

# HRT

**Incorporating  
SCANNERS**

**HAM RADIO TODAY**

MAY 1995 £1.80



**Ron  
Broadbent  
G3AAJ  
awarded  
MBE**

**SRW  
Cobwebb HF  
multiband  
aerial**



- **ADI AT-200 low cost 2m handheld**
- **VHF Award presentations**
- **New Baycom 9600 baud modem**

9 770269 826062 05 >

NEXUS

## HAM RADIO TODAY

HAM RADIO TODAY VOLUME 13 NO.4 MAY 1995

### REGULAR COLUMNS

<b>HRT SOFTWARE OFFER</b> .....	<b>5</b>
This month we're offering a frequency directory database program by VE3HAM, together with an SSTV signal decoding program by WB9MMM	
<b>SCANNERS</b> .....	<b>21</b>
Bill Robertson discusses the range of activities you can listen to on your scanner	
<b>QRP CORNER</b> .....	<b>35</b>
Dick Pascoe G0BPS gives a few tips on choosing a rig for QRP operation	
<b>FROM MY NOTEBOOK</b> .....	<b>37</b>
Geoff Arnold G3GSR looks at what 'environment' means to the radio engineer and gives a few tips on insulating an outdoor radio shack	
<b>DATA CONNECTION</b> .....	<b>39</b>
High speed packet at an affordable cost? Chris Lorek investigates...	
<b>VHF/UHF MESSAGE</b> .....	<b>42</b>
Geoff Brown GJ4ICD finds plenty of activity on the bands and gives an update on the forthcoming Cape Verde DXpedition	
<b>HF HAPPENINGS</b> .....	<b>44</b>
Don Field G3XTT finds plenty of 160m DX and gives an introduction to the joys of 10m	
<b>SATELLITE RENDEZVOUS</b> .....	<b>46</b>
Richard Limebear G3RWL gives an update on the new RS-15 satellites with this month's collation of AMSAT-UK news	
<b>FREE READERS ADS</b> .....	<b>52</b>
Helplines, For Sale, Wanted and Exchange, published free	

### REVIEWS

<b>SRW 'COBWEBB' HF MULTIBAND AERIAL REVIEW</b> .....	<b>15</b>
Reviewed by Eur. Ing. Chris Lorek G4HCL, AA0RX	
<b>ADI AT-200 2M HANDHELD REVIEW</b> .....	<b>18</b>
A sheep in wolf's clothing, or is it the opposite? Chris Lorek G4HCL looks closely at this latest non-Japanese offering	
<b>'WORLD OF HAM RADIO' CD-ROM</b> .....	<b>33</b>
The HRT Editorial team get to grips with over 700MB of ham radio information and programs	
<b>1995 ARRL HANDBOOK</b> .....	<b>36</b>
Reviewed by the HRT Editorial staff	

All reasonable care is taken in the preparation of the magazine contents, but the publishers, nor the Editor, cannot be held legally responsible for errors in the contents of this magazine, or for any loss arising from such errors, including loss resulting from negligence of our staff. Reliance is placed upon the contents of this magazine at readers' own risk.

### FEATURES

<b>VHF AWARDS PRESENTATION</b> .....	<b>11</b>
Our roundup of VHF award winners, presented at this year's VHF Convention by RSGB President Clive Trotman GW4YKL	
<b>IS YOUR BALANCED FEEDER BALANCED?</b> .....	<b>25</b>
Gee Goodrich, G4NLA provides some thoughts on balanced feeders, and describes a useful construction project for a home-made balun system	

### CONSTRUCTION PROJECT

<b>DUO BAND FERRITE LOOP AERIAL</b> .....	<b>28</b>
Richard Marris G2BZQ describes a compact two band HF loop aerial covering the 7MHz and 10MHz bands for your shack table	
<b>HAMCOMM AND JVFX PC INTERFACE PROJECT UPDATE</b> .....	<b>34</b>

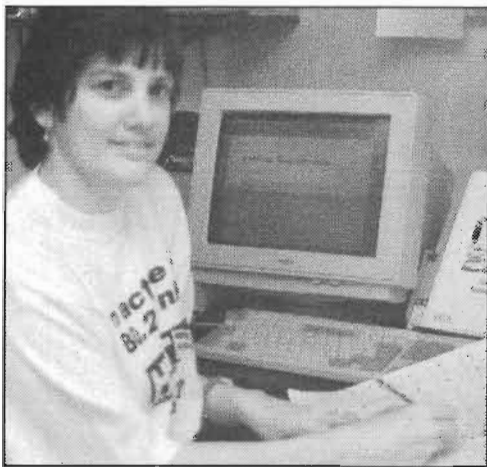
### NEWS & VIEWS

<b>CQ DE G8IYA EDITORIAL</b> .....	<b>5</b>
ORACLE vs IARU? It's that 'Old Chestnut' again!	
<b>RADIO TODAY</b> .....	<b>6</b>
The latest Amateur Radio news	
<b>LETTERS</b> .....	<b>12</b>
HRT readers have their say, no censorship here	
<b>HRT SUBSCRIPTION OFFER</b> .....	<b>34</b>
Make sure you get your HRT each month right through your door	
<b>NEXT MONTH IN HAM RADIO TODAY</b> .....	<b>57</b>
What to look forward to	
<b>CLUB NEWS/RALLIES</b> .....	<b>48</b>
Dynamic go-ahead clubs and voluntarily-run RAE course contact details. Is your club listed? If not, why not?	
<b>CLASSIFIED ADVERTISEMENTS</b> .....	<b>55</b>
Your local dealers, component and kit suppliers, RAE courses, and reader's classified ads	
<b>ADVERTISERS INDEX</b> .....	<b>57</b>
Who's 'in' HRT, trader-wise	



**ADI AT-200  
2m handheld  
reviewed**

**HRT  
MAY 95**



# CQ de G8IYA

## Editorial

*ORACLE vs IARU? It's that 'Old Chestnut' again!*

This thorny old subject really does seem to come round in 'phases' again - right now it's on an international scale and is even more the 'hot talking point' amongst amateurs. The UK packet network has just seen a large number of amateurs taking an impromptu national 'vote' on it, a postal vote was also taken some time ago by the RSGB. It's whether a Morse test should still be a mandatory requirement for obtaining a class 'A' amateur licence. Rather than start yet another 'round' in the 'Letters' column of this magazine on Morse (please, no more!), let me provide some factual information, rather than just anyone's opinions.

I'm basing this on an interesting set of features in the latest 'Morsum Magnificat' ('MM'), the Morse magazine, which is edited by Geoff Arnold G3GSR who also writes HRT's popular *From My Notebook* column. One such feature in MM, by Fred Maia W5YI entitled "*The Future of Amateur and Commercial Radiotelegraphy*", details how advancement in satellite communications have changed the way distress communication at sea is accomplished, and whether amateur radio can be far behind. A rather significant extract from the feature (with my thanks to MM for permission to reproduce here) reads;

"The next two World Radiocommunication Conferences (WRCs) are scheduled for 1995 and 1997 (they are no longer called WARCs). Item 1 of the agenda for WRC-95 is; 'To review the final report of the VGE (Voluntary Group of Experts) and to consider related proposals from administrations, in order to undertake an appropriate revision of the Radio regulations and to provide a timetable for the implementation of outstanding recommended actions.' Amongst other things, the VGE report recommends suppression of RR2800 for the reasons that the purpose is better covered by No. 2801. Texts of these current international regulations are; 'RR2800. In experimental stations any person operating radiotelegraph apparatus, either on his own account or for another, shall have proved his ability to transmit by hand and to receive by ear, texts in Morse code signals. 'RR2801. Administrations

shall take such measures as they judge necessary to verify the operational and technical qualifications of any person wishing to operate the apparatus of an experimental station.'" (end of extract).

Now, just in case this sounds a little controversial to you, the amateur service is covered by RR2735, which reads; 'Any person seeking a licence to operate the apparatus of an amateur station shall prove that he is able to send correctly by hand and to receive correctly by ear texts in Morse code signals. The administrations concerned may, however, waive this requirement in the case of stations making use exclusively of frequencies above 30MHz'.

The IARU (International Amateur Radio Union) has recently published a 26 page document, *The Morse Code and Amateur Radio - A Summary from the work of the IARU CW Ad Hoc Committee* stating their case. A press release from the IARU reads "Consistent with the views of the member societies as expressed through regional organisations, the IARU will neither propose nor support a change in the requirements at this time."

This however isn't deterring a New-Zealand based organisation, *ORACLE* (Organisation Requesting Alternatives By Code-less Examinations) who are lobbying nationally and internationally in opposition to Morse code proficiency as a mandatory component in the examination process for amateur licences, and have formally filed a proposal to modify RR2735 on agenda item 1 for WRC-95, because of the 'similar' VGE recommendation above for experimental stations.

I could fill pages of *Ham Radio Today* on this, yet I need to keep this a 'balanced' magazine! But if you'd like to read more about this, you can obtain a copy of *Morsum Magnificat* No. 38 which goes into this in much greater depth, by post from G.C. Arnold Partners, 9 Wetherby Close, Broadstone, Dorset BH18 8JB England, price £2.20 (UK), £2,25 (overseas), or US\$5.00 cash. In the meantime, I'll be keeping an ear open for what happens, and will report in future 'Radio Today' pages of HRT. But no doubt, the on-air discussions will

keep on, and on. Why can't life be simple? I suppose the reason is 'progress'. For better, or worse.

### This month's software offer

This month, we're offering a frequency directory database program by VE3HAM, designed to keep track of repeaters, shortwave stations, and popular scanner frequencies. The frequency range covered is from 100Hz to 100GHz, and the maximum number of entries is limited only by your hard disk space. The program has powerful search and edit facilities for you to look for frequencies and/or their users, and to add your own.

On the same disk, and complementing last month's 'WeatherMan' program offering, is 'SB-SSTV' by WB9MMM. This lets you decode and display received off-air black and white SSTV signals using your PC's internal Soundblaster card. There's no external interface needed - just plug your HF receiver's audio straight into the back of your computer!

For this month's software, provided on a 1.44Mb 3.5in disk and including return p/p to you as an 'at cost' service to HRT readers, just send a £1.00 cheque or postal order (no coins please), payable to; Mr. Steven Lorek, together with your name and address and the original 'corner flash' from this month's 'contents' page, to; *Software Services, P.O. Box 400, Eastleigh, Hants SO53 4ZF*. Overseas (including Eire); send three US \$1 notes, this normally covers airmail to Europe and surface mail elsewhere. Outside Europe airmail; four US \$1 notes. Other payment methods cannot be accepted due to excessive banking charges - and please do not make your cheque or PO payable to any other individual or any company.

Queries regarding supply of these 'at-cost' disks should be sent to the above address with an SAE for reply, **not** to the magazine publishers or the Editorial staff. Your software disk will normally be placed in the post to you within 7-14 days of receipt of your request, but please allow up to 28 days for delivery.

# LETTERS

## Letter of the month

Dear HRT,

There are rumours circulating that 'Safety' Air Bag Systems now being fitted as standard in many new cars, are, or can be, accidentally activated by radiated RF (car phones have been cited as one cause for this). Having recently purchased a car with air bag system fitted, and being a keen ham mobile operator, I wrote to the car manufacturer for further information - surprisingly they have not chosen to reply or even acknowledge my requests. I wonder if you or any readers have experienced, or can offer any advice in this matter?

Peter Jenkins, G0ECK

### Editorial comment;

**Our Tech Ed suggests that cars must, by law, comply with relevant European directives, for example the EMC Directive (in force now, mandatory from next year) , and/or**

**the Machinery Directive (which became mandatory at the beginning of this year). Some cars fitted with electronic ignition reportedly 'conked out' along a given stretch of German road near to a broadcast transmitter. It kept the tow-trucks busy, as the cars were restored to 'normal operation' a hundred meters or so further along the road. The problem eventually became so bad that, no matter who's fault it was, the easiest solution was the erection of a large wire 'Faraday screen' by the side of the affected stretch of road! Maybe it'll take a 'test case' in the courts when such an air bag is triggered by a transmitter, whether outside or inside the car, to get some action. Rumour has it the car manufacturer will then have rather a big headache in recalling all the cars involved, as will the chap who signed the 'Certificate of conformity' being charged with a criminal offence. If any readers have had experience with this problem, we'd be interested to hear from them, or if you've a comment to make on the subject through this 'Letters' page, do write in!**

## Thanks, teacher!

Dear HRT,

I am writing to you on behalf of all the members of the Amateur Radio and Electronics Society of King Edward's School in Edgbaston, Birmingham, who took the RAE last December. Most of us had never even heard of Amateur Radio let alone be interested in it, before a certain biology teacher made the hobby known to us. Since then, many pupils of the school have taken the Novice licence, 32 to be precise, and out of those people 30 passed first time. One of the two who failed took the exam and passed, one did not bother to take it again. All were taught by that biology teacher. After that, our teacher leaped straight into our RAE course, which 7 people took and 7 people passed. Now, our teacher has moved onto a new Novice course, and I expect we'll be speaking to some new Novices from that one soon, too. So basically, thanks to DCR from all of us at the ARES, and keep up the good work.

The course consisted of David 2E1AWQ, Richard 2E1CBE, Ed 2E1BZK, Charles 2E1CHY, Andii 2E1CBA, Andy 2E1CFX and Martin 2E1CSU. We all owe our interest in Ham Radio to the teacher who got us through. Thanks Sir!

Members of the ARES

## A sense of humour

Dear HRT,

On the subject of experiences of new licensees, I would like to say that in common with Paul (G7RSG) in the March '95 issue, I have had nothing but support from the time-served amateur fraternity. In particular, the support gained via packet radio is second to none. I would like particularly to thank G4IVN and G8VPE for their assistance, and thanks to G3IOR for his help regarding CW and satellites.

I tend to think that occasionally we take ourselves far too seriously, and this gives rise to many of the problems encountered in the hobby. 'Hobby' is the key word. A hobby is a pleasurable pastime, if it is not pleasurable it is no longer a hobby. I don't advise an irresponsible attitude to amateur radio, but let us at least temper it with a little sense of humour, and an ability to laugh at ourselves occasionally.

A final point regarding the disks on the front cover, which are removed by my newsagent before the mag is

## No more hiding

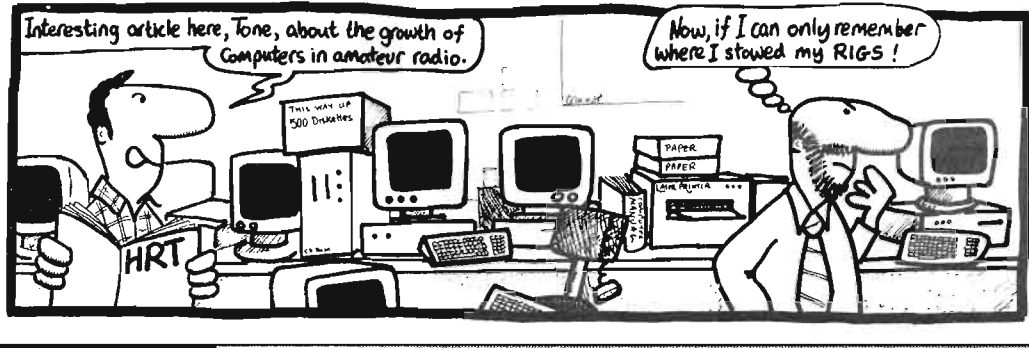
Dear HRT,

It is with delight that I recently received information that the RSGB intend to enforce legislation at their rallies, that requires traders at rallies (markets) to display their names in letters of not less than two inches tall. Many traders at rallies are only too happy to get their names as big and as high as they can, but there is a small number that refuse to comply with this.

It must beggar the question "what are they trying to hide?" Those of us who display our names (and addresses with telephone numbers) are often asked "who was next to you at such and such a rally last month, as the gear I bought doesn't work?". It is very obvious that not all of these traders are dubious, but if all traders are forced by rally organisers to comply with these rules, the innocent rally goer will be much better off when equipment is found to be faulty.

Cllr R. A. Pascoe, G0BPS

# "TONE" BURST



put on shelf display.. I now have to become accustomed to the following conversation when I go to the newsagents to pick up the latest copy:

"Please can I have the free disk which is missing off the cover?"

"You only get a free disk with computer magazines"

"No, they sometimes come with radio magazines as well"

"What's the point of having a computer disk on a wireless magazine?"

"It's a long story, and I'm in a bit of a hurry"

"Well, all disks are in this box, see if you can find it" (a box containing 648 disks is produced from under the counter..... 15 minutes later)

"Here it is"

"Are you sure it's the right disk?"

"Well it does say HRT on the label"

"That could stand for Home Restoration Today or some similar magazine...."

"You told me disks only come with computer magazines..."

"Hummph....."

Have a nice day...  
Peter Attree, G0VHP

## Motocycle mobile

Dear HRT,

Through the pages of HRT, I should like to contact any Radio Amateurs who are also interested in motorcycling, whether they run on two wheels or not. I have started a 'register' of motorcycling Radio Amateurs throughout the UK. The main purpose is the exchange of technical information regarding motorcycle mobile installations, problems encountered and their resolution. Hopefully, this information will be available for others who would like to add to their enjoyment of Amateur Radio and motorcycling, by combining the two.

I now have 17 listed, including myself, but feel there must be others throughout the country who have tried motorcycle mobile, or are currently doing so. Of the current 'members', several have fully sorted systems, others are still attempting to get things to work properly, while others have enquired about the possibility of fitting Amateur Radio to their motorcycles. One of our members is a radio technician fitting radios to police motorcycles, who is pleased to answer technical questions on radio installation, interference problems etc. I have managed one newsletter so far, and am hoping for more feedback on how it should progress.

I am a member of the MARC, the Motorcycling Amateur Radio Club based in California (their first overseas member), President: Ray KD6FHN. They provide communications assistance at many events, be they charity or emergency, in much the same way as Raynet does over here. There is also a technical forum.

Graham Wright, G4FUJ (9 Lypiatt St, Tivoli, Cheltenham, Glos GL50 2UA)

## Ban computers?

Dear HRT,

Once again my interest is sparked by your Editorial, Band Plans! (March '95 HRT). Whilst my comments are not strictly on band plans, they are directed at the inconsiderate fools who think that because they use a computer, they can go anywhere they want, without checking who may be using the frequency. Too many times my CW contact, or SSB contact, is interrupted by a stream of RTTY or one of the other modes used by packet radio operators.

Even more infuriating are the people on CW that use computers and Morse readers to send and receive CW at high speed. This would not be so bad if they had respect for us slower mortals, but they will key up over a QSO without a care for us poor souls struggling to make a contact!

Fine! If you can send code at 40wpm by hand and receive 40wpm by ear, go to it, but not over the top of us poor souls that find it hard. The RAE was a snip to me, I hardly had to think to pass the papers. Code however was dug out of me one word at a time. If I were to know the results of the RAE, I would not talk over the top of an

operator who only got a pass. So why do these idiots key up over those struggling at 12wpm. If you are using a computer for CW, then why bother, why not use packet, or pick up the mike and talk. There is no skill in typing out your message and hitting return, or reading translated code on your screen.

Computers should be banned from competitions, would it be a fair race if you used your Harley against a sprinter in a race? No more is it fair in a CW contest to use a computer.

Dennis Barber, G0UFS/KB8GCF

MORE LETTERS  
NEXT MONTH

# SRW 'CobWebb' HF Multiband Aerial Review

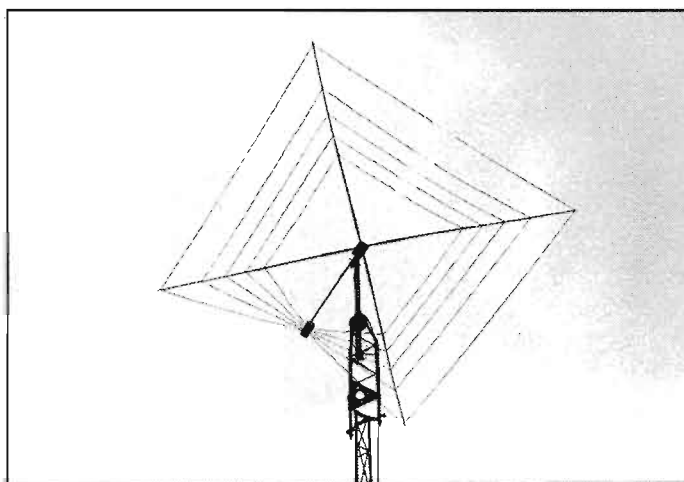
Reviewed by Eur Ing. Chris Lorek G4HCL, AA0RX, (with a bit of help from XYL Sheila G8IYA in on-air HF activity!)

Many amateurs would like to put a good signal out on the HF 'DX' bands, but not all of us can manage to put a monster tower up complete with stacked rotatable multiband yagis! The best that many amateurs have is a postage-stamp garden or back yard to fit aerials into.

In these cases, the 'best attempt' is usually made, often with a compromise aerial. But a HF ground-mounted vertical (because an elevated quarter wave multiband vertical needs a massive ground plane system of wires) just puts your signal into the surrounding buildings, including their resident TVs and Hi-Fi systems. A random length wire needs careful matching, and if this can't be carried out at the feed point it often brings 'hot' RF into the shack.

One answer is an arrangement of dipoles, but for omni-directional coverage (where you don't want dead spots' in coverage) many amateurs go back, again, to the ubiquitous vertical. A unique alternative however is the British designed and made *CobWebb*.

This is a horizontally polarized, omnidirectional, HF aerial covering 20m (14MHz), 17m (18MHz), 15m (21MHz), 12m (24MHz) and 10m (28MHz). A ferrite choke balun is used at the feedpoint, so there's no RF carried on the feeder outer with its attendant problems running down to your shack. It also means there's substantially less chance of EMC problems, which is an important issue on the minds of many amateurs living in today's



The CobWebb multiband HF aerial

modern close-knit housing estates.

The designer of the CobWebb, Steve Webb G3TPW, tells us that the parallel but antiphase 'sides' of the aerial cancel the radiation that would normally be wasted as high angle radiation, and fill in what would otherwise be the nulls off the dipole ends. He adds that the resulting omnidirectional pattern has many advantages over aerials with directional effects. Unless an aerial with nulls in its response can be rotated, it will be found that certain parts of the world will be very difficult to contact. Steve suggests that directional aerials also cause many QRM problems. The nulls in the response cause people to think that a given frequency may be clear, they get into QSO and then find it's actually occupied and have to fight through the resultant QRM.

So was born the 'CobWebb', and I was pleased to be given the chance to have an extended review period to try the performance out myself.

## Physical features

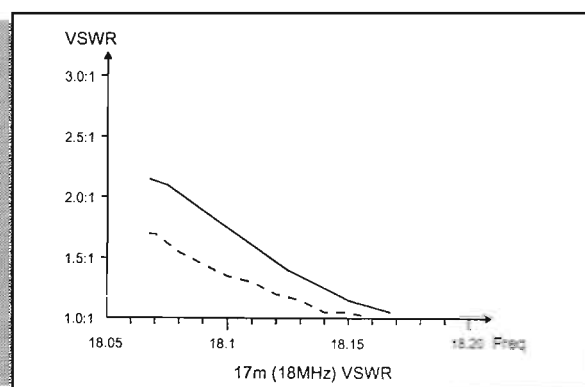
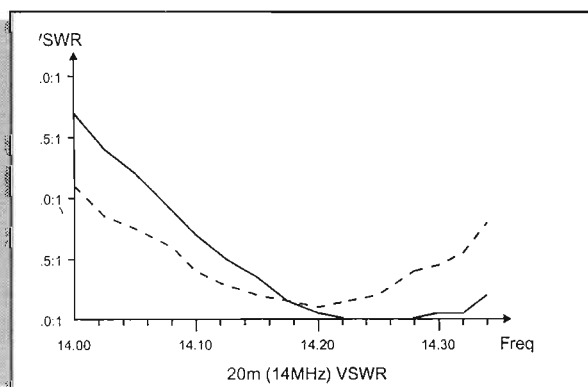
The CobWebb isn't huge, and measuring just 2.5m square and weighing under 6kg it should easily be able to be supported on just an aluminium or steel 'scaffold' pole fixed to the side of your house or flat, or even on your chimney using a suitable lashing kit. It's made of sturdy white fibreglass 'spreaders' carrying the insulated wire elements, with metal brackets to attach to your support pole of up to 51mm diameter.

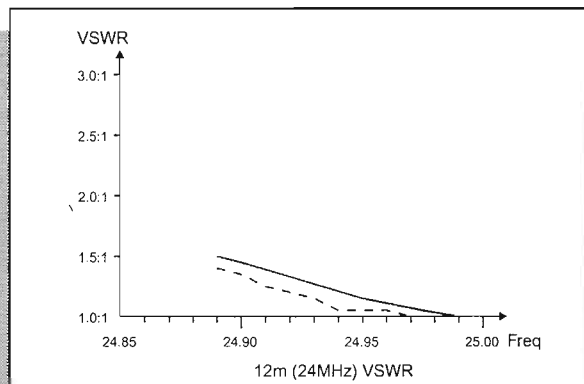
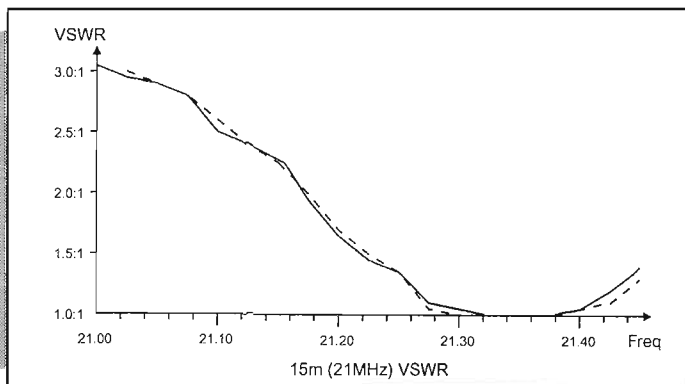
The aerial came supplied very well wrapped, together with equally well-written assembly instructions. Along with all this came several spare screws and tags (the ones you loose outside in the grass!), even an extra piece of tubing for you to 'practice' on prior to tightening the screws on the main fibreglass tubes - overtightening these could damage the fibreglass. A ready-assembled PL-259M plug on a short length of coax is used, so you'll need an in-line SO239 socket, or a back-to-back adaptor plus a normal plug (as I used), to connect your feeder to.

Armed with a star screwdriver and a small spanner, it took me only around 90 minutes to assemble the CobWebb. 30 minutes later (thanks to my tilt-over tower!) it was up at around 10m and I was having my first QSO on 20m using it, with a JW who came back to my first call.

An eye on the shack TV showed no problems on any bands with 100W into the aerial, and

VSWR curves of the CobWebb 'as supplied', prior to any adjustment, solid lines with aerial at 10m agl, dotted lines at 5m agl.

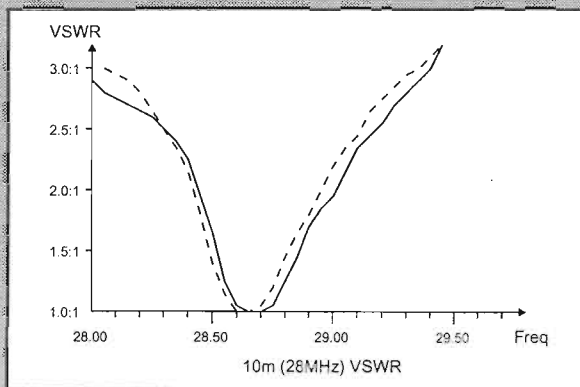




throughout the review period I received no neighbour complaints at all. The only comment I ever got from a neighbour was during some gale force winds, she was worried that my 'nice new aerial' (!) might fall down into my garden. It didn't.

### Resonance

I found that, as supplied, the aerial was resonant at the upper edges of each band, the SWR varying just a little as the aerial was raised and lowered in height. This 'as supplied' resonance I found quite useful, as the CobWebb was more easily capable of being lowered to the required frequency once assembled, than increased. It could be lowered simply by reducing the polyester string lengths between the ends of the wire elements - the element ends themselves already being folded back upon themselves as supplied for any needed adjustment.



### DX capability

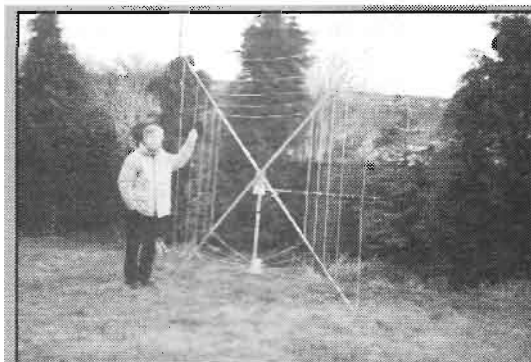
I used the CobWebb at varying heights, and in varying proximities to my house, to hopefully simulate typical installations. With the aerial mounted 'in the clear', I was extremely impressed with its DX capabilities. I found, in my location at least, it worked especially well on 17m, and a recent opening on 12m brought signals from across the Atlantic at very good strengths. It can't, and of course, didn't, compare to a full-size multi element beam, but I found little if any difference between the CobWebb and a dipole at the same height and location for the band in use.

What I did however find was, that with the CobWebb at reduced heights and thus nearer to the various computers and other 'RF hash' from my house for example at 'loft height', just a metre or so above the house wiring), that the CobWebb picked up far less of this hash, with resultant lower noise levels on each band, than a dipole similarly placed. But the DX signals were still there.

With the aerial mounted above the roof ridge heights of surrounding houses, i.e. 'in the clear', every single station I decided to call using the aerial I usually worked, if not on the first call, then on the next or subsequent calls in a 'pile-up' situation. But then, I was sensible enough not to waste time

with my 100W into the CobWebb to call weak DX stations, often running higher power in the first place, in a pile-up competition against scores of 1000W callers using their monoband beams. Not even this marvel of an aerial could be called upon to work miracles!

Even Sheila G8IYA enjoyed a number of 20m and 17m 'ragchews' using the aerial whilst operating my station, with me listening intently and making notes (why do all the review work yourself when the Ham Radio Today Editor can do some of it for you!).

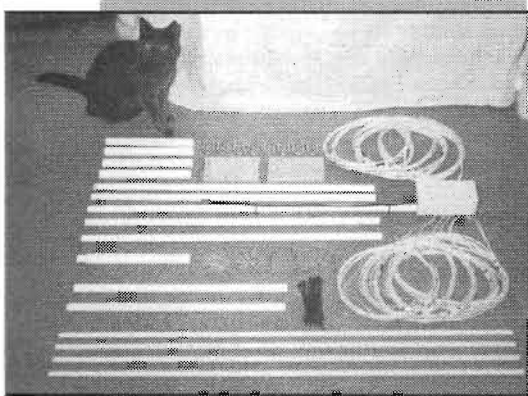


The small physical size of the assembled aerial is shown here, modelled by its designer Steve Webb

### Conclusions

Overall, I was very pleased with the CobWebb. I feel it would make a very useful HF aerial for HF 'DX band' working in a 'compromise' situation, where its small size and minimal mounting arrangements can be used to good advantage.

The CobWebb is currently priced at £161.00 plus £8.00 UK p/p, overseas p/p on request. My thanks go to SRW Communications, who are the CobWebb manufacturers, for the loan of the review aerial.



# ADI AT-200 2m Handheld Review

*A sheep in wolf's clothing, or is it the opposite? Chris Lorek G4HCL looks closely at this latest non-Japanese offering*

A number of years ago, a label on a piece of radio equipment saying 'Made in Taiwan' may have given the owner an impression of having something of an inferior quality. The same really could also have been said of a 'Made in Japan' label many years earlier. Times are changing, and we've recently seen a number of sophisticated products coming from such countries.

One of the latest, in the amateur radio equipment field, is the AT-200 2m handheld from ADI. The promotional leaflet says its the 'Dawn of a new age, made in Taiwan, envied in Japan!' The current selling price of £169.95 is certainly something to be envied, even the accessories (like the optional 7.2V 600mAh nicad at £19.95) seem competitively priced. Let's see what it offers....

## Features

The set covers 144-146MHz on FM, with a keyboard option for extended receive over 130-174MHz if required. Twenty memory channels are provided for frequency storage, and scanning facilities include memory channel scan, 1MHz 'VFO scan', selected range scan with programmable upper and lower scan frequency limits, and four different 'dual watch' facilities which alternate the receiver between two frequencies you've selected. A click-step rotary knob on the top panel lets you manually tune through the memory channels, or VFO frequencies in your pre-programmed frequency steps. The front panel LCD, besides giving a channel and frequency display, also provides a 14 segment bargraph S-meter.

By using the set's keypad you can enter frequencies directly, as well as control other functions such as repeater shift, reverse repeater, VFO and memory scan and dual watch, transmitter power output selection,



and so on. The keypad also acts as a DTMF (touch-tone) keypad on transmit, and DTMF selective calling, and paging, is built into the set. This uses the common three-digit DTMF calling sequences as used by most VHF/UHF sets, and is a rather surprising 'standard' feature to be included in the set at such a reasonable cost! CTCSS tone squelch can also be added as a plug-in option, at £29.95, if you wish. For carrying the set around, your selected frequencies and operating mode can be 'locked' to save any accidental key presses in use.

Sockets are fitted on the top panel for an optional external speaker and microphone, plus the BNC aerial socket which lets you attach an external aerial when needed as an

alternative to the supplied set-top helical. The squelch control is a preset 'fingertip' adjustment type - it's designed to be set and to stay set at that level, preventing accidental operation. A handy 'SQL' button however acts as a momentary 'squelch defeat' to let you check for activity, or just to see what your volume is set at. For night-time use, the set's LCD, together with the translucent keys, can be backlit with a further button push, the third button here doubling up between selecting your pre-programmed 'call' channel (i.e. S20, or your local chat channel) and a 1750Hz repeater access tone encoder on transmit.

The AT-200 comes supplied with dry cell battery pack which takes six AA sized cells. Using this (suitably filled of course) or the optional 7.2V nicad pack, the set's transmitter puts out 2W, with a switchable low power facility to 350mW for local contacts and when you need to conserve your batteries.

Plugging in an external 12V DC supply, or clipping on the optional 12V high-power nicad pack, boosts the maximum transmitter power to 5W, where both 'mid' (2.5W) and 'low' (350mW) power levels are also available. A 'battery saver' which cycles the receiver on/off can be used to prolong the life of your battery pack, and an auto power-off function can automatically switch the set off after a predefined period of no activity.

All this is contained in a set measuring 138mm (H) x 55mm (W) x 34mm (D) with the dry cell case connected, and weighing 350g with AA batteries fitted.

## On the air

On first testing the set, I found I was already familiar with some of the basic operating modes. This is because a couple of earlier Taiwanese handhelds I'd reviewed,





albeit without as many built-in features, seemed to have rather similar

operating features. The AT-200 is obviously a 'progression' and improvement of earlier types.

Without much ado, I'd fitted a set of batteries, plugged the set into my external roof-top colinear, and sat back to see how the transceiver coped. Well, it picked up signals far and near, the near ones (I live in quite an 'RF congested' location) surprisingly not causing the problems I'd have expected. The set was, in fact, far better in this respect than some of the not-so-recent Japanese handhelds I've tried, which I just gave up trying to use, due to received breakthrough, with the same external aerial attached.

### On the move

I found similar results with the set when I used it mobile, connected to my 2m/70cm glass-mounted car aerial. I did have to be careful in using an external DC lead, as the set needs the 'outer' of the coaxial DC plug to be +12V, a little tricky when it's not in use and 'floating around' in a negative earth car. I must confess to smiling at the note regarding the optional PCA145 DC cable in the supplied manual; "Connect

the PCA145 only to this connector, as its plug is the peculiar one."

Driving around my local city centre as well as in rural areas showed the receiver to be very sensitive, as well as being quite immune to most unwanted signals. Unfortunately, I couldn't say the same for the reproduced audio. Using the set's built-in internal speaker, this was rather 'nasal', as if everyone I was listening to had a bad cold. Also, there just wasn't enough audio available for use on the move. Plugging in the supplied optional speaker mic helped a little, there still wasn't enough audio level without the onset of severe distortion, but it did at least let me put the speaker up to my ear to listen to what was happening. An efficient external speaker, or good quality earphone, I feel would be essential for home and mobile use, an earphone also being useful for portable operation. I used one half of a hi-fi type (which I commonly find, and buy, new for just £1 or £1.50 at radio rallies) to good effect, the set's audio with this, in fact, being quite acceptable!

### Portable

When out and about portable, I found the set was reasonably easy to operate, although I very often accidentally pressed the 'lamp' button, the set warning me that I'd done so with a 'bleep'. Apart from repeater access, which was definitely a two-handed affair to operate the PTT followed by the 'call' button whilst transmitting (pressing these the wrong way round caused me to transmit on the 'call' channel instead), other controls and buttons were quite easy to operate in

'handheld' mode. I was pleased to find that, by suitable programming of the transceiver's 'set' mode, I could choose to lock the keypad when needed whilst still allowing the set-top rotary control to be used to change channel.

Living in the 'fringe' coverage area of three 2m repeaters, in use I found the set-top helical to be slightly less efficient than some others I'd tried. Even with the 12V nicad attached to achieve 5W transmit power, I usually had some degree of difficulty in getting into my nearest repeater.

### Technicalities

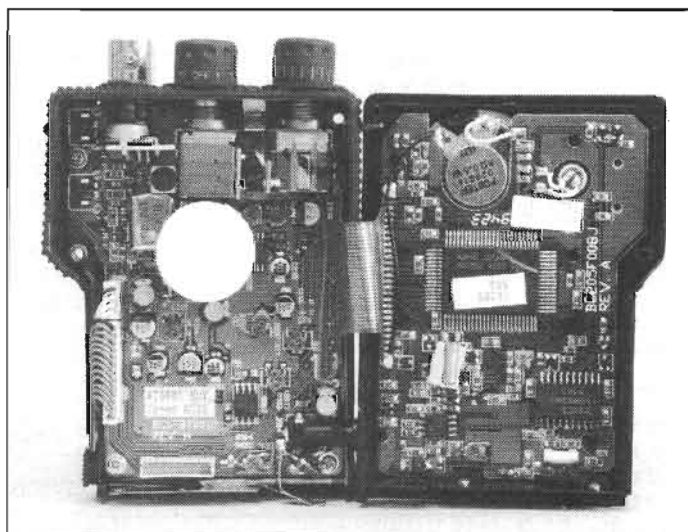
Looking inside the set shows quite a good standard of surface-mount circuitry, with hardly any 'discrete' wiring in evidence. The receiver uses an IF of 21.8MHz, thus removing the 'image' frequency by quite a degree to prevent too many problems. This is verified by the accompanying lab results, where the measured unwanted signal rejection confirms the good performance I found on air.

The transmitter always gave in excess of 5W with a 13.2V supply, the transmit frequency being very accurate and with the harmonics reasonably suppressed. I found, surprisingly, that the set didn't manage to overheat as much as I'd have expected on extended 5W transmit periods, the acceptably low transmit current consumption showing the PA was relatively efficient.

### Conclusions

The ADI AT-200 appears to offer a remarkable amount of features for what is a relatively low cost in the range of currently available 2m handhelds. The inclusion of DTMF selective calling and paging as 'standard' is a useful bonus, with CTCSS (for current and future UK 2m repeater access as an alternative to 1750Hz) being an optional extra. I found the set's technical performance to be quite reasonable, my only adverse comment being that the receive audio in my opinion wasn't as good as I'd have wished.

*My thanks go to Waters and Stanton Electronics for the loan of the review sample.*



## LABORATORY RESULTS

All measurements taken on 145MHz with 12V nicad attached, high power TX selected, otherwise stated.

### RECEIVER;

Sensitivity;	
Input level required to give 12dB SINAD;	
144MHz;	0.145µV pd
145MHz;	0.140µV pd
146MHz;	0.14µV pd

Image Rejection;	
Increase in level of signal at first IF image frequency (-43.6MHz) and 'half IF' (-10.9MHz), over level of on-channel signal, to give identical 12dB SINAD signal;	
Image;	76.7dB
Half IF;	88.2dB

Blocking;	
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;	77.2dB
+1MHz;	95.1dB
+10MHz;	97.1dB

Squelch Sensitivity;	
Threshold;	0.09µV pd (5dB SINAD)
Maximum;	0.25µV pd (25dB SINAD)

S-Meter Linearity;			
Reading Level	Sig. Level	Rel.	
1	sql open	-	
<input type="checkbox"/>	0.57µV pd	-10.9dB	
<input type="checkbox"/>	0.63µV pd	-10.0dB	
3	0.68µV pd	-9.4dB	
3	0.73µV pd	-8.8dB	
<input type="checkbox"/>	0.81µV pd	-7.9dB	
5	0.89µV pd	-7.0dB	
<input type="checkbox"/>	1.01µV pd	-6.0dB	
<input type="checkbox"/>	1.29µV pd	-5.2dB	
7	1.29µV pd	-3.9dB	
<input type="checkbox"/>	1.45µV pd	-2.8dB	
<input type="checkbox"/>	1.69µV pd	-1.5dB	
9	2.02µV pd	0dB ref	
<input type="checkbox"/>	2.54µV pd	+2.0dB	

(Each  signifies unmarked LCD segments indicated)

Intermodulation Rejection;	
Increase over 12dB SINAD level of two interfering signals giving identical 12dB SINAD on-channel 3rd order intermodulation product;	
25/50kHz spacing;	73.4dB
50/100kHz spacing;	71.0dB

Adjacent Channel Selectivity;	
Measured 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;	37.7dB
-12.5kHz;	26.8dB
+25kHz;	62.2dB
-25kHz;	61.8dB

Maximum Audio Output;	
Measured at 1kHz on the onset of clipping, 8 ohm load;	
541mW RMS	

## TRANSMITTER

TX Power and Current Consumption;					
Measured using regulated DC supplied to battery connections;					
Freq.	Power	7.2V Supply	9.0V Supply	12.0V Supply	13.2V Supply
144MHz	High	1.74W/680mA	2.70W/776mA	4.59W/932mA	5.15W/953mA
	Mid	1.71W/676mA	2.70W/776mA	2.70W/711mA	2.70W/713mA
	Low	340mW/361mA	340mW/366mA	340mW/365mA	350mW/380mA
145MHz	High	1.75W/678mA	2.75W/792mA	4.64W/952mA	5.15W/966mA
	Mid	1.75W/678mA	2.75W/792mA	2.75W/726mA	2.70W/725mA
	Low	340mW/367mA	340mW/371mA	350mW/378mA	350mW/384mA
146MHz	High	1.81W/693mA	2.80W/805mA	4.69W/967mA	5.20W/980mA
	Mid	1.78W/691mA	2.80W/805mA	2.78W/739mA	2.75W/739mA
	Low	350mW/370mA	350mW/350mA	360mW/385mA	360mW/390mA

Harmonics;	
2nd Harmonic;	-66dBc
3rd Harmonic;	-82dBc
4th Harmonic;	-71dBc
5th Harmonic;	-83dBc
6th Harmonic;	-84dBc
7th Harmonic;	-86dBc

Peak Deviation;
5.12kHz

Toneburst Deviation;
3.18kHz

Frequency Accuracy;
-100Hz

# SCANNERS

*Bill Robertson discusses the range of activities you can listen to on your scanner*

Following the recent review of the Realistic PRO-2035 base scanner in the March 95 issue of Ham Radio Today, I was interested to also read a review of this set in a popular American scanner magazine. I was even more interested to find that both reviewers found similar results, and gave similar comments in their review text, about the set's poor strong signal handling performance rather than blindly believing, and saying, how wonderful this new set is!

I received a letter from Wyn Davis who asks whether the Bearcat BC-2500XLT, which he bought in the states, can be modified for switchable AM/FM. Well, it's 'hard programmed' for AM only on the airband range, but

it should be able to be modified by the addition of an internally-wired switch, although this would mean a delve into the innards of the set with a soldering iron. Once I've managed to get a circuit and layout diagram of the set, I'll be pleased to advise further though this column and maybe even get a 'mod' published for this, and possibly similar scanners. Unless of course a reader knows of a 'keyboard trick'? Wyn also comments on very poor battery life from the set's nicad. Have any other readers also found the same? I'd be pleased to hear from readers on this, or indeed any other hobby radio listening matter.

on the market today usually cover a very wide frequency range, and as such they're capable of tuning into a similarly wide number of radio transmissions. Like those used by the police and other emergency services, civil and military airband, security guards down at your local hypermarket or shopping centre, taxis, CB operators, radio hams, cellular telephones, pagers, local businesses, the cordless phone used next door, the DHSS, private investigators, your local pizza delivery service, the list is almost endless.

With the equally wide availability of scanners, many people do indeed have great fun in listening to these as a hobby in itself. Most users are sensible and keep what they hear and do to themselves, whilst others like to make a 'big thing' about what they listen to. The latter sometimes then find their knuckles get rapped! Fortunately, mine haven't been. Yet. The serious side to this, of course, is that of criminals using what they hear to advantage. Fortunately more and more 'professional' users, such as police forces, are acting on the sensible assumption that if they want their conversations to be private, they must scramble them. Others, are 'open'. I'm often asked "Surely if I don't reveal or act on what I've heard, it's OK, can't I then listen to what I want?" To clear things up, once and for all (I hope!), here's the official 'word' from the Radiocommunications Agency in the UK, from their RA169 (Rev.1 Dec 1991) information sheet;

## RA scanners info

"There has been some confusion amongst radio users about what they may or may not receive, within the law, and the legality of receive only equipment, especially scanners.

This information sheet attempts to give guidance on the subject by setting out the general legal position. Readers should note however that in the end it is the courts that interpret legislation. How the legislation will apply in a particular case will depend on the individual circumstances.

## VHF/UHF frequency database

My thanks go to the many readers who've written to me, following the 'PC HF Spectrum' database I recently featured in this column, regarding the possibility of a similar VHF/UHF scanner frequency database. I'm currently looking at a couple of

shareware VHF/UHF offerings, and I hope readers will be pleased to know that I've managed to 'twist the Editor's arm' to feature one of these in a forthcoming 'at cost' software collection for readers. Maybe I could also organise printouts of these if readers are interested? In the meantime, the HRT 'fax-back' service has a complete frequency bandplan listing available of amateur HF, VHF and UHF bands and their uses, together with channel information, so you know which 'search ranges' to program into your scanner to hear, for example, FM simplex, FM repeater, or SSB activity.

## What can I listen to?

Talking of such frequencies and their users, typical scanners available



**PRO-2035 as reviewed in Ham Radio Today**



**Switchable AM/FM on the Bearcat 2500?**

This information sheet does not cover television licensing. Any such queries should be directed to the National TV Licence Records Office.

Anyone planning to listen in to radio transmissions should be aware of the following;

No licence is required to use a radio receiver, provided it is not capable of transmitting. However it must be used only for receiving the transmissions meant for general reception, such as authorised sound broadcasts, messages sent by radio

Eavesdropping or listening to messages that are not intended for you is an offence.

Disclosure of what is heard is also an offence.

Under Section 5(b) of the Wireless Telegraphy Act 1949, it is an offence if a person "otherwise than under the authority of the Secretary of State or in the course of his duty as a servant of the Crown, either -

(i) uses any wireless telegraphy apparatus with intent to obtain information as to the contents, sender, or addressee of any message whether sent by means of wireless telegraphy or not which neither the person using the apparatus nor any person on whose behalf he is acting is authorised by the Secretary of State to receive; or

(ii) except in the course of legal proceedings or for the purpose of any report thereof, discloses any information as to the contents, sender or addressee of any such message, being information which would not have come to his knowledge but for the use of wireless telegraphy apparatus by him or another person."

It is an offence to listen in to telephone calls, including those made via cellular telephone networks.

With certain exceptions, it is an offence under Section 1 of the Interception of Communications Act 1985 if a person "intentionally intercepts a communication in the course of its transmission by post or by means of a public telecommunications system."

*Also from the RA sheet;*

*emergency and maritime and aeronautical services. I am interested in them and wish to help?*

No, the Secretary of State's authority is, usually, reserved for persons acting at his request and on his behalf. If you wish to listen into messages, you should obtain the permission of the person sending them.

*Isn't this all a bit heavy-handed?*

No, no one likes their private conversations to be listened in to. Parliament has passed the laws in question to protect the privacy of radio users.

If this information sheet does not answer your query, please write to us at; *Licensing Section, Radiocommunications Agency, Waterloo Bridge House, Waterloo Road, London SE1 8UA*, include in the address the radio service involved. The Agency Enquiry Point/Switchboard number is 0171 215 2150."

*(Our thanks go to the RA for their permission to reproduce the above information, which at the time of preparation, is current, the latest info or any updated information is freely available from the RA at the above address or telephone number - Tech Ed.)*

So there we are. My own opinion, for example in the case of the hobby of civil airband listening (which I promoted last month!), is that the law is unreasonably restrictive. I'm joined by countless other scanner-carrying airband listener enthusiasts at air shows and airport observation areas. In other words, it's stupid, as well as being virtually

unenforceable. Remember the early days of CB, that when enough people 'shouted' for something, it was legalised. Maybe we should shout at the right people? Or maybe we should carry on listening to such things with covert earphones? What do readers think?

I'm always pleased to hear from readers and to answer your comments and questions though these pages. Also, if you'd like me to detail modifications for a particular scanner in these pages for the benefit of readers, let me know! Write to; *Bill Robertson, c/o Ham Radio Today Editor, Nexus Specialist Interests, Nexus House, Boundary way, Hemel Hempstead, Herts HP2 7ST*. In next month's column I hope to review a couple of interesting new UK scanners books, 'Scanner Busters' and 'Scanning Secrets', See you then.

**Receive Only – Scanners Etc  
Information Sheet**

There has been some confusion amongst radio users about what they may or may not receive, within the law, and the legality of receive only equipment, especially scanners.

This information sheet attempts to give guidance on the subject by setting out the general legal position. Readers should note however that in the end it is the courts that interpret legislation. How the legislation will apply in a particular case will depend on the individual circumstances.

This information sheet does not cover television licensing. Any such queries should be directed to the National TV Licence Records Office.

Anyone planning to listen in to radio transmissions should be aware of the following:


**No Licence is Required to use a radio receiver, provided it is not capable of transmitting. However it must be used only for receiving the transmissions meant for general reception, such as authorised sound broadcasts, messages sent by radio amateurs and Citizens' Band Radio and at sea, weather or navigation information.**

**However it is an Offence to use Radio to Eavesdrop on Other Services**

There are many authorised users of radio, such as the Police, the other emergency services, the Armed Forces, aeronautical and maritime services and businesses. These users need radio to enable them to carry out their activities and are protected by Law from unauthorised people listening in to their transmissions.

Eavesdropping, or listening to messages that are not intended for you is an offence.

Disclosure of what is heard is also an offence.



**RA**  
RADIOCOMMUNICATIONS  
AGENCY

**But See Below**

Under Section 5(b) of the Wireless Telegraphy Act 1949 it is an offence if a person "otherwise than under the authority of the Secretary of State or in the course of his duty as a servant of the Crown either -

(i) uses any wireless telegraphy apparatus with intent to obtain information as to the contents, sender, or addressee of any message whether sent by means of wireless telegraphy or not which neither the person using the apparatus nor any person on whose behalf he is acting is authorised by the Secretary of State to receive; or

(ii) except in the course of legal proceedings or for the purpose of any report thereof, discloses any information as to the contents, sender or addressee of any such message, being information which would not have come to his knowledge but for the use of wireless telegraphy apparatus by him or another person."

RA 189 (Rev 1)  
ISSUE 1988 AND 0713  
DECEMBER 1991

The Radiocommunications Agency is an Executive Agency of the Department of Trade & Industry

### The official word on Scanners from the Radiocommunications Agency

amateurs and Citizens' Band Radio, and at sea, weather or navigation information.

The Wireless Telegraphy Apparatus (Receivers) (Exemption) Regulations 1989 (SI 1989 No. 123) exempted from the requirement for a licence any wireless telegraphy apparatus "which is inherently incapable of transmission".

But see below.

However it is an Offence to use Radio to Eavesdrop on Other Services

There are many authorised users of radio, such as the Police, the other emergency services, the Armed Forces, aeronautical and maritime interests and businesses. These users need radio to enable them to carry out their activities and are protected **By Law** from unauthorised people listening in to their transmissions.

### Some questions answered

*"Is a licence needed to own a scanner?"*

Not if it is inherently incapable of transmission. But its use to listen to private messages is an offence.

*Does owning a scanner make a person liable to prosecution?"*

No but its use, except as permitted under Section 5(b) of the Wireless Telegraphy Act would.

*Is it all right as long as what is overheard is not disclosed?"*

No, using radio equipment to listen in, except as provided for by section 5(c) is an offence, regardless of whether the information is passed on.

*Could I get "authority" from the Secretary of state to listen to the*

# Is Your Balanced Feeder Balanced?

*Gee Goodrich G4NLA provides some thoughts on balanced feeders, and describes a useful construction project for a home-made balun system*

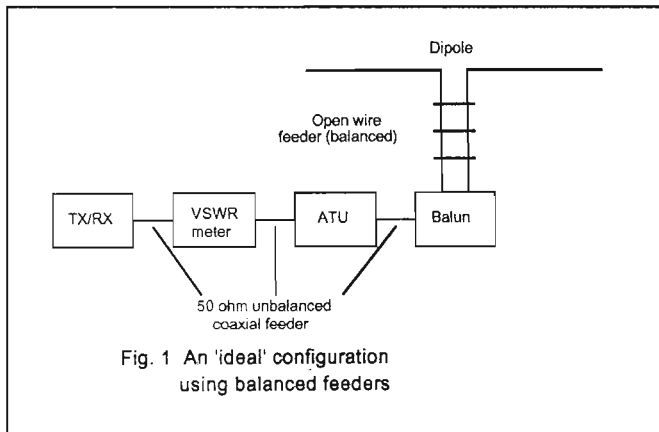


Fig. 1 An 'ideal' configuration using balanced feeders

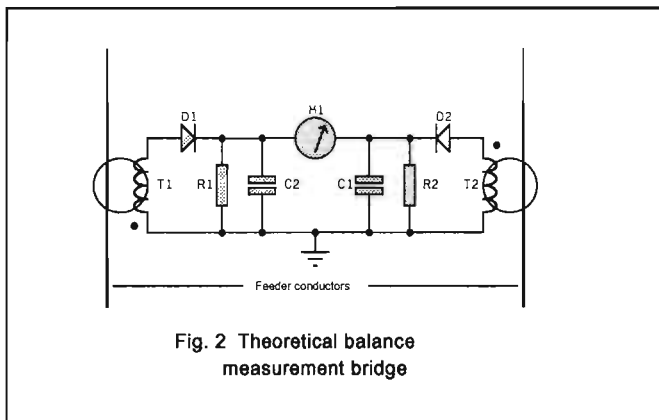


Fig. 2 Theoretical balance measurement bridge

transmission lines, amateur rigs simply do not have 'balanced feed' aerial connectors. Therefore in order to utilise open wire feeder, the 50 ohm unbalanced output from the rig must be converted to a balanced format. This is usually achieved with a device called a 'balun' - or BALANCED to UNBALANCED transformer. Such transformers are easily constructed, and come in a variety of shapes and forms. So in a perfect world, the system illustrated in Fig. 1 would appear to be perfectly satisfactory.

influenced by nearby objects such as masts, trees, and buildings. Therefore the feeder itself may well be 'unbalanced' in RF terms. All these factors work against the 'ideal' configuration we had in mind from the beginning, and ultimately we find that the feeder is radiating! These factors may prevent the balun from working properly. If the aerial and feeder system is very far off balance, the poor old balun does its best to hold the balance but gets hot in the attempt! This heat represents wasted RF, which is of course to be avoided.

I have been aware of problems with the doublet element that I use. All sorts of different balancing tricks had been tried, and just about every balun configuration or idea, but with broadly similar results. Yes, the aerial system worked very well, but with RF getting into the telephone system, hi-fi, shack computers, and the overhead power lines, it was pretty obvious that the feeder was radiating. I knew that it wasn't from the doublet itself, because the transceiver had been lugged down the garden and used to fire up the aerial on a much shorter feeder, with no problems.

The trick appeared to be to find out a bit about the aerial system itself in terms of 'balance', as

Many of us utilise various forms of open wire or balanced feeders to carry RF to and from the aerial system. Open wire feeders have several useful characteristics, not least - that they are cheap and relatively easy to make. However, in order to work effectively, the feedline must not be allowed to radiate significant amounts of RF. This is achieved by ensuring that the RF currents flowing in the feeder conductors are equal in magnitude and opposite in phase. If this condition is satisfied then the electric and magnetic fields associated with the individual conductors cancel, so no radiation takes place.

There is one distinct disadvantage to using open wire feeder

Unfortunately we do not live in a perfect world, and several factors come into play that upset this 'ideal' configuration. First, let's have a look at the dipole element. Is it really balanced in itself? Probably not, many amateur dipoles are 'bent' to fit into the available space. One end may be loaded by a nearby building or tree, and perhaps the opposite end is higher than the other. These factors combine to present a complex impedance at the feedpoint, and probably not quite as well balanced as we first thought.

Now let us consider the feeder itself. As with the aerial, open wire feeders are

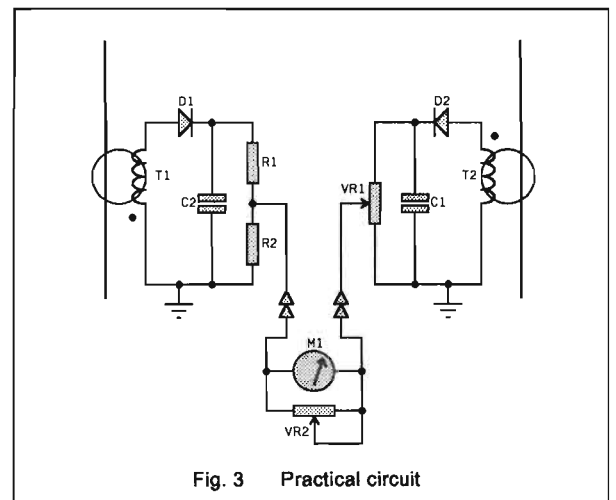


Fig. 3 Practical circuit

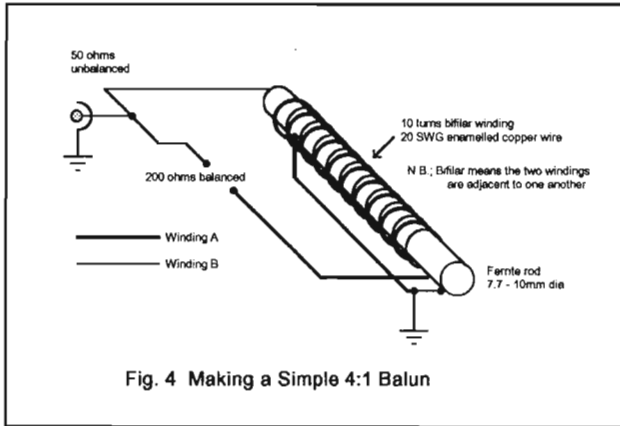


Fig. 4 Making a Simple 4:1 Balun

opposed to impedance and VSWR which most amateurs pre-occupy themselves with. If I could measure the balance, then it was possible that a way of persuading the system into balance could be contrived. In order to measure the balance between the two feeder conductors the circuit shown in Fig. 2 was contrived. Two RF current sensors are used to measure the current in each feeder conductor. The RF current induced in the secondary is rectified and RF decoupled. R1 and R2 are used as the lower arms of a bridge circuit. If the currents induced in each feeder are the same, then the voltages at V1 and V2 will also be equal. Any imbalance can then be measured by M1, a centre-zero 50µA meter. The practical circuit is shown in Fig. 3. In essence the circuit is exactly the same except that VR1 (balance) and VR2 (sensitivity) have been introduced.

The RF sensor circuit was built on a small piece of single sided PCB material, and mounted in plastic box. The plastic box can then be slid onto the transmission line as an additional line spacer. The output from the sensor is taken back to the meter, again mounted in a small box in the shack. However, before using the equipment on an unknown feeder, the bridge itself requires balancing. This is achieved in the following manner. Firstly, a 4:1 unbalanced to balanced transformer is required. This should be constructed as illustrated in Fig 4. In addition, a 200 ohm dummy load will be required to act as a resistive balanced load. I constructed a very short open wire feeder terminated with four 50 ohm 1W carbon resistors connected in series. It is worthwhile checking that calibration equipment has been constructed properly before working on the RF sensor head. The simple test rig

illustrated in Fig. 5 is used to calibrate the sensor. A transmitter is coupled to the unbalanced (50ohm) input to the balun via a VSWR meter. The balanced output from the balun is subsequently coupled to the 200 ohm balanced dummy load. I used 4W at 3.650MHz as a test signal to ensure that the VSWR meter indicated approximately 1:1. Assuming that this simple procedure has validated the test rig, then the RF sensor can be installed in the system

between the balun and 200 ohm dummy load. VR2 should now be set for maximum sensitivity (i.e. maximum resistance). RF should now be applied to the test rig, and VR1 adjusted so that the meter reads zero. The test rig can now be deliberately unbalanced by gripping one side of the open wire feeder. The meter should be seen to swing away from zero indicating an unbalanced condition.

The measuring head may now be installed on the open wire feeder. It helps to know which side of centre zero refers to which conductor, so bear this in mind whilst installing the device. On applying power to the aerial, you will probably find that the open wire feeder is out of balance. So what do we do about it?

One approach would be to use the aerial tuning system illustrated in Fig 6. This unit will allow you to compensate for any feeder imbalance as part of its design. Although I gave much thought to implementing the design, I finally rejected the approach because I suspected that I could find a simpler solution. My doublet is basically used as an LF array, i.e. it gets pressed into service on the 160, 80 and 40m bands. As originally implemented it consisted of a 61m top, at about 12m, fed at the centre with open wire feeder. The bridge certainly demonstrated that the feeder was anything *but* balanced, so my initial suspicions were at least confirmed. Rather than try to impose balance at the shack end of

things with an ATU, I wondered whether it would be possible to organise the aerial feedpoints to compensate for any imbalance. I had a hunch that the 'delta match' would probably be a good starting point and proceeded to modify the aerial accordingly. The delta match arrangement is shown in Fig. 7, and I hoped that moving the feedpoints A and B with respect to the aerial centre and each another would ultimately improve the feeder balance. Strangely, the feeder balance improved dramatically at the very first attempt!

After some thought, I worked out why this immediate improvement came about. Actually I should be put in the corner of my shack with a dunce hat it was so obvious!. My main mast is constructed out of 51mm diameter aluminium section. The original feeder was run alongside the mast, with one

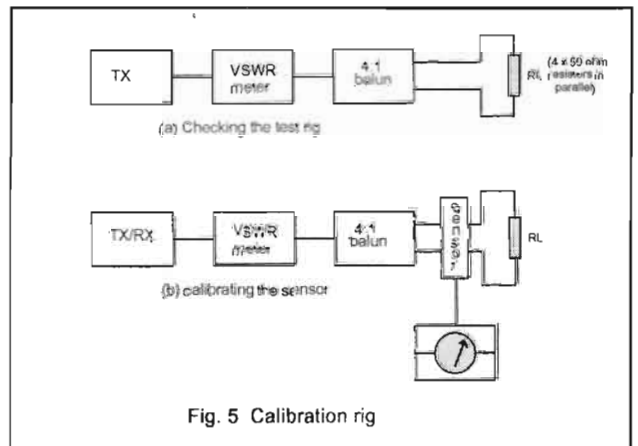


Fig. 5 Calibration rig

conductor closer to the mast than the other. So it was almost inevitable that the feed line would be unbalanced! The delta match arrangement is well clear of the mast, thereby preserving the overall balance of the system. The aerial certainly seems to be a lot less prone to local electrical interference. Otherwise, the aerial's general

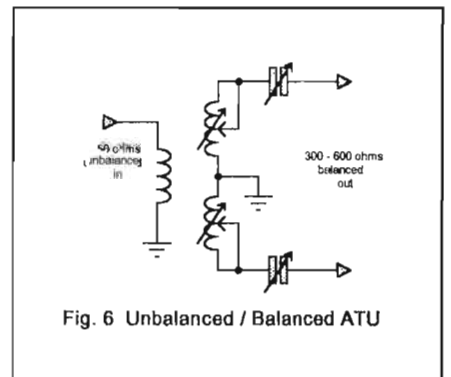


Fig. 6 Unbalanced / Balanced ATU

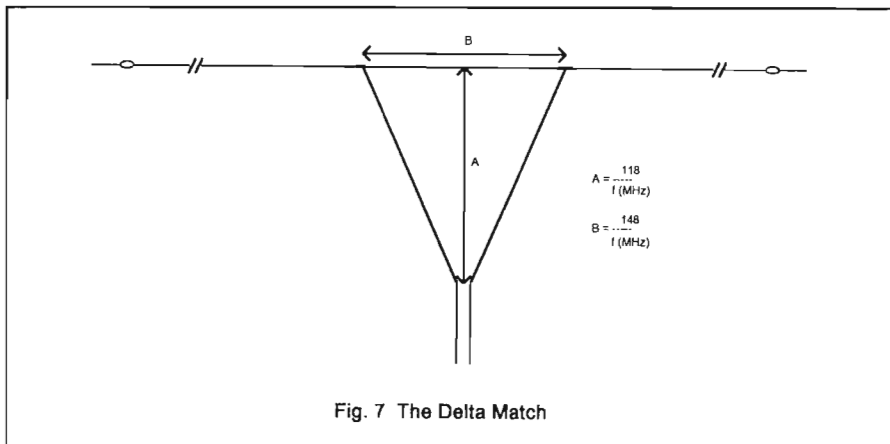


Fig. 7 The Delta Match

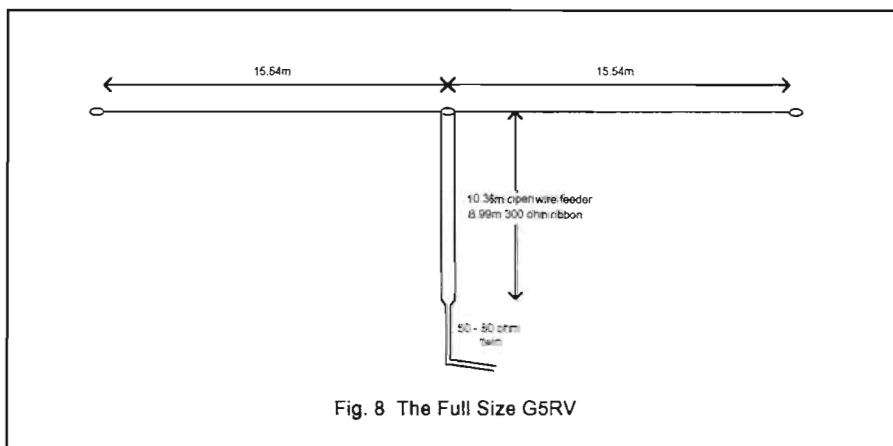


Fig. 8 The Full Size G5RV

performance has remained much the same. The improvement in feeder balance has also greatly reduced the amount of interference I was causing to our domestic equipment as well. Then almost far too slowly, something else began to dawn on me. The G5RV must be one of the most popular HF aerial configurations in current use. The open wire feeder used in the design is an essential part of the design. It has different functions at different frequencies, but for the sake of argument let us discuss the mode of operation on 14MHz. On this frequency the aerial is a three half wave element. Therefore the feed impedance will be about 100 ohms. The function of the 10.35m balanced feeder is to act as a transmission line transformer. So in theory, the 100 ohm feed impedance is transformed to about 60-70 ohms, a reasonable match to 50 ohms.

But how many stations have you worked whose G5RV simply does not behave as the design more or less dictates? Well, in order for the 'stub' to work it must be *a)* balanced and *b)* not influenced by external factors. Understandably, the G5RV is often used in the 'Inverted V' configuration, because only one

support or mast is required. If erected in this way, the matching stub is very likely to be unbalanced or loaded by the mast.

I simply had to test my hypothesis, and as I had 10.7m of discarded open wire feeder from the old doublet, a G5RV was duly constructed. Initially the G5RV was set up so that the stub 'dangled' in mid-air from the 31m top at about 12m. I then tested the stub for balance on all the pre-WARC bands. The balance degraded somewhat on 21MHz, but this I corrected by trimming the dipole element carefully. A VSWR meter was subsequently utilised to check the approximate feed impedance at the base of the stub. The G5RV offered a reasonable match (less than 2.5:1) on all bands, apart from 7MHz, where there seemed to be a large reactive

component. So having completed these tests, the G5RV was hauled up the main mast, with the matching stub about 30cm away from the mast. Oh dear! The stub's balance was thrown quite severely by the mast, and the previously nicely behaved G5RV offered anything but a sensible match on all bands apart from 80m.

So what conclusions should we draw from this? Having discussed all this with an old timer, it was all old hat to him. In his early days, open wire feeder was the norm, and everyone knew that you didn't run open wire feeder close to masts or other objects. I remain firmly convinced that open wire feeder has advantages over coaxial cable, certainly at HF anyway. But, I must be far more conscious of how I install it in order to achieve the maximum benefit from its use. I also thought that I couldn't make efficient baluns, almost to the extent that I doubted that they ever actually worked. It was a bit of a relief to find that the seven different balun units that I had constructed (and, I have to confess, purchased) behaved just as the text books said they should!

Finally, I recognise that some people may have difficulty either obtaining the parts or in constructing the RF toroids or 4:1 balun used in the project. These parts may be obtained from the author at 35, Shipley Common Lane, Ilkeston, Derbyshire, DE7 8TQ (T1 and T2 wound, at £2.50 the pair; the 4:1 balun rated at 100W and suitable for use in aerial systems, supplied in a plastic enclosure with S0259 and pillar connectors at £12.50).

*If you have any queries regarding this project, please contact the author at the above address enclosing an SAE if a reply is required - Ed*

### Bridge Component Table

Part No	Description
T1, T2	Primary - feeder conductor through centre of former. Secondary - 25t 30swg enamel copper wire. Former - Amidon 68-2 toroid.
D1, D2	1N914
R1	1k0 1/4 watt metal film resistor
R2	2k0 1/4 watt metal film resistor
C1, C2	0.01µF 50V ceramic disc
VR1	4k7 trimmer (balance)
VR2	VR2 1K0 potentiometer (sensitivity).
M1	50µA fsd centre-zero meter.

# Project - A Dual Band HF Ferrite Loop

*Richard Marris G2BZQ describes a compact two band HF loop aerial covering the 7MHz and 10MHz bands for your shack table*

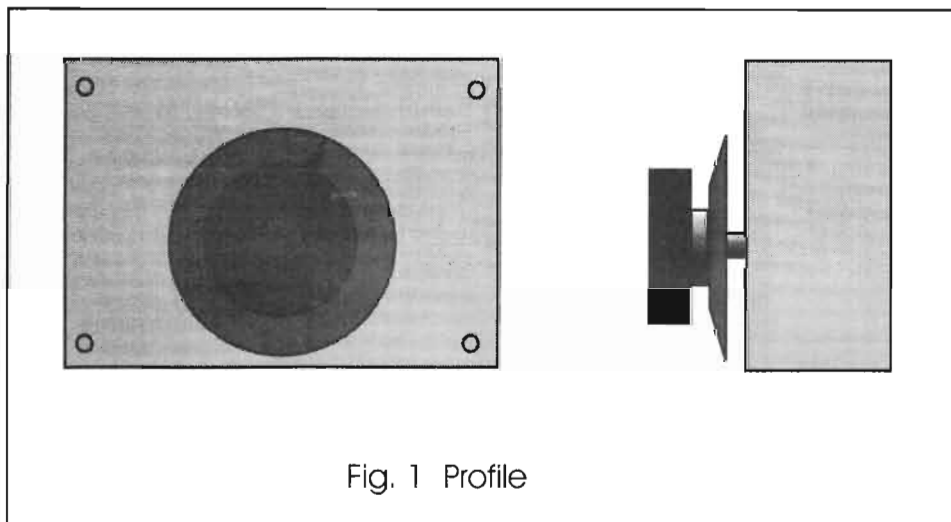


Fig. 1 Profile

This ferrite loop aerial is one of the results of an on-going series of VLF to VHF ferrite loop experiments over the last 20 years or more. Each band produces its own design problems, and care has to be taken to select the most suitable type of ferrite rod for the job. Additionally there has also been considerable investigation into the use of ferrite rods in transmitting

loops, using the 80m band with encouraging success.

There are two main basic material mixtures used in the manufacture of ferrite rods - manganese, zinc and nickel zinc. Manganese zinc rods have a permeability above  $800\mu$ , and are normally used for ELF, VLF, LF and MF frequencies between 1kHz and 1MHz. Nickel zinc rods have a permeability range between  $20\mu$  and  $800\mu$  and are normally used for frequencies from 0.2MHz up to the lower VHF spectrum. Unfortunately, or fortunately from a personal point of view, there are many nickel zinc material mixes, each with its own peculiarities, with diameters between 6.3mm and 25mm or greater, and with a selection of lengths from 50mm to 300mm or more. Some of the longer and fatter rods, are only obtainable to special order, at very high cost and/or in production quantities. Even so the serious experimenter has more than enough

available types, if a search is made among manufacturers/suppliers in several countries, especially the USA. Any reader wishing to make a basic start to pursue the complexities of this matter could well begin with an Amidon Associates Inc. book entitled "Iron Powder and Ferrite Coil Forms". In this book will be found descriptions and characteristics of 11 iron powder and 11 ferrite materials. Many manufacturers quote length and diameters in inches and not metric. Some suppliers confuse the issue by offering the same rods, as others, under their own part numbers.

This 7MHz and 10MHz amateur band ferrite loop uses an Amidon 100m long x 12.5mm diameter (size 4in x 0.5in in the Amidon catalogue) nickel zinc 61 material rod. The 61 mix has a permeability of  $125\mu$  and is quoted for use between 0.2MHz and 15MHz, but I've used this up to lower VHF. Such rods cost substantially more than those available from UK high street suppliers for medium wave radio designs.

The circuit diagram of the 7MHz and 10MHz ferrite loop consists of a ferrite cored inductance, L1, resonated in a balanced circuit with a two-gang 176+176pF variable capacitor fitted with integral reduction drive. Coupling to the receiver input is by means of winding L2, via a short length of 50ohm coaxial feeder. I used a plastic box 118mm wide x 95mm high x 45mm deep, with a large resonating knob, to case the unit. I mounted the box vertically, with the box lid as the front panel/chassis. A piece of cork sheet, or beer mat,

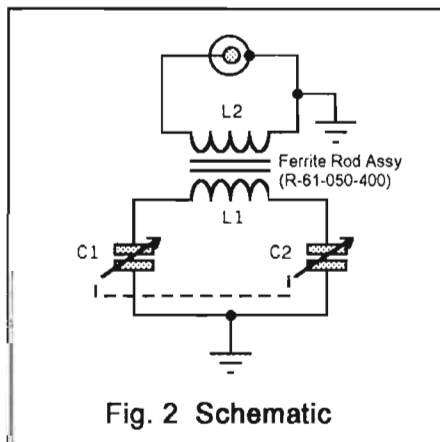


Fig. 2 Schematic



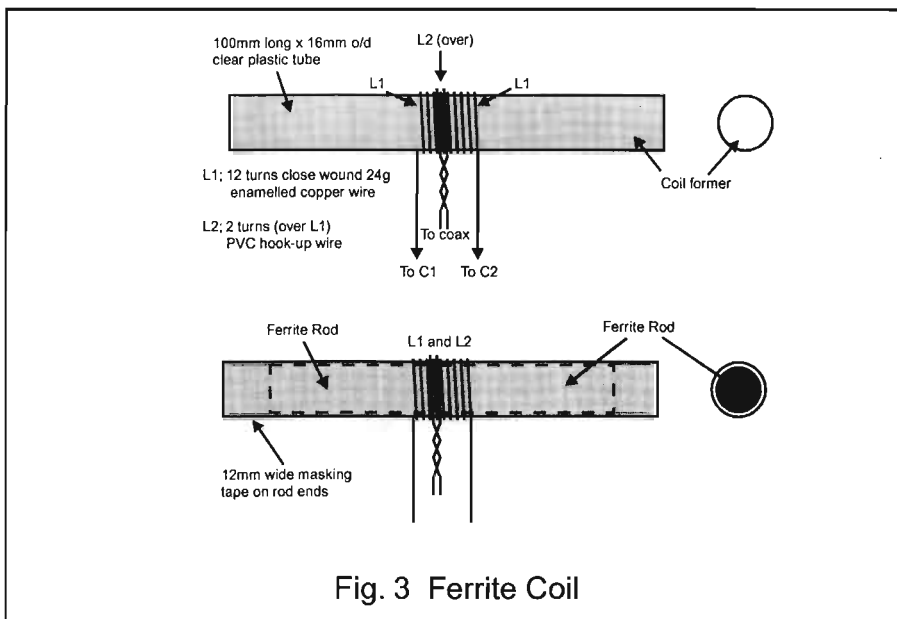


Fig. 3 Ferrite Coil

attached to the base prevented the unit sliding about on the table.

### Construction

**Ferrite coil L1/L2:** The ferrite rod can be purchased from Amidon Associates Inc. 2216 East Gladwick Street, Dominguez Hills, California 90220, USA, under the code number R-61-050-400. Using airmail, delivery is usually received in about two weeks from posting the order from the UK. The cost, at last purchase, was \$6.00 each plus \$6.00 airmail shipping and handling, equivalent to about £8.00 at the time of writing.

The rod is firstly enclosed in a clear plastic tube which is the coil former. This tubing is 16mm o/d polycarbonate plastic obtainable from larger Aquarist emporiums. A 100mm length required cut from the standard 760mm length supplied. L1 consists of 12 close-wound turns of 24 SWG enamelled copper wire at the centre of the tube. L2 is the coupling coil of 2 turns of PVC insulated hook-up wire wound over the centre of L1, with its ends lightly twisted together and taken to the RG58 coax. The ferrite rod is inserted into the above coil, with a couple of turns of masking tape on either end

to hold it rigidly in position in the tube.

### Assembly of the Unit

The 2-gang variable capacitor C1/C2 is mounted on the front panel (i.e. the box lid), with the ferrite coil assembly L1/L2 mounted horizontally above. The preset 15pF trimmers on C1/C2 should be removed, effectively reducing the C1/C2 capacity to about 160+160pF. The simple wiring is shown in the diagram, the coil leads should be kept as short as possible. The ferrite coil assembly is held in position with two standard white plastic stand-off wall pipe clips. A length of RG58 coax is cable-clipped to an existing hole in the rear plate of C1/C2, and is taken out of the side of the unit to the receiver, via a small clamping 'V' cut in the edge of the plastic box. The coax should be as short as possible, and not exceeding 90cm.

### Testing and Operation

The coaxial feeder is plugged into the receiver, which is tuned to the 7MHz band, with near maximum RF gain. The knob on C1/C2 is rotated to

resonance. A convenient captive signal can be obtained by placing a small pocket calculator near the loop, to produce a 'noise' signal. A similar check should be made in the 10MHz band. On the prototype, the 7MHz band resonates with C1/C2 approximately 35% enmeshed, and 15% on 10MHz.

At my location a preamplifier is not used between the 'souped up' receiver and the loop. However on most receivers a wideband 50 ohm in/out preamplifier will be necessary, mounted between loop and receiver. Such preamplifiers are quite low cost, and can be purchased complete, or in low cost kit form, or can be made from text book or magazine designs.

On reception, it will be noted that there is a noticeable reduction in QRM and QRN due to the bandwidth and directional properties of the loop, which gives a figure-of-eight polar diagram. The loop should be rotated for maximum signal and minimum noise. The loop box assembly should be stood on a non-metal surface, and as far away as possible from house wiring and any metal pipes or objects.

*If you have any queries regarding this project please address them to the author, c/o the Editor at the Ham Radio Today magazine address enclosing an SAE if you require a reply.*

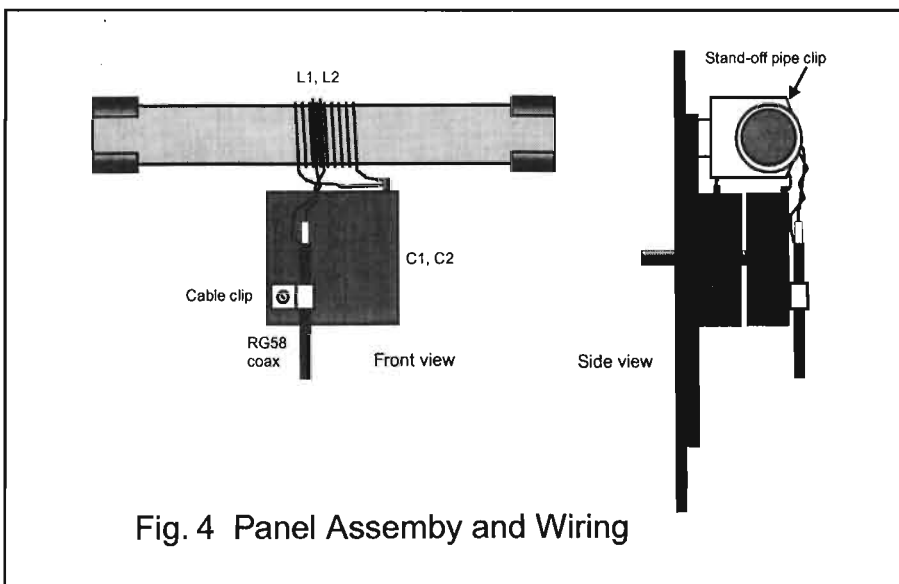


Fig. 4 Panel Assembly and Wiring

### Parts List

Plastic box 118mm x 95mm x 45mm

Ferrite rod 100mm long x 12.5mm diameter, type R-61-050-400 (available from Amidon Associates Inc. - order in inches, 4in long x 0.5in dia, not metric).

100mm (min) length of clear plastic tubing

2 x stand-off white plastic wall pipe clips to hold above tubing

2-gang 176+176pF variable capacitor, with built-in reduction drive

24 SWG enamelled copper wire

90cm max. RG58 coaxial feeder

80mm dia. instrument knob

# QRP corner

## *Dick Pascoe G0BPS gives a few tips on choosing a rig for QRP operation*

Letters from Holland, Spain the USA and more locally Wales this time. Peter PE1MHO sent a packet message to say that he had fun in the QRP Winter Sports. Most members of the Dragonslayers QRP club managed to get a few hours on the air and enjoy the limited conditions on the bands.

Vincec EA3ADV wrote to tell me that the EA QRP club is going from strength to strength with lots of EA operators getting more interested in our side of the hobby. They will be having their club contest on April 16th more details will be available from me by the time this appears in print. We have also finally agreed the reciprocal membership for the EA / G-QRP clubs which will benefit both clubs.

From the USA, an old friend wrote to tell me of his success in the ARCI Winter QRP Fireside Sprint contest. The Americans and the Australians call any short duration contest a "sprint" which I find a very apt name. Byron WU2J visited the G-QRP convention a couple of years ago and I have spent a lot of time chatting with him at Dayton. An avid builder and a keen operator of low power equipment on 17m (18MHz band). He may often be heard using SSB to great effect.

During the sprint, Byron worked G-QRP club members KC0PP, KB2JY, W5HNS and W16D. He also managed to work into Mexico and Ecuador, using an Argo 509 with just a mobile 1.34m high aerial.

This size of aerial brings back memories of a QSO whilst I was in Luxembourg. In chatting to a UK station, he remarked how good my signal was and how lucky I was to have a selection of trees suitable to hang an aerial from. The main point of his comment was about how poor mobile aeriels were and how pleased he was that I had a good aerial out. I waited until the end of the chat to tell him I was using the Hustler Mobile aerial on the rear bumper of my Volvo.

These aeriels do work very well in a mobile situation, in my opinion much, much better than the more usual G-Whip. I managed to break a pile-up some time ago to work into Aaland Island in the Baltic. The station was very busy but stopped the usual DX race for a chat when I mentioned that I

was using just 10 watts of SSB and also almost mobile on the great car park that circles London called the M25.

### **Club Talks**

A visit to the East Kent Radio Society recently to give a talk on low power operating turned into an excellent evening as several members were already enthusiasts. I do enjoy doing these talks as I get to the grass roots of the hobby. I know of other amateurs who are "experts" in their own field who also think the same. I also know that the "expert" who followed me at the EKRS a couple of weeks later was our own Technical Editor, Chris G4HCL, who drove for about two and a half hours each way! There's dedication for you. I use the inverted comma's around the word "expert" as I have no claim to being an expert in anything. I just enjoy passing on my own thoughts on this part of the hobby.

Readers may remember my recent comments on the original UK QRP club, the QRP Society. Whilst browsing through the papers given to me I found evidence that this society had actually been founded in 1949 and not 1954 as I'd first thought. I would be delighted if any ex-members of this society could give me any information on its activities, as I am planning to write up this group for posterity.

### **Netting**

One of the difficulties found on the amateur bands, especially with homebrew equipment, is accurate netting. By this I mean actually transmitting on the same frequency as the other station. I often hear two stations chatting both on different frequencies. It is very important that your transmitted signal is on the same frequency as you receiver. If this is not so you will be using space that another two stations could use.

One way to check your equipment is to add a small switch to your radio which keys your sidetone oscillator whilst your receiver is switched in. Find the signal, get close to the right frequency and press the "spot"

switch, then fine tune the receive signal to the sidetone. You will then be "spot" on!

One other problem often found on our local sideband nets is where we have agreed to meet on 144.225MHz. The net controller, Ian, switches his rig on and sets it to the required frequency and calls for contacts. Joe does the same with his rig, as does Bill, who both answer Ian. However we now have the problem that all three rigs are showing the frequency of 144.225MHz on their displays. How many rigs do you know that are spot on frequency with each other? Joe, above cannot truly resolve Ian so he uses his RIT (Receiver Incremental Tuning) thus offsetting his receiver from his transmit frequency. Bill does the same. The only station on the same receive and transmit frequencies is the controller! Anyone else joining the net will have to retune every time someone else transmits.

It is much easier to forget the RIT (or "clarifier") and listen to the net controller and tune to his frequency with the main tuning dial. Your display may show 144.223MHz but does it matter? When Bill does the same and so does Joe, all will be able to listen and transmit without retuning every time.

### **QRP Equipment**

It is often said that QRP operators are mad, and that only a masochist would attempt to try to make contacts with low power. OK, I'm mad. But I enjoy being that mad. But because I am a little insane doesn't mean that I will use inferior equipment for my hobby. Many enthusiasts get into the hobby by buying a small low power radio because it is easier to carry on holiday or the caravan battery will last longer.

There is a lot of QRP equipment on the secondhand market, but you can rest assured that the best will rarely be seen for sale. Many of the Heathkit series the HW7 and HW8 will be seen at prices around £85 but the much better HW9 will only be seen occasionally at much higher prices.

The HW7 was a dedicated homebrew project in kit form from Heathkit, who company no longer

# From My Notebook

*Geoff Arnold G3GSR looks at what 'environment' means to the radio engineer and gives a few tips on insulating an outdoor radio shack*

Environment is one of today's buzzwords, but for a designer, builder, installer or user of radio, electronic or electrical equipment it generally has a meaning that is somewhat different. What we are thinking about is the environment or situation in which it must operate. Let's look at a few of the factors which go to make up that environment.

## It's the Heat!

First there is what is perhaps the most obvious - temperature. Electronic components are specified by their makers to operate reliably over a certain range of temperatures; how wide that range is will depend on the particular type of component and also the grade. For example, military or aerospace specification semiconductors - ICs, transistors, diodes and so on - will function over a far wider temperature range than the standard industrial grade, but will also cost substantially more. A set intended for use in a situation with a fairly limited range of temperatures, such as a house, can use components with a lower specification (and therefore cost) than one designed as a mobile. In a car that's sitting out in the open, temperatures are likely to range from well below freezing to something over 38 degrees Centigrade, depending on the time of year.

Even in a base-station set-up, the amount of ventilation becomes important. The rig which sits in a rack of shelves, closely surrounded by other equipment, is going to get far hotter in operation than one which sits in splendid isolation on a desk-top (assuming, of course, that you've resisted the temptation to use it as a prop for stacks of reference books).

For a mobile rig installed in a car or other vehicle, it's likely that it will either be sat on top of the dashboard where it will sit baking in the summer

sun, or else tucked away under the dashboard, where there is little or no ventilation. Either way, you've got to allow for the fact that it's going to get pretty warm, a fact that hasn't yet entirely been taken on board by vehicle designers in the move to electronic systems. I know of one make of car where the modern IC-timer based flasher unit which controls

the turn indicators shows a tendency to cease to function on a hot day, even in our British summers. That never used to happen with the old bi-metal strip type of flasher!

But I digress. Unless you are indulging in home-construction, you are going to have to live with the components which the manufacturer decided to use in building your rig or whatever. All that you can do is to keep in mind the need for a reasonable air-flow around radio or electronic equipment. If your rig has a fan-cooled PA with a vent grille at the back, don't push it up against heavy curtains, for example. Don't stack books where they will block ventilation holes in the sides or top of the cabinet. If your only space for reference books is around the rig, build some sort of shelf or book-end arrangement which will ensure that 20 to 30mm of fresh air is maintained opposite any vents. Building your station into some sort of enclosure, or even stacking it tightly in a rack of shelves, certainly makes it all look neat and tidy, but don't forget to allow for that all-important ventilation.

## Damp

Humidity and moisture are in some ways an even bigger threat to radio, electrical and electronic equipment than heat. They can produce corrosion, short circuits, and component deterioration and breakdown. In the great wide outdoors, rain is the most obvious

problem, and is something which has to be borne in mind by designers and installers of aerials, traps, baluns, pre-amplifiers, junction boxes and the like.

Rain is not the only source of damp, though. Mist and fog can leave externally-mounted items running with moisture, as can natural condensation when there is fairly rapid change in air temperature. Condensation can be a problem even inside sealed boxes unless the air trapped inside is completely dry, a situation that's not very likely except in high-spec military or professional equipment. To avoid a possible build-up of condensed water inside the box, a very small hole (around 2 or 3mm diameter) is sometimes drilled in the bottom face. This acts both as a breather hole and as a drain.

Regardless of what the item is, all electronic equipment intended for use out of doors will normally have cable entries or connectors arranged on the bottom face. Ideally, there will be a shroud around them, to protect them from rain, etc., running down the sides of the unit. Where cables have to be taken in through a vertical face, perhaps because there are too many to be accommodated in the bottom face of the housing, the entries must be through proper waterproof glands of the correct size and fitted with sealing washers to match the cables.

Any cables entering an enclosure through a vertical face, regardless of whether it's the side of a box or something more substantial such as a house wall, should approach the entry from below. If the cable is coming down from above, it should be led past the entry and then turned upwards to form a drip loop. This will naturally shed water running down the outside of the cable before it has a chance to reach the entry point, where it might find a way inside (Fig. 1).

I'm assuming that you are fortunate enough to have a dry room somewhere in the house for your shack. If you have instead to make use of the proverbial garden shed,

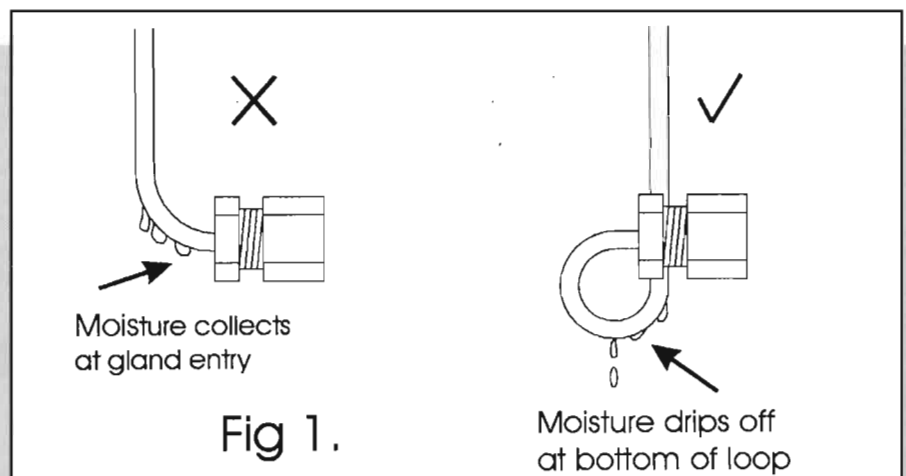


Fig 1.

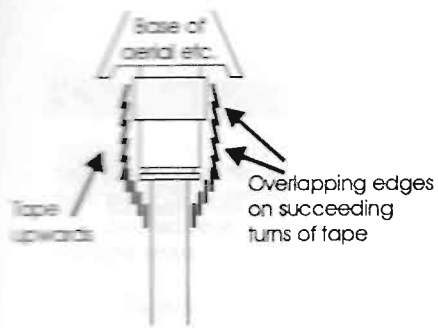


Fig. 2

then you have another problem in keeping that dry. A low-power electric heater, possibly one of those made for use in greenhouses, will help, but the most important thing is to get a bit of insulation between the thin wooden shell of the shed and you and your equipment.

The 25mm-thick expanded polystyrene board intended for use as cavity-wall insulation in new houses is ideal for the purpose. It's available from builders' merchants under the name "Jablite" in manageably-sized sheets and at quite reasonable cost. You can slot it in between the framework of the walls and roof, and because it's so light it takes only an odd nail or a bit of mastic "gunge" to hold it in place while you cover it with a hardboard lining. Adding some sort of cheap secondary double glazing to the windows - even if it's only polythene sheet secured with double-sided tape - is a worthwhile finishing touch.

Insulating a wooden shed floor is a bit more of a problem, because of course you can't easily put the insulation inside as you can for the walls and roof. One solution is to put the polystyrene insulation under the floor before you start to erect the shed, boxing it in with marine plywood (hardboard won't last long in this position) with a liberal application of wood preservative to keep it safe and sound.

Having taken the steps I've described to keep moisture out of your shack, whether in house or shed, there is of course still one way it can sneak in, and that is down the inside of air-spaced or semi-air-spaced coaxial cables. It doesn't do the cable or the connectors any good at all! Worst culprits for letting moisture in are PL259 UHF connectors or the standard TV 75-ohm connectors, neither of which are in any way waterproof. The more expensive "BNC", "N" or "C" connectors are waterproof if of the correct size for the cable diameter, and assembled correctly. Whatever connector is used at the aerial, it should be fitted with an overall sleeve, or at least covered with good-

quality PVC tape, beginning around the cable itself and winding upwards over the plug and socket to form a natural watershed (Fig. 2). Winding the other way, from the top downwards, leaves the upper edge of the tape exposed, and will provide little openings which will channel water to the inside of the assembly.

One way of keeping moisture out of external junction boxes is to fill them full of some insulating medium. Back in the days when I was doing installation and servicing of shipboard radio and electronic equipment, one of the things we had to deal with was the connections to underwater transducers for depth-sounders. Although the junction boxes were in theory totally sealed, in practice the water pressure always caused them to leak slightly, so the technique was to coat each brass connector and associated wire ends with rubber solution, then wind self-amalgamating rubber over the whole. This process was repeated twice, to give a total of three layers, and the whole of the space in the junction box was then meticulously filled with a green mastic gunge called Henley's Compound, before finally screwing down the gasket and lid. What a filthy job it was, usually working by the light of a torch, crouching in water and oil in a steel compartment measuring perhaps four feet by two, right in the bottom of the ship, with hands covered in rubber solution and Henley's Compound. It took the rest of the day to get clean! Nowadays, we could do the same job with some form of silicone grease or sealant.

## A Hard Life

Leaving aside the ventilation aspect which I've already talked about, radio equipment that's used in an amateur base-station usually enjoys a fairly favourable environment. That's assuming that you don't tip it off the table by tripping over the power-lead or whatever! Outside of the home, equipment has a much harder life, particularly in a mobile installation where shocks and vibration can be quite severe.

The most extreme vibration I've ever encountered was some years back, again when I was working in the marine electronics industry. It involved one of the first oil-tankers to be built with its navigating bridge wings in cantilever form - sticking out from the sides of the accommodation

block but unsupported at the ship's side. Vibration on board a ship under way at sea is a strange thing, rather like standing waves on an aerial feeder. It will be very strong at one point, but almost undetectable just a few feet away. In this particular ship, the resonance produced by the unsupported bridge-wings seemed to centre on the radio office.

When the first report came back from the radio officer on the maiden voyage, he said that everything was working fine, except that he was having great difficulty in tuning the main transmitter.

This was not, as sometimes happens, due to an unfortunate choice of aerial length, producing some strange value of impedance on certain bands which the transmitter's "pi" output circuit would not tune. Instead, it was simply that the vibration of the whole transmitter was so extreme that it was impossible to see the indicating needles on the anode and aerial current meters when trying to tune and load! It said a lot for the quality of design and construction that the transmitter went on working even so.

On the ship's return from its first voyage, the vibration consultants investigated and recommended that steel pole supports should be fitted under the bridge wings. This was done, and the vibration was largely tamed.

The sort of vibration you are likely to experience when trying to install a mobile rig in a car can usually be cured with a strategically placed lump of rubber or plastic foam, but keep it well clear of any vent slots. If more drastic bracing is required, be careful not to do anything which might stress or distort the rig case or mounting bracket, as this can induce some strange faults.

One such instance which I came across was on one of the first ever synthesised 70-cm mobile rigs. When the mounting screws were fully tightened, the case distorted and pressed on the edge of the printed circuit board within. This stressed the PCB, which caused a bad contact on one leg of a plug-in crystal located near the edge of the board. The loss of crystal drive activated the loss of lock detector on the synthesiser, which promptly shut down the entire rig. The problem must have been pretty intractable, because that particular rig was quietly withdrawn from the market very shortly after the importer was told of the fault.

# DATA CONNECTION

*High speed packet at an affordable cost?  
Chris Lorek investigates...*

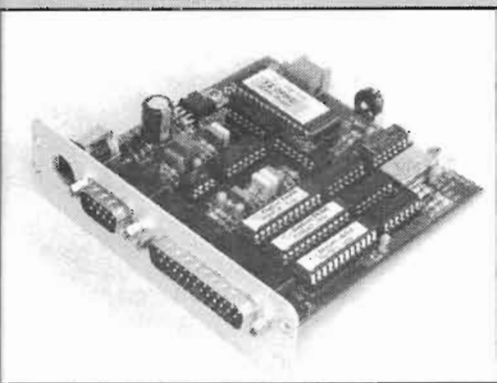
Getting going on 9600 baud may not be too expensive any more. In last month's column I gave a mention of the PAR96 modem from the BayCom team in Germany, and just last week I was very pleased to receive my own PAR96 direct from Johannes DG3RBU of the team.

## The BayCom PAR96

The unit comes in a small two-piece alloy case, and operates from an external DC power supply of 8-12V at 150mA, although an internal



The new PAR96 BayCom 9600 baud packet modem



Here's what's inside the PAR96

+5V feed is also possible. Four small switches accessible from the front panel are used for setting the right 'filter curve' for your rig, and an output potentiometer sets the amplitude level of audio to your rig. Round the back, a 9-way D type connector is used for the radio interface (TX, RX, PTT and Ground plus optional DCD and +5V), the connections being the same as the BayCom 1200 baud 'micro modem'. Like this modem, rather than being a 'stand-alone' TNC the PAR96 uses the power of your PC to handle

packet processing, with appropriate software running on you PC for packet operation.

Unlike 1200 baud operation however, instead of simple microphone and speaker connections to your rig, for 9600 baud use the TX signal will need to feed directly into your set's modulator, and on receive you'll need to take the audio direct from the receiver's demodulator. A number of current 2m and 70cm transceivers already have a dedicated 9600 baud 'data port', but on others you'll have to delve inside with your soldering iron. However, the benefits of the vast increase in 'throughput' speed mean that, if you're in range of a BBS or node with a 9600 baud access port, you'll usually never regret the extra effort involved!

In fact, I'm currently adding a 70cm 9600 baud port onto the rest of my node system equipment at the GB7IW 4m/2m/70cm/23cm node at Chillerton Down on the Isle of Wight, which already offers good coverage for 1200 baud users along the south coast. I'll be performing tests from home using the PAR96 to communicate with this - I'll let you know how I get on through these pages.

## Insides

For the technically-minded, the PAR96 is based on the 'Modern FSK modem' by Henning Rech DF9IC. As direct 'interrupts' into a PC at 9600 baud would occur every 100 microseconds (difficult for even powerful PCs to handle), the PAR96 provides a buffer for this, with two programmable logic chips and two external shift registers. The software used, which also handles the scrambler DCD requirements, is BayCom v1.6. This is supplied with the modem together with printed manuals for both the software and the modem hardware unit itself.

The PAR96 is connected to the Centronics (parallel printer) connector on your PC, using six lines, the TX and RX data being handled serially in bursts of 16 bits each. On transmit, these are written into the modem's TX buffer, and then filtered with a EPROM controlled digital filter prior to further analogue filtering. The data is not scrambled (as is needed for G3RUH modem compatibility) in the hardware, this is done in the software so that the data reaching the modem is already scrambled and NRZI coded.

On the RX side, the demodulated AF from the receiver is low-pass filtered and fed into a binary discriminator, which compares the signal with the mean of the bit stream. The received signal clock is recovered by a 32 stage digital phase locked loop (DPLL) circuit, and the raw data is sampled at this clock rate and fed into the interface buffer.

Even with all this, it's still a lot cheaper than a 'stand alone' 9600 baud TNC, and with the availability of (hopefully!) low-cost kits it could certainly make a difference to 9600 baud use around the UK. The PAR96 is currently available in ready-built form from Siskin Electronics, and as kits and PCBs from the NWUG (North West Packet Users Group).

## Group of the month - Clacton Packet User Group

Bill Rollins G1WRJ recently contacted me with information on a different, but certainly very successful, packet group to the more usual 'large and formal' type, theirs having just seven members. The Clacton Packet Group was formed in 1990, when active packet and data radio operators in the Clacton on Sea area found it would be handy to meet socially on a regular basis for

the exchange of data information, operating tips etc.

Various members of the group decided that the packet network in the North Essex area was lacking in nodes, and thus decided to create some in the locality for mail forwarding etc. Soon born were CLSX22 on 2m and CLSX40 on 4m, both installed at a local social club. At one of the group's meetings, usually held in a member's house, the idea was hatched to run a radio rally, the profits of which could help the group financially to obtain further equipment for the packet network in the Clacton area. The group's experience of radio rallies was nil, but after a lot of work their first rally, in February 1991, was a huge success. As well as financing equipment for local node systems, they also managed to fund a new 2m repeater for the area from this! More rallies followed, so did a further new repeater, for 70cm this time, together with plenty more equipment. The group tell me they also operated the world's first HF packet beacon during 1992, from the Point Clear site of their repeaters, under the callsign GB3PKT. Reports were received from all of Europe and as far away as Canada.

The seven dedicated members of CLPK, Tony G0MBA, Richard G7HJK, Richard G1WDF, Terry G7DNS, Keith G6NHU, Dave G0BKM and Bill G1WJR, have proved that you don't need vast committees collecting subs from users, holding AGMs with the often associated arguments that go with them, to fund and operate repeaters, of which all operators are welcome and indeed encouraged to use. Dedication and the fact that all the above can be realised with a little (or more accurately, a lot! - Ed) of hard work and commitment and, Bill says when the occasion calls for it, not being afraid to put their hands in our their own pockets occasionally when called for.

The group hope their 1995 rally, which is now run in conjunction with Sharward Promotions Ltd. and takes place on August 27th this year again at the Clacton Leisure Centre, will be better than ever.

### Eire packet upgrades

A message from Andy EI2HH @ EI2HH.#WFORD.IRL.EU, who is the SysOp of the EI2HH BBS (no special calls there!) tells me his club is planning to upgrade their local packet network to 9600 baud operation, and he enquires about suitable ex-PMR

radios for this speed. I'd say that most crystal controlled transceivers with 25kHz channel spacing filters should be fine, but if any readers have had success with other rigs, besides the MX294/6 types which are also OK, maybe you could let both Andy and I know. I'll be pleased to use this to then help other readers.

Andy's BBS has three ports, which link to the EI2WRC node atop a 900m mountain 30 miles away, where it then hops into GB7AKE in St. Ives, Cornwall, together with the EI6EH SatGate and the Cork and Dublin BBSs. The direct node link to Dublin is about 100 miles - that's the benefit of living in a country with lots of nice high hills and mountains!

### TCP/IP

Another Andy, this time G7MJV @ GB7XJZ.#48.GBR.EU says he enjoyed the article on TCP/IP, but he found the NOSintro book a bit heavy going at times, especially when he's been trying to use JNOS as opposed to the PA0GR1 version. A timely reminder of a recent offer of help in this column is that a NOS-filled 3.5in HD disk with very simple installation and introductory 'help' files for TCP/IP on amateur radio is available 'at cost' (just £1.00 inc.) through our software service. Just ask for the 'NOS disk', the contact and remittance details otherwise being as the 'HRT disk offer' in this month's issue - no 'corner flash' is needed for the NOS disk.

### PK-12 'SP' problems?

A couple of messages I've received have reported problems that the PK-12 won't accept the 'SP' (*Send Private*, or *Send Personal*) command in its internal maildrop system. Indeed one amateur (incorrectly) took me to task for not spotting and reporting, in my review of the PK-12 recently in Ham Radio Today, that it was impossible for an FBB BBS to auto-forward mail onto the maildrop because to this. The adage of "if all else fails, read the instructions" comes to mind here, as there's no problem at all! I've verified

this on-air with the Oct 94 and the latest Jan 95 PK-12 firmware updates.

The user handbook tells us that the PK-12's maildrop has a flag to show whether the message is designated as Private, Traffic, or a Bulletin. A 'P', 'T' or 'B' after the message number shows the status of every message, and this status can be edited from your console if needed. Quoting from page 84 of the manual; "A user sets this with the SP, ST, and SB forms of the Send command. You can change the status of these messages using the Edit (E) command described above. If only "S" is used as the Send command, the MailDrop will assign the message a Private (P) status."

The actual reason for this 'SP' worry is that, from your local console, you can *only* enter 'S' to send a message, and *not* 'SP' or whatever. However this 'S' automatically defaults the message to 'private', which you can then edit if needed. And yes, receiving an 'SP' off-air from another station works just fine!

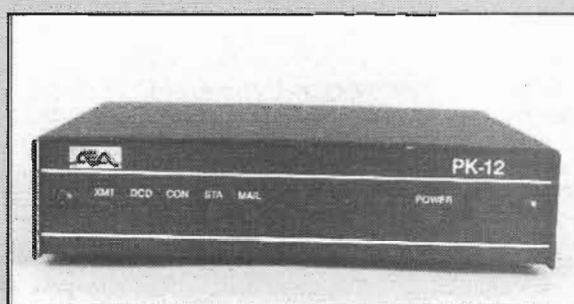
### New 'boffins' book

I've received details of a new book that could very well be of interest to the experienced packet operator who wants to 'spread their wings' a little. It's *Packet, Speed, More Speed and Applications*, which brings together many articles from various US publications, with nearly half of the articles being new manuscripts, updated by their authors. I'm hoping to have a review copy soon, possibly for next month's column, when I'll be able to tell you what you can expect from its pages!

### CTRL-Z, End of message

That's all I've room for this time. Please do keep me in touch with what you're doing, and if you've any thoughts on data modes over ham radio that you feel would be of interest to others, do let me know and I'll try my best to put something suitable together for this column.

You can contact me either by packet direct, or via Ham Radio Today Editorial by phone, fax, or email. Until next month, it's 73 from Chris G4HCL @ GB7XJZ.#48.GBR.EU.



No BBS auto-forwarding 'SP' problems with the PK-12!

# VHF/UHF Message

## *Geoff Brown GJ4ICD finds plenty of activity on the bands and gives an update on the forthcoming Cape Verde DXpedition*

Stateside reported fabulous 'ES' on the 31st of December. N7DB reported the openings as the best for years, these openings lasted up to 12 hours and continued into the New Year, like they did in Europe.

I received a fax from Andy, G7OEC/JO01, who is very active on 50MHz and, on 1/1/95 had good 'ES' propagation and worked; ES5MC (KO38), SP5CCC (KO02), SP4TKK (KO03), SP5EFO, SP7BCS, SP4CHY, and SP7VCD. Down here in GJ 50MHz was open to Finland and Estonia.

On 2/1/95 Andy made more contacts via sporadic 'E' with SP6CPH and OM3ID. This is interesting as my contacts for the same time were with SM4POB (JP70), and beacons GB3LER and GB3RMK were very strong! Lots of MS signals were heard from F, LA, OH, SM, OZ, and EI on the 4th, and reports suggest that the Quadrantids peaked on the evening of the 3rd.

Ela, G6HKM in Essex reported 'a few 50MHz sporadic 'E' QSOs on the 2nd with SPs in JO81 & 91 and OM3ID (JN89). The strong gales have kept the masts tilted over, so not much worked in January'. On the 8th more 'ES' was reported and again GB3LER was S9+ down in Jersey.

Andy also reports that, both he and GOVDE run a 50MHz SSB net on Monday evenings. The frequency is 50.140MHz and the time is 2100 local, over 100 call signs have appeared in the log since last spring!

G7OEC's country score is 37 DXCC, with some rare ones being worked like VP9, YL, Z3, 5T, 1A, TK and even JY with just 10W and a 5 element beam, and, in under two years.

Andy, G7OEC sent another fax update of 50MHz openings. On the 15th OK2PPP (JN99), S52ZW (JN86), and OM3ID (JN88) were all worked via 'ES' between 1500z and 1745z. The 17th produced SM3EQY (JP81) via aurora, GMs and GIs were also heard via aurora.

Neil, G0JHC reported strong 'ES'

conditions on the 20th with YU, OE and Italy. In fact conditions were so good and stable that Neil, while speaking to Enrico IK2GSO, managed to book him a room, by phone, at the Haven Hotel at Sandown Park for the forthcoming VHF Convention, and, confirm everything on the air!

144 and 432MHz were open to Spain and southern France on the 13/14th January, and Spanish FM repeaters were heard very strong on the UK south coast.

### **Cape Verde update**

At last, in early January, our flights and hotel were confirmed for Cape Verde. We leave for Lisbon on the 30th May, after an overnight stop in Lisbon we then continue our journey to Cape Verde's international airport on the island of Sal. Later that day we then fly across to the island of St Vincent. Operation on the air should start on June 1st, this will include all bands from 160 through to 50MHz, the departure date is June 14th.

Jeremy, G3IMW sent a note regarding the 50MHz D44 expedition, as reported in December's HRT. D4 (Cape Verde Islands) are 4 degrees south and about 600km west from where 5T5JC operates from in Mauritania. Armed with this, Jeremy produced the following 1994 data from G2AHU's 28/50MHz notes.

Openings to 5T5, 5 days in May, 12 days in June, and 5 days in July. Read next month's HRT for the comparison of 50MHz QSOs from Jordan and Mauritania, and the Cape Verde's possibilities of 'ES' contacts.

### **EME request**

"I wish to introduce myself as W7HAH. I received my licence in 1938 at the age of 16, building my first 6m rig in 1939 to talk to another ham across town. In the late 50's, I was a radar instructor for the Federal Aviation Administration, my enthusiasm for VHF was rekindled. After I retired in 1975, I built up a VHF

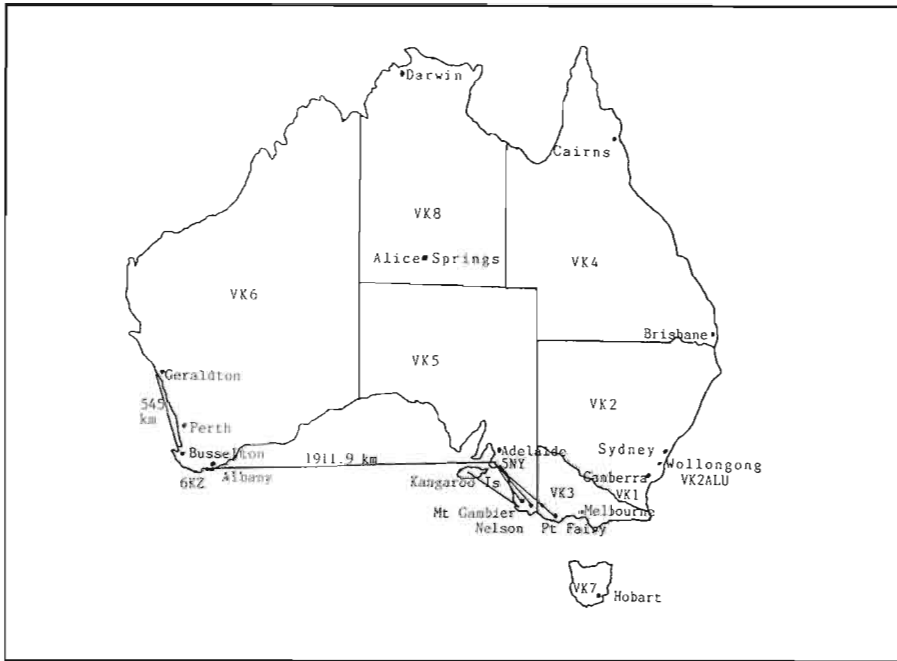
station. I returned to 6m working all states in a short period of time. I then got interested in weak signal communications, putting together a 2m EME station. I held the North American sporadic-E DX record for a number of years. In 1988 I made my first EME contact on 6m with WA4NJP. In F2 cycle 21, I worked no Europeans, hearing only the Iceland stations, no cross band contacts were made. In F2 cycle 22, I worked two European stations. On several openings to Europe, many stations were heard but not readable enough to make contacts. The only alternative was 6m EME. On Jan 22nd 1992, I worked OH2BC via 6m EME using only a single yagi and 1000W. Further contacts were made with I5MXX and SM7BAE. The contact with SM7BAE was made on Jan 31st 1994, both stations were using single yagis, on his moonset my moonrise. This was the first 6m EME contact ever made using single yagis and relying on ground gain to make it possible.

I believe that many contacts can be made this way with proper equipment with European stations. I do realise there are restrictions but maybe special permits can be obtained. Anyone wishing to try can write to me or call (phone 1 406 777 2136). F. (Shep) Shepard, 561 Groff Lane, Stevensville, MT 59870, USA."

After reading the above I contacted the RSGB's VHF Committee, who informs me that "The VHF Committee will look at any applications for high power 50MHz permits". Is it worth a try?

### **Snippets**

50MHz Beacon News; V51VHF in Namibia is still reported QRT (information via V51KC), OD5SIX is confirmed as still QRV, with beacon keeper OD5SK being overseas. Mohammed JY4MB informed me that the Jordan beacon JY6ZZ is not yet active. The beacon 8R1SMC is now finished and ready for shipment to South America by SMC Ltd. However, it may be decided to change the frequency and call to



V31SMC, more news later.

Eric VK5LP reports good Es during November 1994, with quite a few openings to ZL. There has been the occasional TEP opening to Japan via Es extension.

In Eric's latest letter to me he reports very strong 'ES' on the 26/29th December between ZL and VK6 on 50MHz. We also had an 'ES' opening in Europe at that time (the spill over from the southern hemisphere), this again proving that the Sun somehow does contribute in producing sporadic 'E'. Eric also mentions that the 10GHz World record has been taken by VKs; VK5NY/P worked VK6KZ/P over a distance of 1911.9km, both stations used SSB (see map).

### Jordan QSLs

As of late January, only 422 QSLs out of the 1400 50MHz QSOs had

been received for the JY7SIX operation last June. Stations that worked JY7SIX are reminded to send their QSLs to G4CCZ. If you didn't manage to work JY7SIX, then look out this year for Mohammed JY4MB. As you can see by the QSL card, he is active on 50MHz with an Icom IC736 and a vertical aerial. However, Mohammed may well use the 6 element yagi that was used by JY7SIX, as, Mike G3OIL who built and donated the beam, has requested it be put to good use rather than to leave it on the hotel roof in Jordan.

### Licence changes

Thanks to OH6DD for his information informing us that the Finnish 6m band now covers 50-52MHz (was 50-50.5MHz). Mobile operation is now allowed as well as FM and repeaters. Restrictions have

been lifted in 8 countries covering OH6, allowing transmissions to take place during TV hours from the E2 transmitter in Vannas, Sweden. Due to this, expect some new activity from KP13. Ten OH6 countries still remain on the

'no-go' list covering parts of KP02, 03, 12, 13.

### UXOFF

QSL cards from Nikolay Lavreka, UX0FF (Ukraine) have recently started to trickle through into Western Europe. If you still need a card, try P.O. Box 3, 272630, Izmail, Ukraine, CIS.

### 3V8BB

A fax from JF2EZA (QSL manager for 3V8BB), suggests 3V8BB will try for a 6m licence in the near future. 50MHz equipment is already in place. How about the HRT Tech Ed going out there again? (Watch this space - Ed!)

### 3A2

Two resident local amateurs in Monaco have now applied for 50MHz permits, if this proves fruitful then another new country will be active for the summer 'ES' season. Please note that if permission is granted that this will not allow amateurs from other CEPT countries the use of 50MHz in Monaco.


### Late News

Neil, G0JHC received a fax from 3A2LZ stating that Monaco will be granted 50MHz permits this year. Frequency allocation and power levels have yet to be decided, but it looks like a slot between 50.150 and 51.200MHz will be granted with power levels around 25W. This is one of the last two European Countries to be granted 50MHz, the last is Hungary.

Well, all in all, despite the winter months, at least there has been a little activity on the VHF/UHF bands.

I have had many letters (even from Canada and the USA) requesting to join the D44 expedition. At present I think we have enough operators, and, as Julio (D44BC) has given us the use of his house and equipment, then too many operators may well overcrowd the situation. Anyway, thanks to all who asked.

Thanks to the UKSMG and others for the input this month, news and views please to: Geoff Brown, GJ4ICD, TV Shop, Belmont Rd., St. Helier, Jersey, Channel Islands, JE2 4SA, or fax/phone 01534 77067



JORDAN

# JY4MB

Confirming QSO with: SWL-RPT

STATION	DAY	MO	YR	UTC	FREQ	RST	2WAY
GJ4ICD	17	6	94	18:36	50	59	SSB

PSE QSL     TNX     BEST 73

MOHAMMAD BALBISI  
P.O. BOX (3236)  
AMMAN - JORDAN



# Satellite Rendezvous

*Richard Limebear G3RWL gives an update on  
the new RS-15 satellites with this month's AMSAT-UK  
news collation*

The RS-15 satellite, recently placed in orbit, was sent up on the first successful test flight of a new launch vehicle. RS-15 was said to be the *only* passenger on the new ROKOT rocket, a joint commercial venture between Germany and Russia. ROKOT is described as a low cost launcher for small satellites into low-earth and sun-synchronous orbits and will apparently be available for commercial launches by the end of 1996. Apparently the vehicle is based on the SS-19 ICBM booster (1st and 2nd stages) plus a new third stage known as 'Briz'.

Pat, G3IOR reports that in addition to a Mode 'A' transponder, RS-15 also has a Mode K and T transponder. However, UA3CR reported that it will be kept in Mode 'A'.

There had been reports that RS-15 will be the last RS satellite as the funding for future RS satellites is gone. However, RW3DZ, who is currently in this country, said that at least one more satellite is planned, for the 1996 timescale. Also the Russian facility will still build for future AMSAT etc., satellites.

More information about RS-15 will be published after complete testing of all systems. Please send your reports and comments to control station (RS3A): P.O. Box 59, Moscow 105122, Russia

## Mir packet BBS

The cosmonauts aboard Mir ask that those who use its packet BBS to please delete their mail messages after reading them. They have a limited memory TNC and with all the use it has been getting lately, the 22 kilobytes fills up quickly! Also remember that the Mir PBBS can only accept one connection at a time. All other stations must *stop* calling the Mir PBBS while a station is actively using the Mir PBBS. Calling the Mir PBBS, while someone else is logged in and trying to transfer data is considered poor operating practice.

It's suggested that anyone who is interested in visual passes should start keeping tabs on Mir now. For a satellite to be visible, it must be above your horizon and in sunlight while you are in darkness on the ground. While such are unlikely in the evenings, there appear to be good opportunities around dawn. And don't forget to monitor 145.550MHz for ham activity from the

spacecraft! (*Tech Ed's note - Mir Keplers, available from HRT, can be used with suitable programs, such as 'PC-Track' in last month's software offer, to calculate visible times and positions of the Mir spacecraft at your location.*)

## Digital Satellites

KO-25 has crashed a couple more times and at the time of writing is in the final stage of being reloaded. The same applies to KO-23. KAIST are still investigating both crashes.

While KO-23 & KO-25 were down, numerous reports were received concerning the abnormal operation of the UO-22 broadcast server. Ground controllers have looked at the activity logs of the spacecraft and have come up with the conclusion that it happens due to overload; the file system is running out of available directory entries. As users upload more files the file system begins to scan the entire directory structure looking for files that can be deleted; this takes several minutes thus resulting in the cessation of messages from the broadcast server.

UoS highly recommend that users of UO-22 limit the number of files they attempt to upload to the spacecraft until the overload situation is resolved.

This may take several days as it will first be necessary for the other spacecraft to come back on line. Until then, please limit the number of files to be uploaded to the spacecraft.

## PB and WiSP users

A software glitch occurred recently on the Amsat Oscar-16 fileserver. The problem causes groundstation software such as 'PB' to report the AO-16 directory captured on the groundstation PC is up-to-date when in fact, it is not. To compensate for the directory error, PB users are asked to delete the PFHDIR.HOL file from their

PacSat directories. The next time PB is run, the user will be prompted to select the number of days from which the directory should be updated. Some users have reported that entering 0 is sufficient to correctly bring the directory up to date. If this doesn't cure the problem, try using a higher number.

WiSP users have reported a similar directory problem. One solution is to delete the mspe.pfh, mspe.inf, and mspe.dhl files, and select the number of days from which the directory should be updated as with PB above.

## UoSat

Some consideration is being given to switching the primary downlink to 70cm (435.025MHz) whole orbit and feedback from the user community about this particular change would be welcomed.

## TrakBox firmware bug

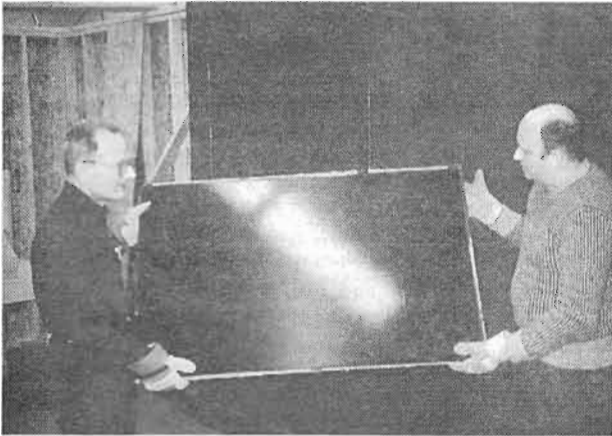
As many TrakBox users must know by now, there is a bug in firmware versions 3.30a through 3.30h. The problem relates to the the clock settings now that we are in the year 1995. New code is available from various sources for the benefit of those users who have EPROM programming capability. Special thanks goes to Sueo, JA6FTL, for providing version 3.30i so quickly.

## Oscar 10

It's still operational in Mode-B. Despite good signals from the transponder, there are very few stations using it. Its currently available when in view but *please do not* attempt to use it if you hear the beacon or the transponder signals FMing, and there are reports that AO-10 has started to 'FM' very badly at times.

# OSCAR NEWS

The official journal of AMSAT-UK for all users of OSCAR satellites



FEBRUARY 1995  
NUMBER 111



Oscar News, the bi-monthly journal of AMSAT-UK

## Amsat-UK Colloquium 1995

Plans are already afoot for Colloquium '95 which is from 27th to 30th July. While, as usual, there will be items of general interest there will also be an emphasis on operating on the different spacecraft and helping beginners; a second stream will include workshop-style presentations in a fully functioning groundstation capable of operating all modes. This groundstation will also be available out-of-hours for general operating sessions; a special certificate-style QSL card will be available.

The social side of the Colloquium has not been forgotten. Thursday night will feature a pub-style quiz complete with prizes; Friday night is barbecue by the lake night, and Saturday night will feature the usual banquet, complete with a magician who promises to make Ron disappear. For those staying over on the Sunday night there are plans involving one of the local watering holes.

Of course, the quality of the

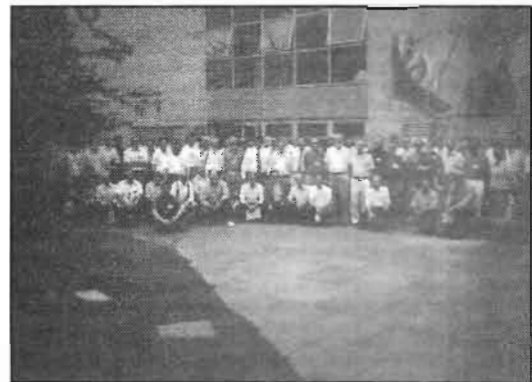
Colloquium is largely dependent on the lecture material so this is the beginning of the process to persuade, inspire, motivate, encourage, exhort, goad and wheedle folks into presenting a paper. Without them the Colloquium is a non-event. We don't want only the egg-heads to do it, we want the ham-in-the-street to talk to us as well otherwise the event is unbalanced. If anyone wants help in preparation they should feel free to communicate privately with me, or any other committee member, for help - we want to help.

## Latest Keplers

The latest satellite Keplers are available by fax from the HRT fax-back line, 01703 263429, request fax document 88 from the satellite menu for this month's. They're also available by post by sending an SAE together with the corner flash from this page to the HRT Editor, stating whether you want *all* satellites (10-15

A4 pages), or just *all amateur* satellites (one A4 page). Amsat-UK Keplers are also put out on packet fortnightly, sent to KEPLER @ GBR.

If you're interested in amateur satellites and would like further information about Amsat-UK, contact: AMSAT-UK, c/o Ron Broadbent MBE, G3AAJ, 94 Herongate Rd., London, E12 5EQ. Big SAE gets membership info. SWL's are welcome. All new joiners get the USAT-P tracking program on 5-1/4 disk. Why not ask them for information on the new Phase 3D project - the superb new satellite planned for launch soon.



Over 180 AMSAT enthusiasts from around the world gathered at the University of Surrey, Guildford, England for the 1994 AMSAT-UK Colloquium. (AMSAT-NA photo by KB1SF - courtesy Oscar News).

### Provisional Oscar 13 Transponder schedule up to May 22nd

ModeB:	MA 0 to MA 190	
ModeBS:	MA 190 to MA 218	
ModeS:	MA 218 to MA 220	< S beacon only
ModeS:	MA 220 to MA 230	< S transponder; B trsp. is OFF
ModeB:	MA 230 to MA 256	Alon/Alat 230/0
Omnis:	MA 250 to MA 140	Move to attitude 180/0, May 22

Continuous up to date information about A013 operations is always on the beacons, 145.812MHz and 2400.645MHz in CW, RTTY and 400bps PSK.

### RS15 Keplers

Catalog number	:23439
Epoch time:	95018.43232054
Element set:	21
Inclination:	64.8172 deg
RA of node:	137.1826 deg
Eccentricity:	0.0167529
Arg of perigee:	287.8288 deg
Mean anomaly:	70.4424 deg
Mean motion:	11.27524601 rev/day
Decay rate:	-3.90e07 rev/day^2
Epoch rev:	263

Note: these were as available at the time of writing - to obtain updated RS-15 Keplers see main text!