voice repeaters, there often seems a reluctance for 'end user' packet operators to contribute to the Node and BBS stations they use. But if you think of it, a typical BBS with its multiple ports (i.e. several transceivers and TNCs) together with a computer with expensive hard disk, or a string of say four transceivers/TNCs in a node system, to say nothing of the electricity costs, can tie up considerably more capital than a typical 2m or 70cm voice repeater. There's a lot of equipment out there which we amateurs freely make use of, think about it.

## CTRL-Z, End of Message

Even though GB7GUR is currently 'cut off' radio-wise from the mainland BBS system, it's still in operation on all it's licensed frequencies through the enthusiasm of Chris the GB7GUR sysop. He tells us he's looking for an AMT1 or 2, if you can help send a message to GB7GUR @ GB7SEK.

Alan G7IWA @ GB7XJZ has been in touch to say although he's only been on the air for a couple of weeks he's thoroughly enjoying himself. He tells me it was predominantly HRT that gave him the confidence and background knowledge to 'give it a go' on packet, and getting his licence no less than 16 years after passing the RAE. Welcome to the mode Alan, packet is expanding by leaps and bounds, I'm sure there'll always be something new to keep you interested!

With the extended roundup on space age packet, that's it for another month. Next month I'll be testing the DRSI 'plug-in' dual port TNC, this simply fitting into a PC expansion slot and coming with a plethora of 'bundled-in' software, you'll see how I got on next month. I can be contacted by a message sent to me at GB7XJZ, or by phone, fax and mail c/o the HRT editorial address, so let's hear what **you're** up to. 73 de Chris G4HCL @ GB7XJZ.

**Table 1**

**Typical U2MIR-1 Personal Message Listing**

```
cmd:c u2mir-1

*** CONNECTED to U2MIR-1
Logged on to U2MIR's Personal Message System

CMD(B/H/J/K/KM/L/M/R/S/SR/V/?)>
L

Msg # Stat  Date      Time  To      From     @ BBS  Subject
   77 P     00/00/00  00:00 U2MIR   WB6LLO          VOICE
   76 PR    00/00/00  00:00 U2MIR   ZL1AFC          v
   75 PR    00/00/00  00:00 ZL2AVK  ZL2TT           greetings
   74 PR    00/00/00  00:00 VK4AGL  VK4ZF           greetings
   72 P     00/00/00  00:00 U2MIR   K1HTV           Hello again Musa
   71 P     00/00/00  00:00 U2MIR   WD4AHZ          Hello
   70 P     00/00/00  00:00 U2MIR   ZL1TRE          Hello again
   69 PR    00/00/00  00:00 U9MIR   VK3CFI          eva
   68 PR    00/00/00  00:00 U2MIR   VK3CFI          more list
   67 PR    00/00/00  00:00 U2MIR   VK3CFI          list commands
2436 Bytes free
Next message Number 78

CMD(B/H/J/K/KM/L/M/R/S/SR/V/?)>
```

**Table 2**

**Rudak II BBS Log-On message**

```
Welcome to the RUDAK II Bulletin Board System V1.00

Logged in at yy-mm-dd hh:mm:ss,  x Users
This is a preliminary release.
Please report deficiencies to DL2MDL.
73 de AMSAT-U-ORBITA/AMSAT-DL/RUDAK-Group.

Enter H for Help
UA3CR  de RUDAK>
```

# From My Notebook

***Geoff Arnold G3GSR shows us what EMF and PD mean in receiver specifications***

Anyone who begins playing about with radio or electrical gadgets soon comes to realise the basic fact that when you connect a current-consuming circuit across a supply of electricity, the voltage of that supply will fall.

Just watch the lights at home go down when someone switches on the electric kettle in the kitchen to make an evening cuppa, or when the thermostat on the immersion heater decides that the hot water tank is getting rather too cold. This can also apply radio signal voltages as well, and knowing why this happens can help you to understand attenuators and filters, and to the way that all manner of inputs and outputs are matched to each other - aerials, pre-amplifiers, linear amplifiers, microphones, loudspeakers, telegraph terminal units, video cameras, transmitters and receivers to name some that the average radio amateur might be interested in. So, you would be right in thinking that it's something well worth getting to grips with!

## Mr. Thevenin

Named after its originator, the principle is stated in something called Thevenin's theorem. This says 'Any active network with two terminals may be replaced in the steady state by a voltage source and a series impedance. The voltage of the source is equal to the open circuit voltage at the two terminals, and the series impedance is the impedance between the terminals with generators replaced by their internal impedance.' The idea can be shown in a simple circuit diagram called a *Thevenin equivalent circuit* (see Fig. 1).

The box marked 'Supply' in Fig. 1(a) might be, for example, a dry battery, a stabilised PSU, a car battery/alternator combination, or an AC mains supply. Whatever it is, it can be considered to be a generator G of zero impedance, a so-called 'perfect generator' whose voltage never changes regardless of how much current you draw from it, in series with an impedance Zs of a value equivalent to the series/parallel combination of all the internal impedances of the supply, Zs is called the source impedance. The beauty of the Thevenin equivalent circuit is that having split the impedance and the voltage of the supply into two separate elements, we can extend the idea to include external circuit impedances to produce a supply with a quite different source impedance.

## An Example

As I've already said, you can consider any form of supply in terms of its Thevenin equivalent circuit, even things that you might not normally consider to be supplies, such as receiving aerials. When testing or realigning receivers on the bench, the aerial is replaced by an oscillator or 'signal generator' which can produce an artificial signal whose frequency, strength and modulation characteristics are under the control of the technician. That arrangement of signal generator plus receiver forms a very useful introduction to the Thevenin equivalent circuit.

Consider Fig. 2, which shows a 50 ohm signal generator feeding into a 50 ohm receiver input circuit. The signal generator 'sees' a load of 50 ohms, and the receiver, looking back into the signal generator, 'sees' a source impedance of 50 ohms; both should be happy! If the signal generator is set to deliver an open-circuit output (EMF) of 1 microvolt, that signal will be divided equally across the source impedance Zs and the load impedance of the receiver front end ZL, giving half a microvolt potential difference (PD) at the receiver input terminals. It's a basic law of electrical networks that PD equals half of EMF in a matched circuit.

But perhaps the next job on the bench is a realignment of a receiver with a 75 ohm input impedance. That receiver won't be matched to the signal generator, which may upset the operation of either or both pieces of equipment, and if the output level control on the signal generator is calibrated in PD rather than in EMF, as they sometimes are, it will be telling you stories! Our 1 microvolt signal will now be divided in the ratio two-fifths across Zs and three-fifths across ZL. Certainly any sensitivity measurements made on the receiver will be wrong. But as I said earlier, we can extend the Thevenin equivalent circuit to include external impedances, and come up with the arrangement of Fig. 3.

The external series resistor Rx is added to the Zs, giving an effective output impedance for the signal generator of 75 ohms, so the receiver will get its proper 50 per cent share of the 1 microvolt EMF from the signal generator, and will 'see' its proper source impedance of 75 ohms.

That just leaves the signal generator for us to consider. It will be seeing a total load of 100 ohms (25 and 75 ohms in series), but luckily that will generally not matter, as most signal generators consist in reality of an oscillator-plus-buffer amplifier arrangement having an output impedance of some 5 to 10 ohms, padded out to 50 ohms or whatever by means of a series resistor. And of course there's usually a constant-impedance attenuator in the lead to the output terminals, so that you can set the output level you need for the tests in hand.

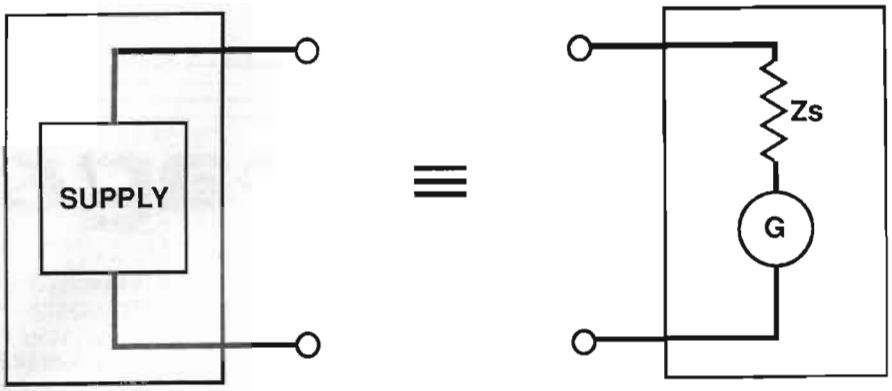
## More Difficult

That works nicely where we need to increase the effective output impedance of a signal generator, but what happens if we have the opposite situation, a 75 ohm signal generator and a 50 ohm receiver? An outline of the solution is shown in Fig. 4, but it's not as simple as that first appears. Don't be fooled into thinking that you could just make R1 25 ohms and R2 50 ohms and all would be well; not so! The signal generator will 'see' a load of R1 in series with the parallel combination of R2 and RL, not just R2. Similarly, the receiver will 'see' a source of impedance equal not just to R2, but to R2 in parallel with the series combination of Rs and R1.

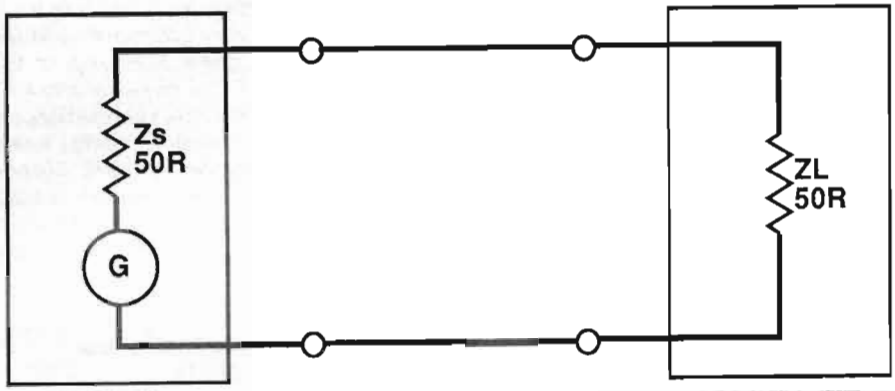
A little bit of arithmetic will soon reveal values for R1 and R2 to achieve the desired result, but note the two resistors actually form a potential divider, and so the input level to the receiver will be less than the output from the signal generator. An impedance matching network like that formed by R1 and R2 is often referred to as a 'pad', and if the values of the two resistors have been chosen to give the desired impedance ratio combined with the least possible signal loss it is called a 'minimum-loss pad'.

You can of course consider R1 and R2 in Fig. 4 to be part of the signal generator, in which case its Thevenin equivalent circuit is identical to that in Fig. 2!

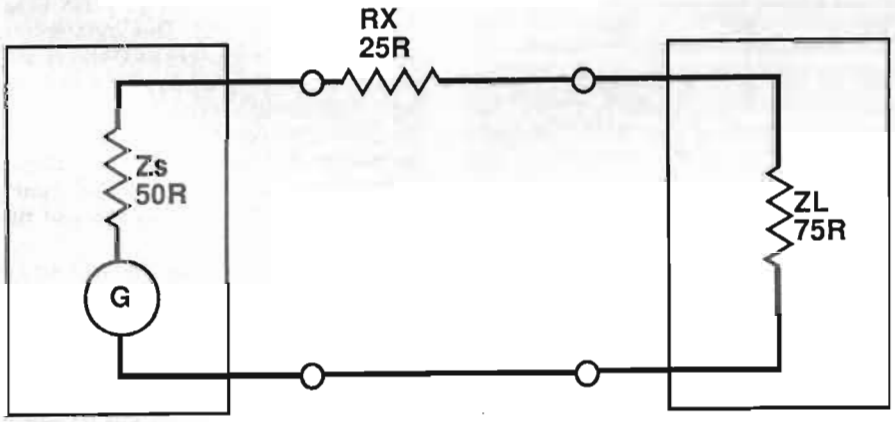
If you simply wanted to feed a 50 ohm receiver from a 75 ohm aerial, you could calculate the resistor values, install the pad and forget it, except perhaps when you curse the loss in signal reaching the receiver! If you want to do a succession of measurements on a receiver on the bench, however, the minimum-loss pad has the severe disadvantage from the practical point of view that the loss is not a round number of dB.



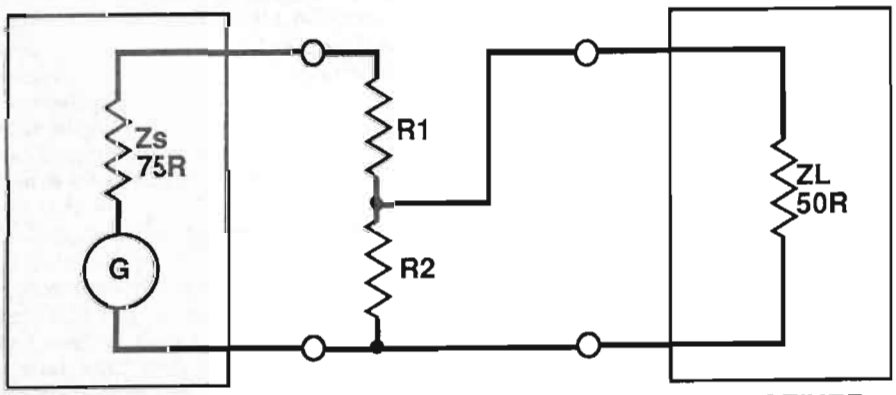

(a) Fig. 1 (b)




SIGNAL GENERATOR Fig. 2 RECEIVER INPUT




SIGNAL GENERATOR Fig. 3 RECEIVER INPUT




SIGNAL GENERATOR Fig. 4 RECEIVER INPUT

So, instead of designing the pad for minimum signal loss, it is usually arranged to give the required impedance matching combined with a round number of dBs of attenuation, easing the mathematics for the test technician! To achieve this, a further resistor is inserted in the lead joining the junction of R1/R2 to the receiver, turning the network into a 'T' attenuator. Yes, But...

I plan to return to the subject of attenuators in a later *Notebook*, but for the moment I want to round off this month's piece with a few qualifying comments. For the sake of simplicity, I've made some assumptions in my explanations that aren't quite true!

First, a receiver which is said to be designed for an aerial impedance of 50 or 75 ohms often doesn't present a load of that value at its aerial terminals. In fact on a receiver for the HF bands, it would be very difficult to maintain a constant impedance across the frequency range even if the designer wanted to. So the assumption I made about the voltage across the aerial terminals being exactly half of the EMF (open-circuit voltage) of the signal generator wasn't true.

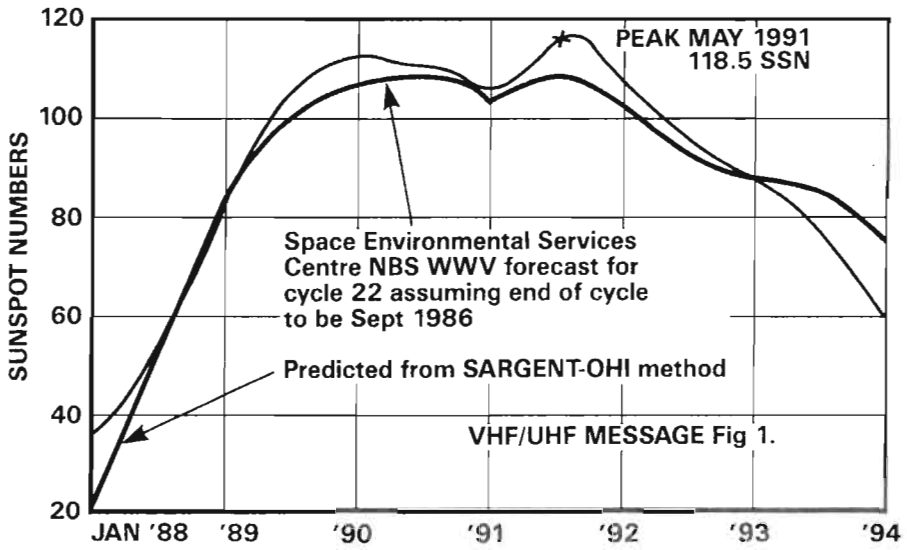
Test conditions for receivers laid down in British Standards recognise this fact by specifying that the sensitivity (the input signal level required to produce a given signal-to-noise ratio at the output) should preferably be stated in terms of signal generator EMF. Alternatively, it can be stated in terms of what the standard calls 'closed-circuit' (CC) voltage, which is defined as being half the EMF. In other words the standard is telling you to assume that the input impedance of the receiver is a true 50 ohms (or whatever else the manufacturer specifies), even if it isn't.

You might complain that this means that the sensitivity figure quoted by a manufacturer or reviewer for the receiver is therefore 'phoney', but that isn't really so. You could say they're all equally wrong, I suppose, but so long as everyone who makes the measurements uses a comparable equipment set-up, and the same measurement techniques and definitions, they should all get the same answer *(like we do in all HRT equipment reviews - Ed).*

Finally, I've shown the connection between the signal generator and the receiver as a simple two-wire line in each case, whereas it will actually be a piece of coaxial cable. Coaxial cable has a characteristic impedance, of course, and should be matched at both ends, especially at VHF and above. This requirement can affect where you put the matching pad, and the form it may take. That simple series resistor to boost 50 ohms to 75 ohms may not be an acceptable solution.

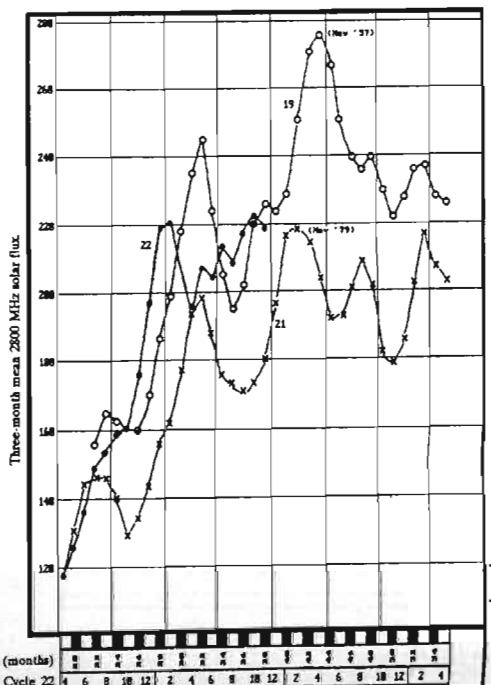
# VHF/UHF Message

***Sunspot Cycle 22, did the experts get it wrong? Ken Ellis G5KW reports.***




As a result of the poor propagation conditions over the last three months and unconfirmed reports that the peak of cycle 22 took place last year, some confusion and pessimism exists with 50MHz operators who were not active during previous cycles. To get the records straight a few comments from my own activities and observations during cycles 18-22, 1947-1990, may be useful. In general, since records were kept, the span of a sunspot cycle was 11 years plus-minus, the peak of cycle 22 was generally accepted as Nov 1979. Nov and Dec 1979 provided us with some Worldwide cross-band DX, during early 1980 we had a trough, then a second peak with again Worldwide openings.

During 1981-82 conditions were much better, especially the autumn and winter 1982/83, then a gradual fall to the cycle minimum. As a point of interest I reprint at Fig 1 a forecast by Geoff G3ENY based on a prediction from 'Sargent OHI' method and WWV forecasts which I included in my column of July 1988. This compares the forecast by the Space Environmental Services NBS assuming the end of cycle 21 to be September 1986, and the prediction from Sargent-OHI method.




Cycles 19, 20, and 21 followed a similar pattern as was shown by Smithy G8KG in his article in HRT Apr 1990 comparing the relative progress of cycle 22 with cycles 19 and 21 at the same age. His comments at that time now make interesting reading; "Whatever the final outcome, 1990 will certainly be another good year for 50MHz operators with very high solar indices and probably a rather quieter geomagnetic field, and the peak could prove to be the highest on record. Furthermore, even numbered cycles tend to have prolonged maxima lasting two or more years." *(Solar flux 29/1/91 353-05-1, the highest yet recorded.)*

## Cycle 22 already higher than the peak of cycle 21!

Further to Smithy's forecast above, the solar flux did indeed break all records. January 28th 301-08-2, 29th 327-05-1, 30th 353-05-1 (the highest solar flux for cycle 21 was measured on November 8/9th 1979 as 324/325).

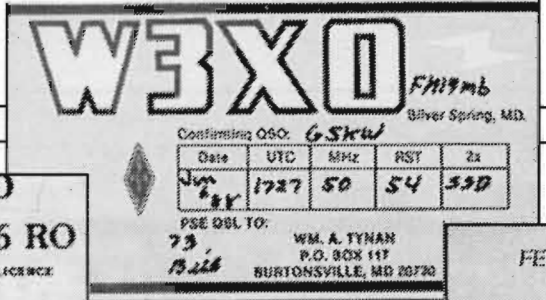
A 'Stratwarm' condition was in operation during the last three weeks of January 1991, same as last year. This caused Polar Cap absorption over the east-west northern path, but farther south many DX paths were open. Here at Folkestone we were generally at the fringe of the 2500 mile single hop path, as my west country propagation study proved. During some openings at the end of January either the skip widened or multi-hop was in operation as the east coast North Americans were heard working Scandinavia, Central Europe and Mediterranean stations. I have referred to this phenomena when working east and west coast Americans at the same time with nothing in between.

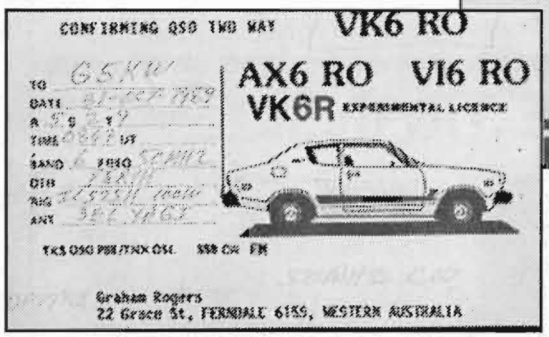
## GJ4ICD Completes DXCC 50MHz

As mentioned briefly in HRT last month, Geoff Brown GJ4ICD of St Helier Jersey, completes his two-way 50MHz DXCC at 1056z by working PT7NK Brazil on 1st February 1991. This outstanding feat is more remarkable as Geoff is self-employed running a busy TV and Radio business and also taking an active part in the production of the UK 6m newsletter, he also finds time to take his son Simon out fishing. We offer Geoff our hearty congratulations and hope the last few QSL cards come through soon so that the award can be claimed. Who in the UK would have thought this possible when we got our permits eight years ago? Who will be the first on the UK mainland?

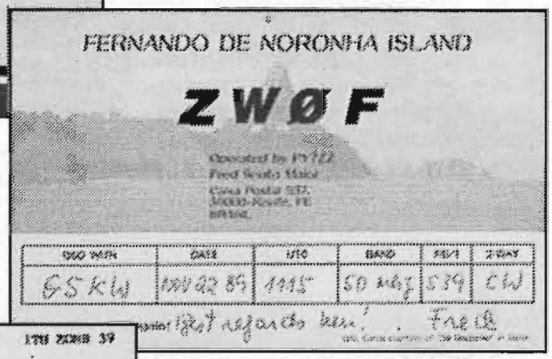
## Cycle 22, an update by Charlie Newton G2FKZ

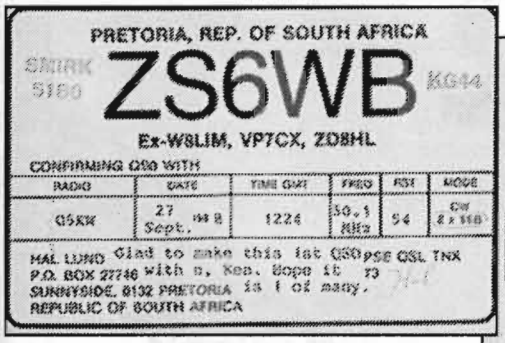
The sun is full of tricks, solar cycle 22 has caught everyone on the hop, the smoothed sunspot number maximum passed by in July at a level of 158.1. At the time it was not believed, and it is only now being recognised as the maximum. It was not really bad forecasting that was at fault, the cycle started in September 1986 and levels rose faster than any other cycle recorded so far. It is well known and noted for every previous cycle, that the faster a cycle rises, the higher it goes, at least that was what has happened up to now. If we look at other aspects the production of high energy 'X' and 'M' flares then cycle 22 raced ahead. To take just one example, during 1990 there were 8 'X' and 28 'M' flares. Four proton events occurred, three of which were of such high energy levels that they gave ground

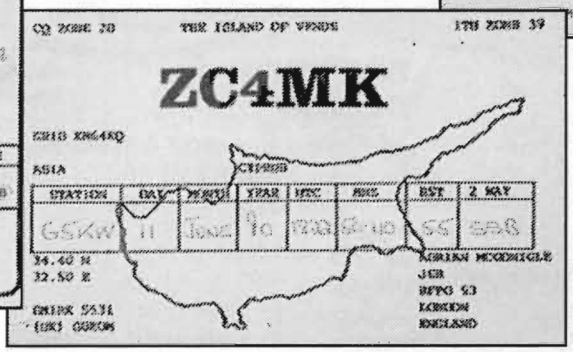



**6m Worked-All-Continents is a reality, as these QSLs show!**





level events, in fact so far cycle 22 has seen 9 ground level proton events, this is more than any previous cycle.

Many of us remember the massive auroral event of March 1989, and the numerous smaller events leading up to what we thought would be a massive high spot cycle with many widespread auroras. Alas it's all gone wrong, what magnetic activity there has been of late is, strange to say, in the wrong place. If we take last October as a sample, the geomagnetic levels at Lerwick a northern observatory were remarkably quiet. On the 1st, the 8 'K' indices for the day were all zero, on the 7th and 17th the daily total was only 4. Altogether during the month there were 47 periods when the 'K' index was zero, there was only 1 disturbed day, the 11th, with a total of 32. In contrast to this, every day the southern observatory at Hartland recorded much more disturbed conditions. On the 1st, the quietest day, only 4 zeros against Lerwick's 8, for the whole month only 14 zeros against Lerwick's 32.

That's not all, the sun normally has 2 semi-permanent coronal holes, one at each pole. These send out tongues towards the solar equator, bits of which break off, and as they cross the sun's central meridian can give auroral conditions. So far in cycle 22 the sun hasn't produced a southern hemisphere coronal hole, and the northern one was very strange as it started near the solar equator and drifted towards the north pole. Of late what auroras there have been are mainly due to filament disintegration. Alas, I have peered into my crystal ball, looked at past records, and I can't tell what the experts think as they have been very quiet of late. But so far cycle 22 is confounding us all. Have you any ideas?

## Ted Collins G4UPS writes;

Bill Wiseman KM1E will be active from 16 December 1990 until some time in March 1991 from Green Turtle Cay Island, one of the islands in the Bahamas. The callsign will probably be C6A/KM1E in grid FL16. QSL is via his home callsign; P.O. Box 120 Woolwich, ME.04579 USA.

**Morocco;** When Joel CN2JP packed up on the 7th December for his flight home he had only managed to work two UK stations, GJ4ICD and G5KW. He has left his TS680S and his dipole for the use of CN8ST, so if you manage to work that station on 6m his QSL info is; Mr. Tarik Skiredj, 81 Avenue Akbah, Apt 1, Rabat-Agdal, Morocco. I understand that a 5 ele yagi and a 6m amplifier is being sent by Joel N6AMG to CN8ST. Talik had his first European opening on Saturday 15th December and during the opening I understand he worked 20-25 G stations, mainly in southern England. Update to the 21 December, Tarik had worked 11 counties on six.

**Newfoundland;** Quite recently VO1NE and VO1WA have become active on 6m. They have worked quite a number of European stations, but as those who have worked him have probably found out, neither is listed in any call book. So if you want GN27 confirmed, details for both stations are; Mr. A. Walsh VO1WA, P.O. Box 652, Marystown, Newfoundland, Canada A0E 2M0, and Mr. J. Pitman VO1NE P.O. Box 1055 Marystown, Newfoundland, Canada A0E 2M0.

**KA3B/C6A Expedition;** I've had information from Harry Schools regarding his trip to the Bahamas during Nov 27th to Dec 4th 1990. Harry worked 6 countries including LA9ZV (who he managed to work after he had applied his aftershave lotion to his trip home!). Harry worked W, VE, YS, V31, TI and LA.

**Surinam;** PZ1EL and PZ1AP both had a good European opening on 27th Dec 1990. QSL information Mr. R. Tia PZ1EL, P.O. Box 9131, Paramaribo, Surinam. Mr. Arnold J. Polsbroek, P.O. Box 566 Paramaribo, Surinam.

During a QSO with SV1DH, Costas informed me that there will be a meeting with the Greek PTT towards the end of January 1991 to discuss the possibility of 6m permits being issued outside the Athens area. This will be good news for the SV5 and SV9 operators, a number of whom are just waiting for permission to become active on the band. It would also mean two new DXCC countries on the band.

**Spain;** I understand that in a recent meeting with the Spanish PTT, the authorities have granted the use of the 6m band in principal, and I gather that future meetings will be held to discuss the power limits, frequency spectrum etc.

**Falkland Islands;** A new station has recently become active on 6m from the Falkland Islands, Martin VP8CEX. Not only has he worked into LU but he has been heard in W4. Further details when I have them to hand.

**Italy;** Mike I2CSB, who many of us have worked has moved to the Foggia area and is now active as I7CSB. His new QSL information is: Mike Copola via Bisceglie 82, 1-71016 San Severo, Foggia, Italy. Mike also informed me that during the Sporadic E season June/July he will be QRV from JN80, 90, 81 and JN99. Further

information when I have it.

**Israel;** Ralph 4X4IF, reports that a crucial meeting with the Israeli PTT will take place around the 9th of January 1991, to discuss 6m operations from 4X4. Further info when I have it.

**Ivory Coast;** QSL information for TU2EW is as follows: Daniel Biau, P.O. Box 1890, Abidjan 11, Ivory Coast.

**6m Beacon for Paraguay;** Doug Wooley ZP6XDW, will look after the beacon which should be on the air sometime in January 1991 using the callsign ZP5AA. The 5W beacon operating in CW mode will send ZP ZP ZP ZP5AA GG14. The crystal frequency is 50.023MHz with the actual frequency 50.0245MHz. We are most grateful to Pat Bunn N4LTA, for building and shipping the beacon.

**Malta;** Two stations in Malta have asked me to pass along their full names and addresses for QSL purposes. Brian J. Cole 9H5ET, 140 St Mary St, Zejun, Malta. G.C. and John Dougal 9H5EE, 8 St Anne Court, Bisazza, St Sliema, Malta GC.

**Denmark;** Information from Ivan OZ7IS reveals that Denmark is planning a 51MHz repeater system. Output/input channels: 99, 97, 83, 81 / 99, 97, 83, 81.

**Zambia** A recent letter from Hal Lund ZS6WB, indicates that the 6m transceiver that was intended for Brian 9J2BO has been stolen. Hal reports that he has another one available which he will send to Brian as soon as possible. So at least we know why we have not heard 9J2BO on the band. He goes on to ask UK operators to please include their grid squares, WAB locater etc. on their QSL cards. When the openings restart to ZS6, he will be listening especially for those who have yet to work him.

**Yugoslavia;** On the 24th January YU1ABA booked in on 28.885MHz, his name is Yo and he gave me the information that the club station is now equipped for receiving on 6m and able to work crossband. QSL information; YU1ANT, Radio Club Pane Djukic, Barajevska 34a, Belgrade, Yugoslavia.

## Thanks to Ted Collins G4UPS

*We would like to place on record our grateful thanks and appreciation to Ted for the comprehensive information he has provided us with over a long period. This is in addition to the time consuming job he is doing for the 6m Group. Good show, keep it up Ted!*

## Geoff GJ4ICD reports

The 9L1 beacon is once again showing up every day, solar flux levels have shot through the roof, and who knows what February is going to bring but it looks good *(yes, DXCC for GJ4ICD — congratulations).* F1JKK will be QRV from TT8 in Feb for four months. PT7NK is QRV from H106 each day, he'll be on at 1100z-1200z on 50.105. The 30/31st were best days of the month, with beacons FY7, PT7, 9L1 consistent signals.

Early February started off great with my 100th country being worked, this was a really good feeling to have achieved all this in such a short time (two and a half years), some USA operators have taken three solar cycles! However, more countries have been available during the last year or so. Although 100 have been worked I am still missing a handful of cards to claim DXCC which I am chasing at the moment. I'm close to claiming the 400 50MHz squares award as I have the 1st 175-375 RSGB certificates, I also have the 1st certificates for 20-90 countries. After completing these challenges my activity will continue on 6m and not die out like the light has burned out!

50MHz has some very interesting happenings, many of which we know nothing about, so it is my intention to monitor more and pass on this information to help with the research of this fabulous band. The callsign of GJ4ICD will not disappear now that DXCC has been accomplished. My square situation; 50MHz 434, 144MHz 269, 432MHz 119, and 1296MHz 59.

# QRP CORNER

*Dick Pascoe G0BPS shows how to make the best of low power SSB*

It was pleasing to see that several G-QRP club members managed to work across the pond using low power recently. Randy Rand AA2U is one of those individuals that manages to work the world on milliwatts, and uses wire aerials only. George G3RJV and Dave G4WZV both managed to work Randy, and I understand these were two- way milliwatt QSOs too! Randy is one of the very active members of the Amateur Radio Club International (ARCI), the American equivalent of our G-QRP club, and anyone interested in joining the ARCI can contact myself, their UK membership secretary. Their magazine 'The Quarterly' is much like SPRAT.

## Sideband QRP

Most talk of QRP seems to indicate that all the activity is centred around the Morse key. Whilst most G-QRP club members seem to prefer the key, there are still a few who prefer to use SSB at power levels that to most would seem ridiculous.

Look though at the type of rig that most first time buyers go for, FM on 2m, the most popular being the FT290. Add a beam and switch to SSB and these newcomers are often quite surprised at the distances that can be worked on 2m (I have a QSL card for a 2000+km contact with 2.5W on 2m!). Activity on HF can be a little more difficult, though not impossible, and answering a CQ call using low power can often bring results.

The SSB columnist of the G-QRP club magazine 'SPRAT', Ian G3ROO, often uses this technique. One of his proudest moments being called by, and completing a QSO with a 'W' after tailending him. Ian was running just 25mW (that is one tenth of one quarter of a Watt!). A brief aside; some may not have heard of the term 'tailending'. This is the technique where an operator waits until the station they want signs with the person they are working and then calls them. This is a very effective way of gaining contacts with low power, much better than just calling CQ.

On SSB, a power limit of 10W PEP for QRP has become accepted as the norm, and the internationally agreed QRP SSB frequencies are; 1.950, 3.695, 7.090, 14.285, 21.285 (Eur) 21.385 (USA), and 28.885MHz. Note that 14.285MHz and 28.885MHz are also used for VHF nets, hence QRP usage may be slightly +/- of these.

## QRP SSB, some help.

With the key down on CW, virtually all of the output power is fed to the aerial, but in SSB this is by no means the case. Typically only an average of about 10% of the maximum is actually used, with maximum only being generated on 'speech peaks'.

There are two answers to this problem, more power (which we may not want), or a method of increasing the average level of audio fed into the rig, giving a resultant average level that will approach these speech peaks. There are several commercial units available for this, most of which work very well if used correctly. The often heard 'head in a bucket' syndrome is sometimes caused by having the gain of these units turned up too high, defeating their purpose by making the audio unreadable. These commercial units vary in price, but as always it is often cheaper to build your own.

The circuit shown uses a Plessey IC that's quite cheap. The audio is fed to the unit via VR1 which permits the input impedance to be altered to suit the user's microphone. C1 provides some of the low frequency roll off on the input to the IC, and decreasing the value of C4 increases the HF roll-off point. C5 is a coupling capacitor between two pins of the IC, reducing its value will raise the point of LF roll off.

The gain of the circuit can be adjusted by using VR2, R2 is included to ensure that the resistance at this point isn't reduced below the minimum. The attack and decay timing of the circuit are controlled by R1 and C3, with the values shown the attack time is set at 20mS and the decay set at 20dB/S. These settings can be varied at the discretion of the constructor.

The construction is fairly simple and I've built one unit on a 25mm square PCB. Setting up is easily achieved by getting a distant friend to listen to the audio. Initially set the variable resistors to mid point except VR2 which should be at maximum. On- air, adjust VR1 until residual noise vanishes, then speak into the microphone at normal voice levels and adjust VR3 until distortion creeps in. Now reduce VR3 to below this point.

In use, the unit should be encased in a small metal box, power may often be available from the microphone socket. That's it for this month, ideas and comments to me at 3 Limes Road, Folkestone.

**Components list**

| | |
|---|---|
| C1, 2, 4 | 2u2 |
| C3 | 68uF |
| C5 | 4n7 |
| C6, 7 | 10nF |
| R1 | 1K |
| R2 | 680R |
| R3 | 220R |
| RV1, 3 | 1K |
| RV2 | 4K7 |
| D1 | 6V2 Zener |
| IC1 | SL6270 |