

HRT

HAM RADIO TODAY

Incorporating
SCANNERS

APRIL 1995 £1.80

● *HF on a Budget with the Heathkit SB-101*

● *Amateur Radio in Bosnia*

● *Satellite tracking software offer*



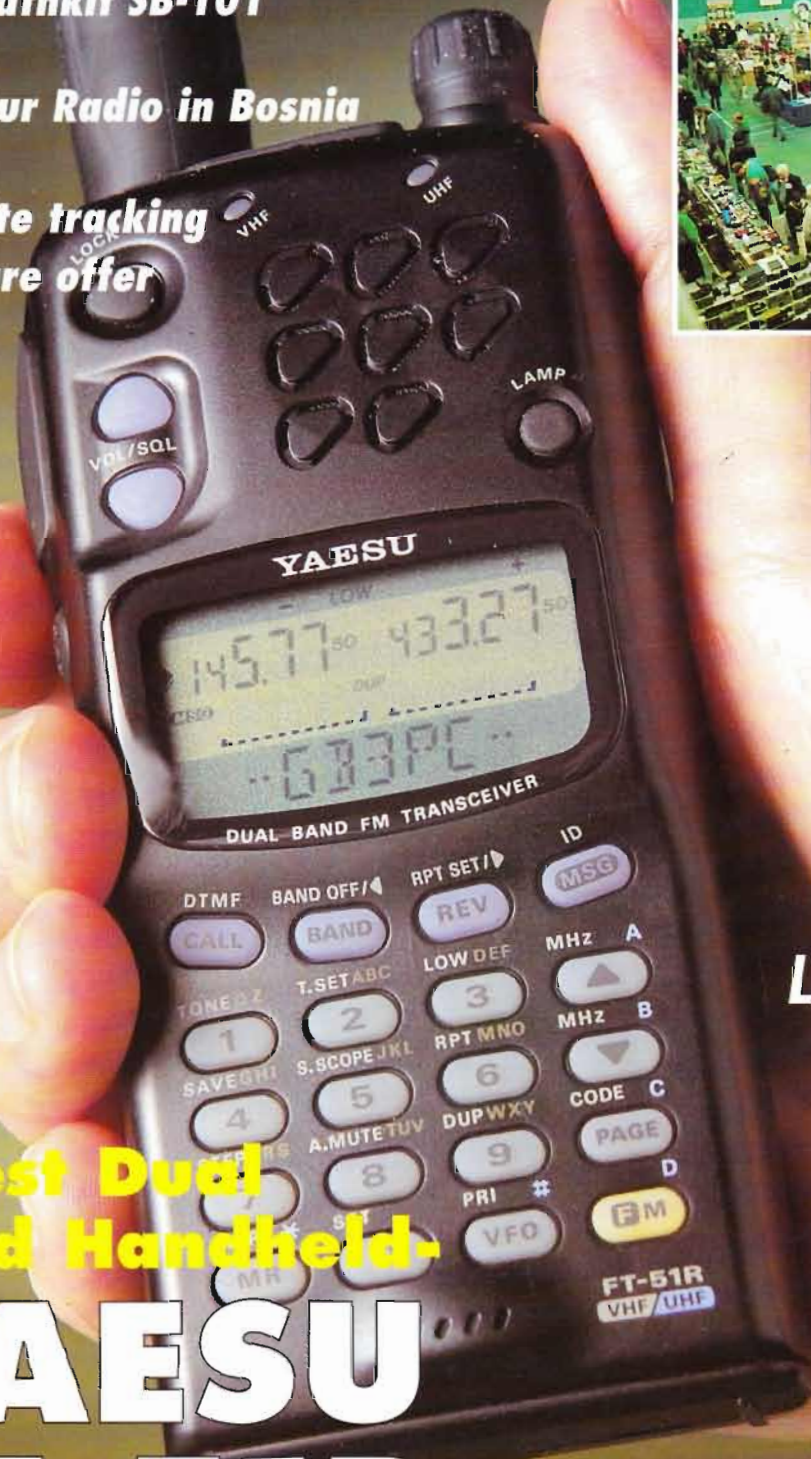
LONDON SHOW SPECIAL

Including;
Exhibitor list
Floor Plan
Lecture Programme
New Products

Latest Dual Band Handheld

YAESU FT-51R

Reviewed



9 770269 826062 04

HAM RADIO TODAY

VOLUME 13 NO. 4 APRIL 1995

REGULAR COLUMNS

HRT SOFTWARE OFFER	10
Satellite tracking software offer and more!	
SCANNERS	23
Bill Robertson gives a few tips on taking your scanner abroad, and offers a handy set of tips for scanner problem-solving	
QRP CORNER	36
Dick Pascoe G0BPS converts a computer mouse into a Morse key, and tells of Russian QRP operation from a kayak	
FROM MY NOTEBOOK	38
Geoff Arnold G3GSR discusses local oscillator injection for SSB and CW use in receivers, and the alignment of local oscillator stages	
DATA CONNECTION	40
Our resident data SysOp asks "is this really a TNC I see before me?"	
VHF/UHF MESSAGE	42
Geoff Brown GJ4ICD shows how to extend the capabilities of an FT-690, and gives an update on Sporadic 'E' cloud monitoring	
HF HAPPENINGS	44
Don Field G3XTT provides a guide to Top Band, and details a Dxpedition with up-to-the-minute communication technology	
SATELLITE RENDEZVOUS	46
Richard Limebear G3RWL with the AMSAT-UK news including the new RS-15 satellite	
FREE READERS ADS	52
Helplines, For Sale, Wanted and Exchange, published free	

REVIEWS

YAESU FT-51R REVIEW	16
Chris Lorek takes a look at a tiny dual band handheld	
REALISTIC PRO-39 SCANNER	25
Chris Lorek G4HCL tests a 'mid-range' handheld scanner	

FEATURES

OPERATING HF ON A BUDGET	20
Ben Nock G4BXD suggests that there may be a cheaper alternative to the high cost of modern rigs, with the Heathkit SB-101 transceiver	
LONDON AMATEUR RADIO AND COMPUTER SHOW GUIDE	29
Your complete guide to the London Show including exhibitor's list, floor plan, lecture programme and new products	

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 however arising from such errors, including loss resulting from the negligence of our staff. Reliance is placed upon the contents of this magazine at readers' own risk

CONSTRUCTION PROJECT

RF SNIFFER	27
Mel Evans GM6JAG describes an easy-to-build weekend project that's very useful in the shack	

NEWS AND VIEWS

CQ DE G8IYA EDITORIAL	5
The Editorial phone lines been busier than ever - both of them!	
RADIO TODAY	6
The latest Amateur Radio news	
LETTERS	12
HRT readers have their say, no censorship here	
NEWSAGENTS COUPON	37
No more problems in getting your favourite mag, but if your newsagent doesn't want to stock HRT on the shelves then let us know and we'll give them a kick up the 'whatsits'!	
HRT SUBSCRIPTION OFFER	57
Make sure you get your HRT each month right through your door	
CLUB NEWS/RALLIES	48
Dynamic go-ahead clubs and voluntarily-run RAE course contact details. Is your club listed? If not, why not?	
NATIONAL SOCIETIES AND ORGANISATIONS	51
Contact details for the RSGB, Radiocommunications Agency, SSL, ISWL, and many more national organisations	
CLASSIFIED ADVERTISEMENTS	55
Your local dealers, component and kit suppliers, RAE courses, and reader's classified ads	
BACK ISSUES	57
Have you missed an issue in the last 12 months?	
ADVERTISERS INDEX	56
Who's 'in' HRT, trader-wise	
WHO'S WHO AND WHAT'S WHAT IN HRT	57
Contact details for the people who put the magazine together	
ARTICLE PHOTOCOPIES INFORMATION	56
How to get a copy of the article you want so much	

**Realistic
PRO-39
handheld
scanner
reviewed**



**HRT
APRIL
95**

CQ de G8IYA

Editorial

The Editorial phone lines been busier than ever - both of them!



Phew! The response to the last couple of issues of Ham Radio Today magazine, with the cover-mounted PC disks packed with ham radio software, has been phenomenal. I know some readers have been having difficulty in obtaining a copy, as a number of newsagents have sold out of their full stock of copies within a day or two of putting the magazine on the shelves. From listening on the air, and from members' comments at the three amateur radio societies which my Tech Ed has been presenting lectures (on HRT Equipment Reviews) at in the last few weeks, the idea seems to have gone down well with many amateurs. Yes, I admit, I've had a small number (which, incidentally, I can count on the fingers of one hand) of complaints, so you'll see that this month's issue is back to the 'usual' price, with (again) our 'usual' software offer of a PC disk packed with even more superb software for just the price of a blank disk and return postage to you. See elsewhere in this issue for details of obtaining *your* disk!

Using the HRT 'Voicebank'

Another service which seems to have gone down well is the HRT 'Voicebank' and 'Fax-back' service. This is available to all readers, on 01703 263429, 24 hours a day, with both speech and faxed information on the very latest ham radio news, HRT updates, satellite Keplers, and rally information. A number of rally organisers have already given me direction information and even printed location maps, and you'll now see, during the seven days prior to all the rallies and events involved (like the London Show this month), the HRT Voicebank/Fax-back service will carry the latest news, updates, and information - even printed directions and a map straight to your fax machine!

To use the service, you'll need a telephone, or optionally a personal fax machine if you also want to receive

printed information, with a DTMF (touch-tone) keypad, i.e. having numeric keys plus the * 'star' and # 'hash' keys. Alternatively, a hand-held DTMF pad held next to your telephone mouthpiece will also work - and remember that many 2m/70cm handhelds have this facility built-in.

The call will be automatically answered within a couple of rings, and you'll be greeted with an introductory message from the Editor. At this point, if you want to *send* us a fax, just do so by pressing the 'start' button on your fax machine, the voicebank will recognise your fax tone and answer automatically. It will also respond to automatic faxes being sent, there's no requirement to *send* us a fax 'manually'.

You'll then hear the 'menu' of available choices. For example, you'll be instructed to press the '1' key followed by the '#' key for ex-PMR conversion information and updates, for the latest HRT news and updates, press the '2' button followed by the '#' button, and so on. Just press whichever number button that corresponds to the information you'd like to receive, remembering to end this with the '#' button (there's up to 999 possible selections, so the '#' button acts as your 'enter' button). If, at any time during the menu, you want to listen to the available selection again, just press the '*' star button on your keypad. You'll then hear the further information you've requested, and on many occasions you'll have the opportunity of receiving faxed information on that subject - again if you'd like to receive this just press the button(s) stated. Once you've entered your first fax document selection, you'll hear a recorded voice confirming which document(s) you've selected, followed by an announcement to *"To receive the selected fax document, press '1', to receive a different fax document, press '2'".* So, if you made a mistake, press '2', otherwise press '1'. You'll then hear a further announcement saying *"To receive the selected fax document, press '1', to receive additional fax documents, press '2'"* (note; this is not

the same message, repeated - many callers think it is, you need to follow the instructions and press the appropriate button to receive anything!) So, if you want to receive more documents beside the one(s) you've already selected, press '2', when you'll be returned to the 'main menu', otherwise, press '1'.

After having selected the document(s) you want, you'll hear *"When you hear the fax tone, press the 'start' button on your fax machine, or choose the 'manual receive' on your fax software"*, at which stage you should do as required. The fax-back system will, after a few seconds, send a periodic fax tone to your machine to tell it to start receiving. If you haven't done anything, or hung up, it'll just reset itself after a short period to await further callers.

Why?

"Why do all this?" you may ask? Well, for one it saves my voice, and time, in answering commonly-asked questions, such as "where can I buy one of the ex-PMR rigs you've recently featured a conversion on", and "Have you reviewed such-and-such a HF rig, which issue was it in, and where can I get a photocopy?". The 'knock-on' effect is that Chris and I have more time in putting together an even better magazine for you. Our 'real human' Editorial phone line (Tel. 01703 262105) is of course still available, even during the 'cheap rate' in the evenings between 6.30-8.30pm. So you're not losing anything - the Editorial staff are very pleased to help you on any query regarding the content of HRT, and our head office (Tel. 01442 66551) and back issues/subscriptions department (Tel. 01737 768611) can also certainly help during normal office hours for queries regarding subscriptions and readers' services. So, if you've been having problems in getting a regular copy, why not give them a ring - you may even be pleasantly surprised with a 'special offer'!

LETTERS

Letter of the Month

Dear HRT,

I hope you will take the following as it is intended i.e. a constructive criticism. The experiment of a cover disk is a most unwelcome one. I suspect that if it became permanent along with the massive hike in cover price you will lose many readers. As a subscriber I realise that for the February and March issues I will be 'immune' from the price rise, if I were not then be assured I would not pay £2.50 for a radio magazine. Your recently introduced postal software service is a very good idea and I hope you can continue with it. The price is reasonable too. So please no more gimmicks. If you would like to introduce 'specials' like PCBs then do not put them on the cover as with other publications, but rather make them available in the same way as the £1 software. That way, only those with an interest would need to pay.

As for the other suggestions such as FaxBack and voice bank, why not?,

but not at the expense (increase in cover price) of readers who have no interest in such a service. You could finance it by using a premium rate telephone number. Perhaps a bulletin board financed in the same way, it might contain scanner PCX files of circuit diagrams of PMR gear.

By all means 'fine tweak' the magazine, but not too much, it is already a good read.

Tony Fishpool, G4WIF

Editorial comment;

The voicebank/FaxBack service is provided totally free of charge by the Editorial team for our readers (it also saves us time in answering commonly-asked questions!), all you pay for is your phone call, which of course isn't a 'premium rate' line! It deals with many of the questions we receive, such as where to buy ex-PMR gear, equipment review dates, ex-PMR conversions etc, and an added advantage is that it can be a useful

service for rally news, satellite Kepler information, and so on, again for the benefit of readers. You may also have read the article in the March issue about the 'Radio Shack' bulletin board with its HRT discussion groups, a 'direct line' to the HRT Editor as well as providing a 'discussion forum' for readers, this again is also totally free. At the moment I am waiting to hear the results of the cover disk experiment, but from what I have heard from a large number of readers and several newsagents, it sounds like it has been extremely popular - in fact I've received several comments that newsagents have unexpectedly sold out of all the issues they had on their shelves! The publishers, Nexus, tell us the price increase was needed to cover the extra costs, VAT is also apparently charged on magazines with disks on them. The £1 postal PC software will continue for as long as possible, and I'm very pleased that this has been popular, it's an 'at cost' service to readers.

Strange hummings in Bristol

Dear HRT,

Could any readers help me with the following problem? Since the summer of '93 many people living in and around Bristol have been affected by a continuous humming sound, to some it is an irritation, while others are driven to despair.

By a process of elimination during the past year the most probable cause appears to be an ELF radio transmission. There are two signals, at 150Hz and 450Hz, the 450 is pulsed at 100Hz by a type of ringing oscillation.

The authorities will not admit to the problem although the Environmental Health Dept. have received numerous complaints. A letter to the local press brought me 30 replies asking for help. My task now is to locate the transmitter and its owner, so that I can present a case to my MP.

The information I have on ELF's is dated in the 80's and refers to American systems built at that time. It states that the modulation is FSK, but the signal I am receiving appears to be a mixture of amplitude and phase, I am not sure if the two signals are required together for decoding. Any information on this matter would be a great help.

John Dawes

Amateurs or Operators?

Dear HRT,

I am in full support of the comments made by D. J. Walters G4DFV (Dec 94 HRT), about the changes in Amateur Radio over the years. It was highly expected that Brickbats would be thrown from the CB and Novice fraternities, as demonstrated by the three scathing diatribes published in letter column last month.

I have been a radio enthusiast for more than 40 years, I was a licensed amateur for 15 years, until constant globe-trotting with

"TONE" BURST



by GOMEN



Fully legal

Dear HRT,

For the first time I bought your magazine (I'm not a Radio Ham but a CB operator), and upon reading the letters 'CB v Hams' would like to put my comments.

I run a legal station (power output, aerial size, mic and licence etc.) and have had contacts into Russia and other countries when conditions have allowed, and I'm very pleased with this. Two CB operators a couple of miles south of me, who cannot be bothered to take the RAE, are now playing about sending Morse to each

other via computer program (I believe Hamcomm) and I have heard them talking about sending Slow Scan TV over the CB channels! From what I've heard of these 'gentlemen' one lives in a nice estate and is the 'nice person who lives next door' who constantly says how good he is and anyone whose car is over 2 years old, ought to be banned from the road (are you getting the picture?). Me, I suppose I am classed as your 'council house - hairy factory worker'. The difference being, I run legal, he doesn't (OK I forgot his 25W amp on constantly), but who would the RIS check first?

I would like to take my RAE and

become a 'Ham', but the cost is way out of my price range (I mean the cost of equipment - I'm fairly confident I could pass the RAE), so it is not even worth starting a course. As one writer says, if the DTI cleaned up CB stations, the whole of 'radio' would get cleaned up. I know of stations who have bought 'Ham' equipment and just use it, no licence, no test, no cares, the equipment probably stolen anyway! Also you get the 'back off the set and twiddle brigade'. I wonder if it's worth carrying on?

Good luck,
Dave from Derbyshire

my career left little time for such a hobby. In my time spent listening and operating on HF and VHF, I totally agree that operating standards and technical knowhow about radio matters have declined, with a decidedly marked drop since CB raised its ugly head. Anyone who has spent as many years as I have listening on the bands, and who still denies this fact is only fooling themselves.

G4DFV is absolutely right in what he says. If only other people would have the guts to stand up and support him, I am convinced many others like myself agree with what he suggests. Judging by the replies to his letter, did G4DFV perhaps hit

some raw nerves, setting off pangs of guilt conscience within these people? After all, if these people were faultless, why bother replying? After all, throughout his letter, G4DFV did specifically refer to 'a small minority'.

I would like to add something of my own to this argument. Firstly, CB radio was never intended as a 'stepping stone' to Amateur Radio, neither was it intended as a means of contacting DX stations. It was only ever intended as a two-way radio communication system for use by the general public. It is only by abuse of CB, using illegal modes, powers and aerials, that it begins to remotely resemble legitimate

Amateur Radio from an operating point of view. As I see it the last generation of Radio Hams have been born and raised in a society full of all the highly sophisticated professional technology of today's 'black boxes'. No longer does that creative spirit that inspired the great inventors and geniuses of Amateur Radio, or even the enthusiasm to learn and construct, exist within the new breed, who, in my opinion, are not worthy of the title of Radio Amateurs, they are merely button pushers and knob twiddlers....simply 'Ham Operators'.

Yours faithfully,
Tom Mcpherson

£10 for the Letter of the Month

Do you have something constructive to say on the state of amateur radio today? Perhaps you'd like to put your viewpoint to the readers, get some discussion going, or give an answer to one of the issues raised? We'll pay £10 for the best letter we publish each month. So write in with your views, to Letters Column, The Editor, Ham Radio Today, Nexus, Nexus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST, or fax your letter direct to the Editor's desk on 0703 263429. Please keep your letters short, we reserve the right to shorten them if needed for publication. Reader's views published here may not necessarily be those of the magazine

Yaesu FT-51R Review

Chris Lorek G4HCL takes a close look at a tiny dual-band handheld

It was in the 1993 'London Show Special' issue of HRT that I marvelled at the many operating features of Yaesu's then-new dual band handheld, the FT-530. Regular readers may remember that I was extremely impressed with its operating versatility, but I had difficulty in operating the many features, and the set had rather poor receiver strong-signal handling immunity. Even so, it became my 'favourite' handheld rig, and I've used an FT-530 all over the UK and even around the world, including 'rare DX' locations like 3V8.

The biggest problem I've come across with this, and one or two other recent dual band handhelds, is with their receivers often being totally 'wiped out' by other strong signals on nearby bands, such as VHF paging transmitters. For example, I can't use the FT-530 at all in one particular location in Bristol city centre due to an adjacent government transmitter. I wondered "When would they do something about it?". It now looks like they have!

Features

The FT-51R seems to have all the good features of its predecessor, and true to form it adds a lot, *lot* more. Moreover, I'm pleased to say it's rather easier to use in many respects, due to a scrolling 'help' text display on the set's LCD that guides you through many of the set's functions. A 'quick help sheet' provided along with the 72 page (!) user manual also acts as a 'memory jogger'. I found I certainly needed these....

The FT-51R follows on in terms of styling and circuitry from the FT-11R (2m) and FT-41R (70m) handhelds (*the FT-11R was reviewed in the 1994 'London Show Special' issue of HRT - I wonder if Yaesu launched their new handhelds at this time deliberately? - Ed*). The set has FET transmitter power amplifiers on both 2m and 70cm, putting out 2W on 2m and 1.5W on 70cm with the supplied 4.8V nicad. Attaching an optional larger 9.6V nicad pack, or connecting the optional external DC power adaptor, raises the maximum power on each band to 5W. That's a lot of potential



from a tiny set, which measures just 57mm x 122mm x 26.5mm with the supplied nicad.

Frequency Coverage

The transmitter covers the usual 2m and 70cm amateur bands, and the receiver, besides covering 2m and 70cm, may be extended by a simple button push to cover 110-180MHz, and 420-470MHz with AM receive capability on airband, where licensing conditions allow this. As well as a 1750Hz toneburst for repeater access, CTCSS encode and decode is built in for either repeater access or 'quiet monitoring', and a 'CTCSS scan' can be used to detect which sub-tone is being used on the channel you're listening to.

The transmitter power can be switched between maximum, this depending on the battery fitted, and up to 4 pre-set low power levels including an 'economy low' power of 20mW for very local use. A built-in 'intelligence' can also be used, where the set monitors the received signal level and switches in an appropriate low power level. The receiver 'battery saver' can also use its built-in intelligence if you wish, to automatically vary its on/off ratio depending on your operating habits.

Memories

The set has a capability of 40 memory channels on each band, which besides storing the usual frequency, offset, and so on can also store an 8 digit alphanumeric 'tag', for naming your channels with something meaningful, like "GB3PC", "RAYNET 1", "CLUB CH2", "S20 SIMP" and so on. If you don't need this facility, the set's memory channel capability increases to 60 channels on each band.

Together with dual and cross-band reception and cross-band duplex transmission, the set can also monitor two frequencies on the same band simultaneously - useful for keeping an 'ear open' on, say, your local club's 2m 'natter channel' whilst also listening to activity on your local 2m repeater. The set does of course have plenty of scanning modes for signal searching, with one extra - a 'spectrum scope' display! Instead of just listening to a given channel, or scanning across a few channels searching for activity, you can if you wish get the set to show you, visually, what activity is like on a few channels either side of the one you're tuned to - be they memory channels or 'VFO' channels. This isn't 'new', but it's a novel 'extra' on a set which I feel already has nearly everything.



Selective calling

DTMF selective calling and 'paging', using the 3-digit DTMF system common to many Japanese sets, is fitted to the FT-51R, as well as Yaesu's alphanumeric message transmission. With this you can send and receive short text or numeric messages of up to 10 scrolling characters between similarly equipped sets, including things like your callsign, or 'CALL ME', or 'TEA READY' or whatever!. You may think this is novel, but what happens when you've got the volume turned down? Well, the set has various 'noises and warbles' it can make when you're called, but it can also audibly send the received alphanumeric message or paging number received to you in Morse code through the set's speaker. What will they think of next?

On the air

On holding the set for the first time, I was struck with its small size - it's certainly the smallest dual band handheld I've used. In fact, the accompanying instruction book was about three times the size of the set itself - there must be a moral here somewhere! The set was noticeably 'thin' in size, and it fitted into my top pocket very easily.

As with the single-band FT-11R, there are no volume or squelch knobs as such, instead a pair of small 'up/down' buttons are used for these, with further buttons on the set switching control between bands. Although the main click-step tuning knob could be used for this purpose, i.e., changing its function from a channel up/down control to volume/squelch up/down, I still would have preferred individual volume knobs - I found the buttons were a pain to use in practice. A press of the 'F' button changes these to varying the receiver squelch in 16 pre-set steps, again I found this a 'pain'. There is no quick 'squelch defeat' facility on the European model of the set to let me check what the volume on each band was set to - this instead needed another multiplicity of button-pushing operations.

Well, that's the main grumble over with, now onto the nice things! Apart from the volume and squelch control method, I found the other controls on the set quite easy to use, and most of these were sensibly placed for reasonably convenient operation. For example, a small button beneath the PTT bar changed operating control between one band and the next, and

a 'sub-mute' function allowed me to listen on both bands simultaneously but when I went onto transmit it automatically muted the sub-band receiver for me. This saves any embarrassment when in QSO and someone starts calling 'CQ' or whatever on the other band!

I found the alphanumeric memory 'tag' display very useful, and I tended to just use the memories most of the time with the click-step tuning knob to change between these. The 'spectrum scope' I personally found more of a 'gimmick' than being useful, as the set could *either* display the scope with no receive function at all, or be on normal receive or in scan mode with the receiver functioning, and not both at the same time which would have been rather better.

The LCD gave plenty of information of what was going on, and the superb backlight illuminated this, and the translucent keys, very well for night-time operation. A handy facility was that the backlight could be set to automatically illuminate for a few seconds each time the receiver 'scan' halted on an active channel, or the 'selective call' raised with a message or paging ID, which I found very useful indeed.

Besides the LCD indicating frequency and separate alphanumeric tag (this section doubling up to a spectrum scope), the display included individual bargraph S-meters for each band, these also 'doubling up' as volume and squelch setting level indicators. I found the minimum threshold squelch level, particularly on 70cm, too high - signals had to be quite readable to lift the squelch even at its most sensitive setting, although with the sets' very good sensitivity I found this little problem. In fact, out and about using the 4.8V battery, I found the set could often hear more than it could communicate with. I often found it frustrating in being able to fully copy my two semi-local 2m repeaters but not get into them with the set's 2W - although an 'upgrade' to the 9.6V battery with the resultant 5W transmitter power would I'm sure have helped.

As well as using the set for its primary 'portable' purpose, the FT-51R joined me over several hundred miles on the open road in the Editor's car, connected to the externally glass-mounted dual-band whip. I found there really wasn't adequate receive audio from the set's internal speaker for use on the move, it just distorted horribly before it was loud enough to hear, an

external speaker was essential here. An optional speaker-mic would possibly have been handy here, Yaesu also have one available with a remote LCD display fitted on the speaker-mic casing suitable for the FT-51R which could also be a useful accessory on the move.

At home, connecting the set to my rooftop colinear gave excellent results. I'd honestly expected to have had non-stop paging interference and other such horrible noise I've come to expect from tiny dual banders like this. But no, just clean, crisp, signals from the very sensitive receiver. Even my local fire brigade transmitters on 146MHz didn't cause me any problems on 2m unless I took the set out and used it within a few hundred metres from them. This certainly makes a change from other sets I've tried, including the predecessor to this one!

Lab tests

As found on air, the receiver was indeed very sensitive, with surprisingly good strong signal handling 'thrown in'. Notable was the good 12.5kHz adjacent channel rejection on both 2m and 70cm, the 2m image rejection was over 100dB. The 'half IF' rejection on 2m (+22.525MHz), often the cause of problems, was quite good also, this being removed in frequency from the dreaded UK 'paging band'. The bargraph S-meter gave a useful dynamic range, rather than the limited few dB or so I sometimes find.

On transmit, the set gave an acceptable power output when powered from a charged 4.8V nicad, with correctly set deviation levels and exceptional frequency accuracy.

Conclusions

I initially had a number of reservations about the FT-51R, until I used it on air. The reservations quickly reduced in number! In my opinion, the FT-51R is an excellent, feature-filled rig for portable use, one I'd be quite happy to use as a 'primary' rig when out and about portable as well as for occasional home use with an external aerial. I must confess that I didn't like the method of volume and squelch adjustment one bit, but then on such a small set where do you put these extra controls?

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

LABORATORY RESULTS

All measurements taken on 145.0MHz and 435.0MHz, using fully charged

TRANSMITTER

TX Power;		
<i>Measured using fully charged 4.8V nicad</i>		
Freq.	Power	
145MHz	High	2.49W
	Low 3	2.49W
	Low 2	1.86W
	Low 1	450mW
	E Low	20mW
435MHz	High	1.51W
	Low 3	1.51W
	Low 2	1.47W
	Low 1	410mW
	E Low	15mW

Toneburst Deviation;	
145MHz	435MHz
3.29kHz	3.30kHz

Peak Deviation;	
145MHz	435MHz
4.97kHz	4.72kHz

Frequency Accuracy;	
145MHz	435MHz
+12Hz	+39Hz

Harmonics;		
	145MHz	435MHz
2nd Harmonic;	-76dBc	-71dBc
3rd Harmonic;	-73dBc	-78dBc
4th Harmonic;	<-90dBc	<-90dBc
5th Harmonic;	<-90dBc	-
6th Harmonic;	<-90dBc	-
7th Harmonic;	<-90dBc	-

RECEIVER;

Sensitivity;	
Input level required to give 12dB SINAD;	
144MHz;	0.14µV pd
145MHz;	0.13µV pd
146MHz;	0.13µV pd
430MHz;	0.15µV pd
435MHz;	0.14µV pd
440MHz;	0.14µV pd

Squelch Sensitivity;		
	145MHz	435MHz
Threshold;	0.08µV pd (5dB SINAD)	0.17µV pd (16dB SINAD)
Maximum;	0.21µV pd (20dB SINAD)	0.27µV pd (22dB SINAD)

Adjacent Channel Selectivity;		
<i>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;</i>		
	145MHz	435MHz
+12.5kHz;	44.4dB	49.3dB
-12.5kHz;	60.8dB	52.5dB
+25kHz;	66.6dB	60.1dB
-25kHz;	69.5dB	63.3dB

S-Meter Linearity		
	145MHz	435MHz
S1	0.20µV pd (-20.7dBf)	0.20µV pd (-20.8dBf)
S2	0.29µV pd (-17.7dB)	0.37µV pd (-15.3dB)
S3	0.41µV pd (-14.7dB)	0.49µV pd (-12.9dB)
S4	0.52µV pd (-12.6dB)	0.63µV pd (-10.8dB)
S5	0.74µV pd (-9.5dB)	0.78µV pd (-8.9dB)
S6	0.95µV pd (-7.4dBf)	0.96µV pd (-7.1dB)
S7	1.30µV pd (-4.6dB)	1.20µV pd (-5.1dB)
S8	1.65µV pd (-2.5dB)	1.57µV pd (-2.8dB)
S9	2.21µV pd (0dB ref)	2.15µV pd (0dB ref)
S9+	2.95µV pd (+2.5dB)	2.87µV pd (+2.5dB)
S9++	3.92µV pd (+5.0dB)	3.78µV pd (+4.9dB)

Blocking;		
<i>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;</i>		
	145MHz	435MHz
+100kHz;	83.4dB	75.0dB
+1MHz;	88.9dB	84.1dB
+10MHz;	95.2dB	91.9dB

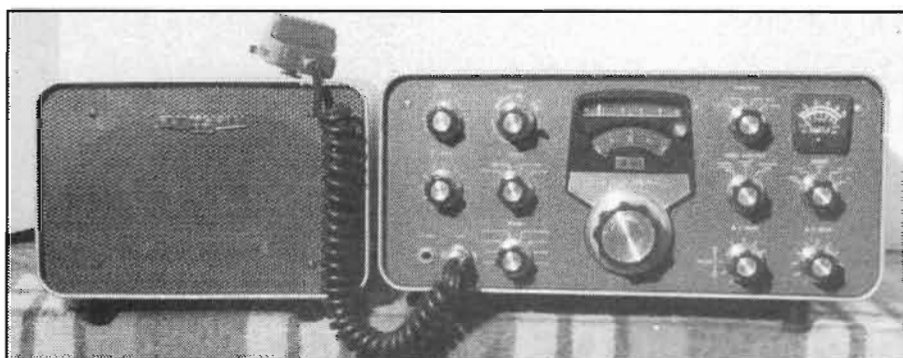
Intermodulation Rejection;		
<i>Increase over 12dB SINAD level of two interfering signals giving identical 12dB SINAD on-channel 3rd order intermodulation product;</i>		
	145MHz	435MHz
25/50kHz spacing;	65.3dB	60.3dB
50/100kHz spacing;	68.5dB	59.9dB

Image Rejection;		
<i>Increase in level of signal at first IF image frequency, and at the 'half IF' frequency difference, over level of on-channel signal, to give identical 12dB SINAD signal;</i>		
	145MHz	435MHz
Image	101.5dB	71.1dB
Half IF	72.3dB	78.7dB



Operating On A Budget

The high cost of modern day rigs might prevent some folk from operating on the bands, but Ben Nock G4BXD suggests that there might be a cheaper alternative in the Heathkit SB-101 transceiver



Operating on a budget these days can be a difficult task, especially with the relatively high price of modern equipment. There is however an alternative, that is to buy a piece of second-hand gear, something a little older, even valved perhaps, but that gets you on the air and in the game.

In this vein, I would like to suggest a typical valved set, made in the 60's but still capable of operating on the bands, getting those contacts and giving you the chance to gain HF experience without the need to remortgage your house to do so.

The Heathkit SB-101 HF transceiver, incorporating a double conversion receiver section, is a valved, table-top set, designed for mains operation and covering the 80, 40, 20, 15 and 10m amateur bands in 500kHz segments, four of them on 10m, with CW and SSB modes.

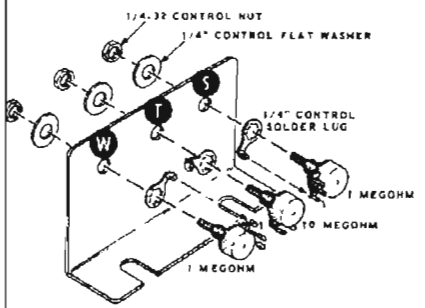
The set was sold in the UK by the Gloucester based Daystrom Ltd., a member of the Schlumberger group, and was intended as a kit, though could be bought pre-built. The performance of any 101, and for that matter any Heathkit gear acquired, must depend to a large extent upon the soldering abilities of the original assembler, but all the Heathkit

Front view of the Heathkit SB-101 transceiver, matching speaker (with PSU inside) to the left.

products came with a very comprehensive instruction and assembly manual, ensuring even the amateur constructor a good chance of a worthy finished item. The set was available from the mid 1960's and was offered as a kit for around \$370

Refer to Pictorial 3-16 for the following steps.

() Refer to Detail 3-16A and mount a 1 megohm miniature control (#10-153) at S on the control bracket. Use a 1/4" control solder lug, a 1/4" control flat washer, and a 1/4-32 control nut. Position the control and solder lug as shown. Bend the control solder lug against lug 1 of the control.



in the USA at that time.

The set has the facility for separate crystal IF filters for CW and SSB, a 100kHz crystal calibrator is fitted for frequency checking and dial calibration, and a separate mains power supply was supplied. A matching cabinet houses the loudspeaker.

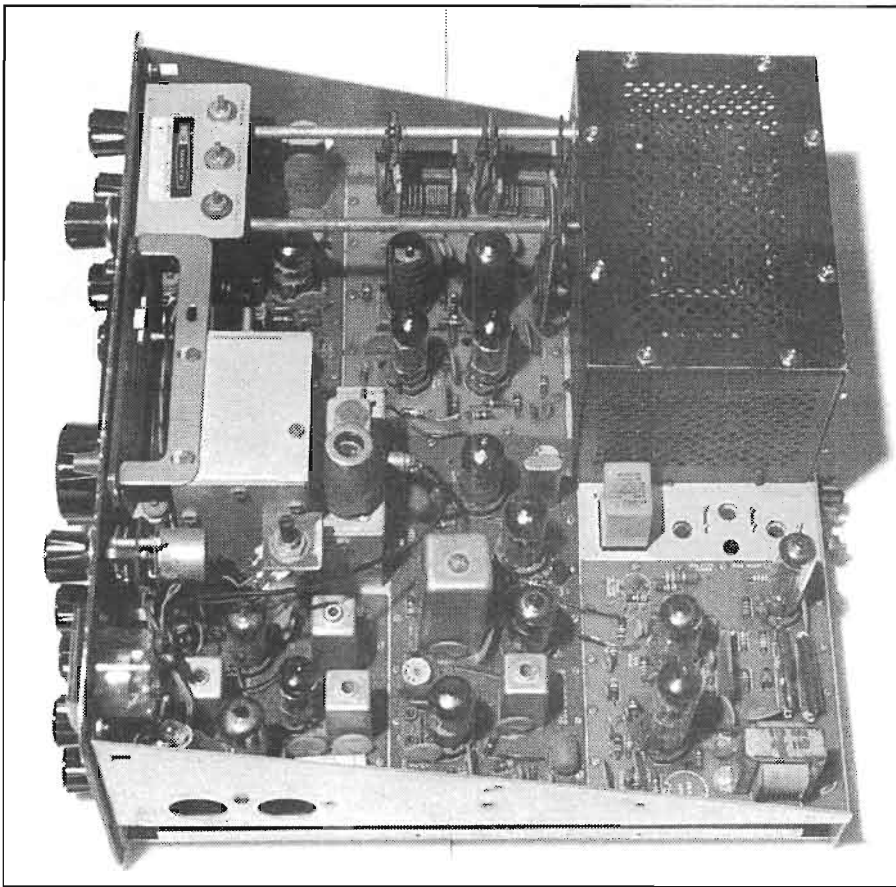
The style and general appearance of the set is very smart, a dark green fascia with a light coloured perforated case and dark green and silver knobs. The set would certainly not look out of place in a living room.

The transceiver, utilising 20 valves and 16 semiconductor diodes, has provision for normal PTT operation or VOX operation including the usual features, anti-trip etc. The main local oscillator came preassembled and aligned, making the construction and final alignment even easier. The panel meter operates as an 'S' meter on receive, and on transmit allows the monitoring of HT voltage, PA current, RF output, ALC levels and PA grid current.

Circuit basics

On the receive side, the aerial signal is amplified by a tuned stage and feeds the first mixer, a switched crystal controlled oscillator being used, to produce a first band pass IF of 8.395 to 8.895MHz. The master local oscillator operating between 5 and 5.5MHz is then mixed with the bandpass output to give the second IF of 3.395MHz.

The filters are in the 3.395MHz section, which is also the initial sideband generation frequency, the filters being used in both the receiver path and the transmit path. The SSB



Inside view of the upper part of the SBf101 transceiver, PA compartment at the top right, VFO unit on the centre left, with Audio stage bottom right.

filter gives a quoted selectivity of 2.1kHz at 6 dB down, 5kHz at -60dB, with the CW filter quoted as 400Hz at 6 dB down and 2kHz at -60 dB.

The second IF signal then passes to the product detector stage where, combined with the BFO, the audio is recovered. The BFO signal is also used for the balanced modulator on the transmit side.

On the transmit side, the microphone input is amplified and applied to the balanced modulator along with the BFO/Carrier Oscillator signal. This produces the Upper and Lower sidebands which are then passed to the filter which eliminates one of them, hence, Single Side Band. The selection of USB or LSB is by a crystal selection in the BFO stage.

The 3.395MHz SSB signal is then amplified and mixed with the LMO signal to produce a tunable SSB signal between the bandpass limits above. This signal is then further mixed with the crystal oscillator to produce the final 'on air' frequency in the selected amateur band.

A tuned driver stage is followed by the PA output stage that utilises a pair of 6146 valves in the final to

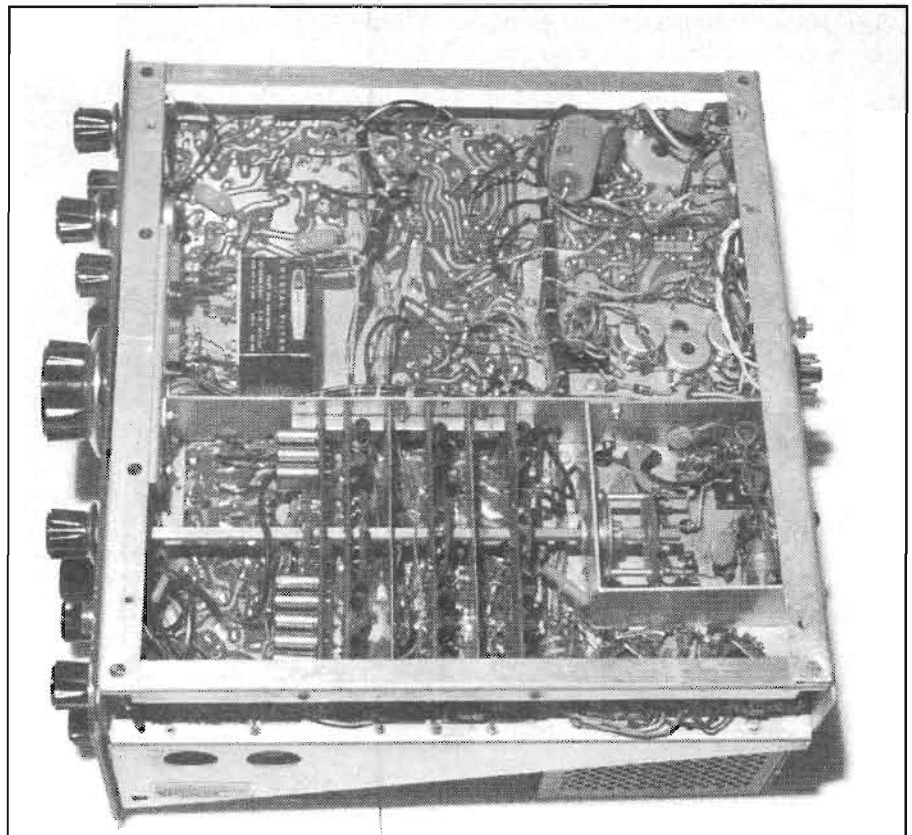
deliver around 100W of RF on 80 through to 15m, and around 80W on 10m.

Power supply

The power supply utilises a twin wound primary transformer enabling both 120 or 240V operation. The secondary, after rectification, produces 800V HT, 300V HT, -100V HT for biasing and muting, and 12.6V AC for the heaters. The SB-600 speaker accompanying this set, styled in a matching case, had the HP-23B psu fitted inside.

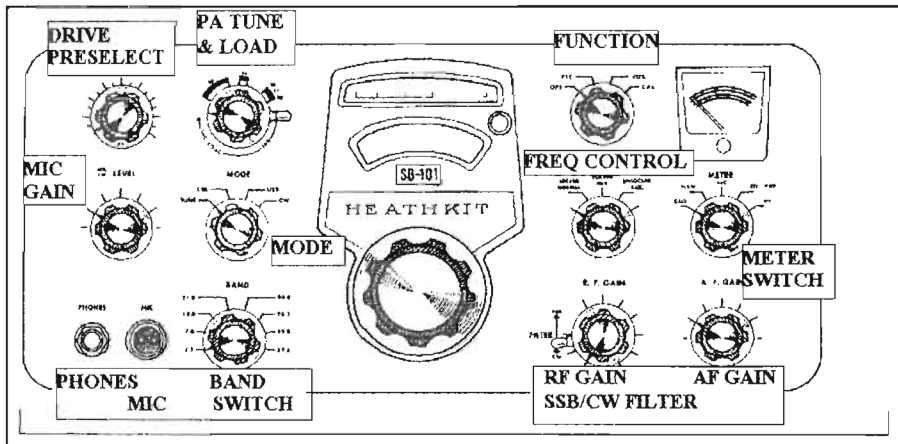
Additional features

Along with the main aerial input, the set provides a second aerial input jack and switch enabling the TX and RX to operate on different aerials, or to take input from, and feed, something like a transverter. Further outputs on the rear apron allow for the Morse key, a further AF output,



Underside view of the SBf101 transceiver, SSB and CW filters are the large block on centre left, RF coils and mixing crystals along bottom wall, PA compartment at the lower right.

and a phone patch input, used in the USA for some years. All the connectors are phono types, as favoured by Heath on all their equipment.



In Use

The set is very nice to operate, the drive mechanism had slightly worn on my set but was still quite good. The tuning rate is acceptable and the read-out accuracy is better than 500Hz, more than adequate.

Tune up is straightforward, switch to *TUNE*, adjust the mic gain until current starts to show, with the meter monitoring PA current, and adjust *DRIVE PRESELECT* for a peak in current, then *PLATE TUNE* for the usual dip. Alternatively, monitor the RF out on a power/SWR meter and tune the *PLATE* for maximum output.

Care should be taken not to hold a high current during *TUNE* for too long to prevent damage to the PA valves. Otherwise, after a few re-adjustments to *PLATE TUNE* and *LOAD* controls, maximum RF output is achieved. The only complaint I can really make is that there is no provision to manually go to transmit without holding the mic PTT button.

Long 'overs' on the air gave great strain to my thumb and I would have liked a manual override on the set. All the other controls are most effective. One point, not really a

complaint as such, is that the meter, when switched to the 'S' meter position on RX, goes to ALC monitor on transmit. I would have preferred it to switch to monitoring the PA current.

A high impedance microphone, something like the Shure 444 or 202 is ideal for this set, the more recent 500 ohm variety on many modern and PMR rigs is not suitable without modification to the SB-101 itself.

Conclusions

Obtaining a rig such as this will give one many hours of fun operating on the band. True, it lacks the digital readout, the umpteen memory channels, FM or RTTY facilities, not many flashing lights and it has only one VFO. But, after all that, it is *cheap*, and does get you going without breaking the bank.

Other Heathkit rigs of a similar style are around, the SB-301 receiver and the matching SB-401 transmitter for instance. The slightly earlier HW-100 and 101 models, 80 to 10m transceivers, and the single band transceiver series, the HW-12A covering 80m, the HW-22A covering 40m and the HW-32A covering 20m, all SSB with 200W PEP.

Many such rigs are available at rallies and the like, and, due to the large number produced, there is usually no problem in obtaining the circuit diagrams in the event of repairs.

I would like to suggest to any newcomers that rigs such as these are considered where you feel that you cannot get onto the bands due to the high cost involved. It is impossible to quote prices, but I would be very surprised if you could not get going for a lot less than £100 with a good piece of older kit. Happy hunting and see you on the air.

Technical Phrases

IF	Intermediate Frequency
ALC	Automatic Level Control
SSB	Single Side Band
CW	Continuous Wave (Morse Code)
BFO	Beat Frequency Oscillator
LMO	Local Master Oscillator
PTT	Push To Talk
PA	Power Amplifier
PMR	Private Mobile Radio
VFO	Variable Frequency Oscillator
PEP	Peak Envelope Power

Specifications: Heathkit SB-101 HF Transceiver

Frequency range (MHz): 3.5-4.0, 7.0-7.5, 14.0-14.5, 21.0-21.5, 28.0-30.0 (in 4 steps)

Power rating: 100W o/p 80-15m, 80W 10m

Intermediate Freq: 1st IF 8.395-8.895MHz, 2nd IF 3.395MHz

Stability: Less than 100Hz drift per hour after 20 min warm up. Less than 100 Hz per hour drift for +/- 10% line volt variation.

Modes of operation: CW, USB, LSB.

Sensitivity: Less than 0.25µV for 10 dB sn/n for SSB

Overall gain: Less than 1.5µV for 0.5W audio o/p.

Image rejection: 60dB or better

Dial accuracy, Elect: Within 400Hz on all bands

Visual: Within 200Hz on all bands

Power requirements: 105-125V or 210-250V AC 50/60Hz

Rear apron connections: HF aerial, 2nd aerial input (both 50 ohm) Speaker 8 ohm, Phone patch jack, ALC feed for linear, 2 spare sockets, mains input socket.

Valve compliment: 1 - 6CB6: LMO
2 - 6AU6: RF Amplifier,
Buffer

1st TX Mixer
1 - 6CB6: 2nd TX Mixer
1 - 6CL6: TX Driver

2 - 6E146: PA Output
1 - 6AB4: 1st Oscillator
1 - 6AU6: IF Amplifier
1 - 6EA8: Mic amp
1 - 6EA8: Sidetone osc
1 - 6GW8: 1st Audio,

Audio Output
1 - 6BN8: Product
Detector, AVC

2 - 12AT7: Crystal osc,
VOX Amplifier

1 - 12AU7: Sideband osc
1 - OA2: Voltage regulator

Dimensions: 378mm wide x 168mm high x 400mm deep

Weight: 38.5kg

SCANNERS

Bill Robertson gives a few tips on taking your scanner abroad, and offers a handy set of tips for scanner problem-solving

Around now, readers may well be looking forward to a summer holiday abroad, or maybe even a short break over the Easter period. What better than to get 'closer to the local action' by taking your scanner along, particularly if you have at least some command of the local language.

'Channel hopping' is becoming easier, with few if any customs formalities across many European borders. But going a little further afield could bring problems. For example, try taking your scanner to certain countries, and you could have the odd problem or two. Not with the scanner itself, but what the authorities might think you're doing with it! Some common 'tourist countries', Tunisia as a specific example, won't allow you to bring your scanner into the country - if they find it in your suitcase then you're lucky - you'll probably just be able to get a receipt and collect the set on your departure. If you do get it into the country and get your 'collar felt', that's when the worries start! Check import restrictions before you travel.

North America is reasonably 'liberal' in many respects, but do beware that some states ban the use of scanners in motor vehicles - something to watch out for when driving around in your hire car. Use in the European Union countries is much the same as the UK, where you can usually use a scanner to receive broadcasts and ham operators, but not private conversations. A 'tip' for getting through customs is to clear all the memories apart from, say, some Broadcast Band II (88-108MHz) frequencies, or if your set also has HF (Short Wave) coverage then program a few BBC World Service frequencies in - useful when the customs officer wants a demonstration that you're not a subversive character coming to spy on their government.

At the airport

Using your scanner in the UK airport whilst waiting for your flight, listening to air traffic, although technically illegal is often



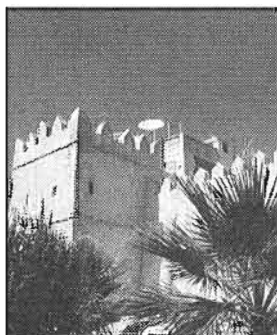
Airband activity can be interesting

'overlooked' by the authorities, and with flight delays it could help pass the time! Overseas airports, especially in remote 'long haul' spots, however can be a different matter, especially if they're shared with military use, so be careful!

As radio gear can severely upset automatic flight instrument landing systems on board an aircraft, don't be tempted to use your set on the plane whilst it's taking off or on the landing approach. If you want to use it at other times then check first with the cabin staff - this is most important. You'll often find there's no problem, and it does of course help to get a window set so you can position the set-top aerial next to the outside world. An aircraft's metal shell makes an excellent RF shield, and practice has shown there's a lot of electrical 'hash' within the aircraft.

On location

If you're in a country where you understand the language, the US if you're British for example, or a different area of your own country, you'll probably be pleased you took your scanner along. For example, I often listen on the VHF Marine Band while on holiday in a UK seaside resort, listening to the 'chat' between fishing boat owners and pleasure-trip



Even idyllic locations are filled with scanning action

carriers adds a very 'local' dimension to the holiday. I often hear them talking about how good, or bad, the tourist trade has been that day, and even sometimes overhear a few tips on where the best restaurants are - like the ones who really do serve fresh local shellfish rather something taken out of the freezer!

Bearcat scanner repair tips

I often receive questions such as "I have a Bearcat 200' which has gone faulty, the keyboard's locked up, where should I start looking?". Well, I have an up-to-date (written Jan 95) multi-page document, by Bob Parnass AJ9S with permission to freely distribute, which has several pages worth of tips and common faults found on a number of Bearcat scanners, and of course how to go about correcting them, together with sources of schematic diagrams and spare parts. If you'd like a copy, just send me a stamped, self-addressed envelope preferably at least A5 sized, c/o the HRT Editor (address below), marked 'Bearcat Information' and you'll have a copy within a few days. If you'd like to enclose a letter with any other questions, or ideas for me to cover in the 'Scanners' section of HRT, I'll be very happy, and will reply through this column.

Bill Robertson will be pleased to answer queries on any hobby radio listening subjects through this column, but regrets he's unable to give personal replies by letter. Write to; Bill Robertson, c/o HRT Editor, Nexus Specialist Interests, Nexus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST.

Realistic PRO-39 Scanner Review

Chris Lorek G4HCL tests a 'mid-range' handheld scanner

I've often been asked "I'm looking for a 'middle-of-the-range' handheld scanner, what is there about that's readily available?". I often reply to the effect that the Realistic PRO-39 would be a possible choice, yet on looking back I find I've never actually tested it myself. "Better put this right" I thought! Within days, a review sample had arrived on my doorstep, courtesy of Link Electronics.

Features

The PRO-39 is a 200 channel handheld scanner, covering 68-88MHz (FM, 5kHz steps) 108-136.975MHz (AM airband, 25kHz steps), 137-174MHz (FM, 5kHz steps), 380-512MHz (FM, 12.5kHz steps) and 806-960MHz (FM, 12.5kHz steps). As such, it covers many of the most popular monitoring bands, although the 5kHz steps aren't ideal for European use revealing the scanner's 'primary' market of the US.

You can key in a frequency to listen to directly using the front panel keypad, and 200 memory channels, arranged in 10 banks of 20 channels each, can be used for automatic channel scanning. A frequency range 'search' can also be programmed by entering 'lower' and 'upper' limit frequencies with the keypad, the scanner cycling through this range in the step increments as above, pausing when the squelch raises. For handy storage, ten additional 'monitor' memory channels can be used for you to temporarily store any interesting frequencies you find in the 'search' mode, which you can then transfer to the normal memory channels for subsequent scanning.

The PRO-39 has a smart dark grey plastic case, with an attached belt clip at the back for easy carrying. It's

powered from a slide-in battery pack which holds 6 AA sized cells, you can use either rechargeable types or normal cells. Two small DC sockets at the side of the case are provided for the use of an external 9V DC supply or suitable DC adapter, plus an optional plug-in charger if you've fitted nicads.

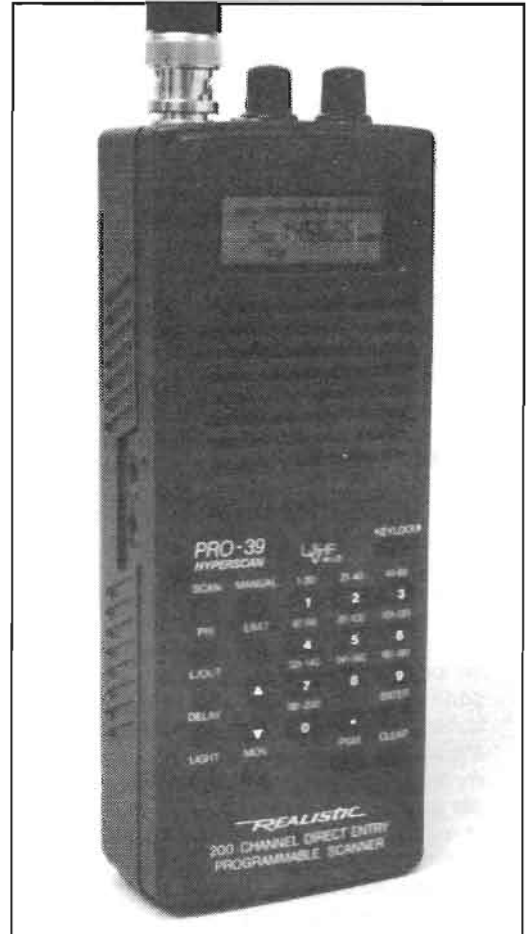
A flexible helical set-top aerial is supplied, and the BNC aerial connector used lets you connect an external aerial, for use at home or in your car. Next to this on the top panel is a 3.5mm jack socket for an optional external speaker or earphone. A rotary on/off/volume control and rotary squelch control complete the top panel line-up, the legends next to these being 'reversed' so they actually read correctly when you're carrying the set around using the belt clip.

Small rubberised buttons are used for the remainder of the controls, these unfortunately aren't backlit although the LCD may be backlit briefly for night-time use to see what the scanner's doing. The set itself measures 145mm x 58mm x 42mm and weighs 250g without batteries.

On the air

I found the 31-page user instruction book gave clear details on using the various controls on the scanner, although a beginner would I'm sure also benefit from further reading, such as an 'Introduction to Scanning' text which the supplied booklet doesn't really cover.

I quickly managed to fill plenty of the set's memory channels with my favourite frequencies, gained from past experience, and tested the 'search' facility to find a few more. On VHF, I found the 5kHz steps were a bit of a limitation, and although the set has a high search speed of 50 steps a second, this for example effectively reduces to 10 channels a second for 25kHz spaced signals. 12.5kHz channel reception was, of course, a compromise as the set couldn't tune to these accurately on VHF.



Scanning the memory banks, at the set's specified 25 channels per second - was however very fast, and I found I was listening to plenty of 'action'.

The PRO-39 was quite comfortable to carry around, and I found the receiver to be reasonably sensitive on VHF, although signals on UHF, e.g. the 70cm amateur band, were noticeably weaker than a 'purpose-designed' receiver for the band.

Unfortunately, on UHF I found I often received signals on indicated frequencies where they shouldn't be - due to 'image reception' limitations of the set. This was less so on VHF, but even so I couldn't comfortably listen to one of my semi-local 2m repeaters, GB3SC, due to airband AM signals being received on the same 'apparent' frequency. This however, to be fair, is a common limitation in such 'mid-range' wide coverage scanners.



Connecting my rooftop VHF/UHF vertical aerial at home to the scanner gave quite reasonable results, and apart from the 'image' limitations I found the scanner coped with rejecting strong out-of-band signals rather well for such a set. Indeed, quite strong signals just one 25kHz channel away were suppressed quite nicely, far better than the performance given by a much more expensive base station scanner from the same manufacturer!

The audio from the internal speaker was crisp and clear, and there was plenty of it even for use in a car. Plugging in an earphone for private listening did however give me quite a bit of residual 'hiss', with pops galore as the squelch opened and closed. I'd recommend a series resistor or headphones with a volume reduction facility if you use the earphone connector for this.

Lab tests

My lab measurements confirmed the reasonably good strong signal handling capabilities of the set. You shouldn't get too many problems by attaching external aerials to this scanner. The 'image' limitations were an exception though, again confirming the results I found on air. In fact on 435MHz UHF, the 'image' signal, i.e. the *unwanted* signal, came through *better* than the frequency the set was *supposed* to be tuned to, and at 'upper UHF', 935MHz, the image came through at exactly the same strength as the wanted signal. Again, this is a common limitation, and some image reception is to be expected, but at this level (which I've seen before on earlier sets from this manufacturer) it looks like they still haven't quite got their design or factory alignment right.

Conclusions

The wide availability of the PRO-39 will be the reason it sells well, and I'm sure it will. It's reasonably priced, it receives plenty of signals, unfortunately not all in the right places, and unlike some other higher-priced scanners it thankfully doesn't get 'wiped out' by other strong signals in the same band. Overall, as a 'middle-of-the-range' handheld scanner, I would consider the PRO-39 to be quite a reasonable 'buy'.

My thanks go to Link Electronics in Peterborough (Tel. 01733 345731) for the loan of the review scanner.

LABORATORY RESULTS:

All measurements taken at 145MHz, NFM, unless stated.

Sensitivity;	
Input signal level in μV pd required to give 12dB SINAD;	
Freq.	Level
68MHz	0.16
78MHz	0.16
88MHz	0.17
108MHz	0.27 (AM)
118MHz	0.28 (AM)
128MHz	0.30 (AM)
136MHz	0.31 (AM)
137MHz	0.25
145MHz	0.27
155MHz	0.26
165MHz	0.30
174MHz	0.32
380MHz	0.48
400MHz	0.29
435MHz	0.47
450MHz	0.48
500MHz	0.44
512MHz	0.47
806MHz	0.40
850MHz	0.36
900MHz	0.39
935MHz	0.39
950MHz	0.42
960MHz	0.49



Squelch Sensitivity;

Level of signal required to raise receiver squelch

Threshold; 0.19 μV pd (7.5dB SINAD)
Maximum; 1.14 μV pd (30dB SINAD)

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; 11.7dB
-12.5kHz; 11.2dB
+25kHz; 70.8dB
-25kHz; 70.0dB

Blocking;

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

+100kHz; 80.2dB
+1MHz; 91.5dB
+10MHz; 93.2dB

Intermodulation Rejection;

Measured as increase over 12dB SINAD level of two interfering signals giving identical 12dB SINAD on-channel 3rd order intermodulation product;

25/50kHz spacing; 60.4dB
50/100kHz spacing; 60.8dB
100/200kHz spacing; 62.0dB

Image/IF Rejection

Difference in level between unwanted and wanted signal levels (1st image 21.4MHz away, 2nd image 910kHz away), each giving 12dB SINAD on-channel FM signals;

	145MHz	435MHz	935MHz
1st Image;	23.5dB	-1.4d (!)	0dB (!)
2nd Image;	55.8dB	52.9dB	47.6dB

Maximum Audio Output

Measured at speaker/earphone socket, 1kHz audio at the onset of clipping (10% distortion), 8 ohm resistive load;

196mW RMS

Project - A Simple RF Sniffer

Mel Evans GM6JAG describes an easy-to-build weekend project that's very useful in the shack

With the ever-increasing use of digital electronic meters, a problem for the home constructor is that, despite their accuracy and convenience, these meters cannot show a 'swing' in RF levels the way that a good old-fashioned analogue 'needle' type can. The moral is to hang on to any old Avos you may come across, as even the industry standard meter has also recently gone digital. In the meantime, if you haven't come across one, or you only have a good digital meter, then this little weekend project will

help you tune up those ex-PMR conversions, check the output from your latest homebrew VFO, or monitor your 2m transmissions.

Your bank manager will like it too, as with only five parts, a meter and some kind of case, even buying everything new as listed, you won't need to ask for a second mortgage to cover the costs. In any event, nothing is very critical in the parts list, and so you should be able to find most of what's needed in any respectable junk box.

The circuit

Take a look at Fig.1. This shows the circuit diagram for what has been variously called an 'RF sniffer', a field strength meter and a diode probe in different disguises. The heart of the unit is a pair of germanium or silicon diodes, D1 and D2. From choice, germanium diodes will give a better sensitivity than silicon due to their lower conducting voltage of around 0.3V, but any small-signal RF types will work here. The circuit acts as a voltage doubler on the incoming RF and rectifies it to DC, whilst C1 and C2 filter and smooth the DC voltage before it gets to the meter. R1 simply acts as a sensitivity control.

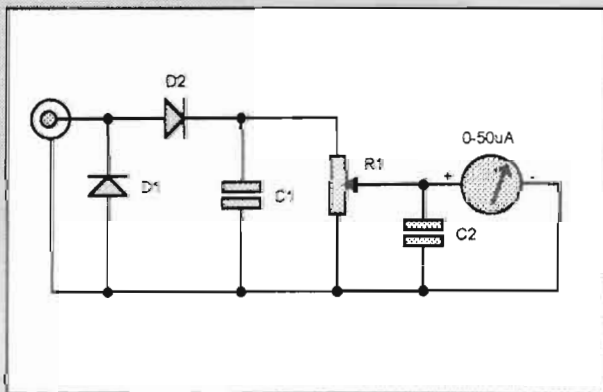
The meter is likely to be the most expensive item if you need to purchase it new. For best results, choose as large a meter as your pocket can stand, larger meters are easier to read! A 50 μ A meter would be ideal, but if a 100 μ A meter is at hand, it can be used without any real difficulty, although the finished unit will not have the same sensitivity.

Assemble the PCB first, using a hacksaw and some superglue, taking sensible precautions particularly if there are young children in the household. Next, solder the parts to the board as shown, including the pot R1.

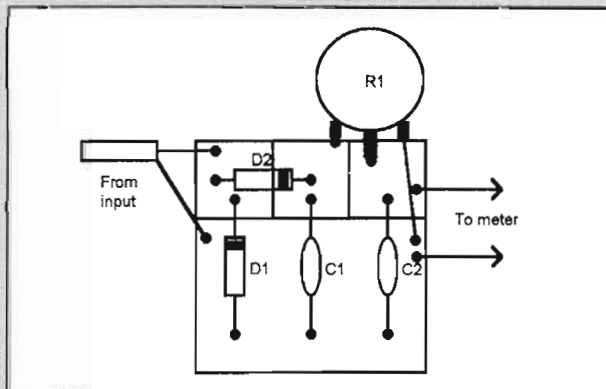
PCB material

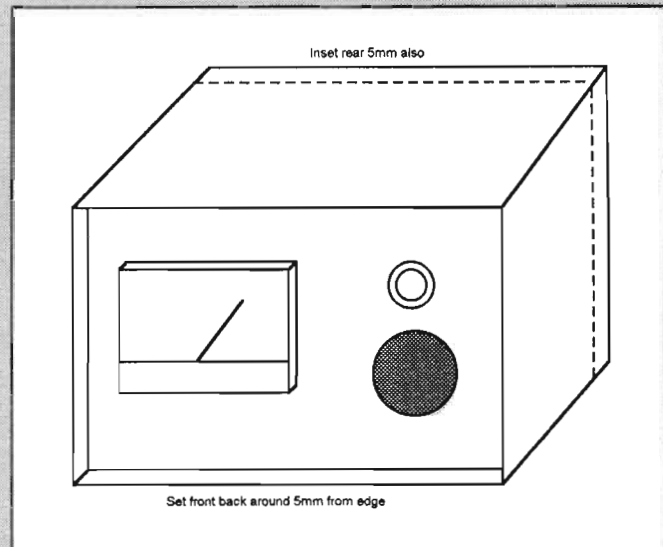
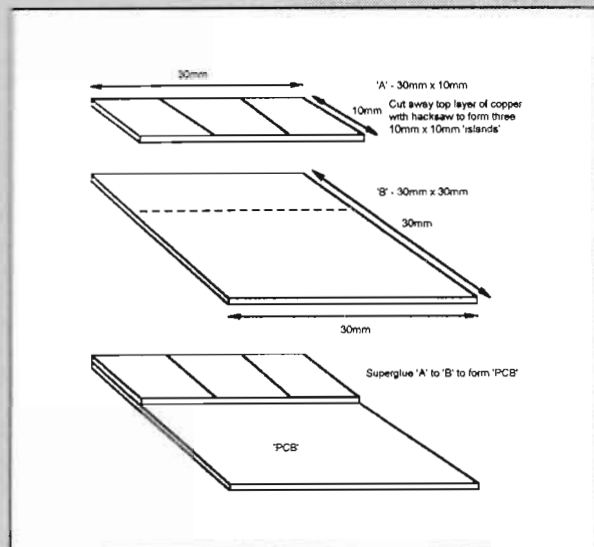
You can often find large but discoloured offcuts at rallies at very reasonable prices, it can also make an ideal small box. Roll your own and save the pennies! For this,

Fig. 1
Circuit
diagram



Parts
placement





make sure all the pieces of PCB material are square and 'tack solder' the seams in one or two places first, then run a fillet of solder down the inside of each joint, using a large iron. The base may be held in place by self-tapping screws, and some self-adhesive feet, and a coat of car-type spray paint will complete the unit quite professionally.

Add a short whip aerial and an RF probe, and you're ready to go. You can use the sniffer from 160m up to UHF, only the sensitivity control needs to be adjusted. Use it with the whip plugged in to monitor your 2m handheld whilst transmitting, or to check final aerial adjustments on that new 20m dipole. Simply position the meter where you can read it, but as far away from the aerial as possible, and keep the whip away from the feed line. The greater the transfer of power from your transmitter to the aerial, the greater the readings on the meter. Remember the highest radiated field strength may not always occur at lowest SWR.

Plug the RF probe in, and you can fault-find by looking for RF signals at each stage of a transmitter. Usually, each stage will show an improvement on the one before. If not, or no indication at all, chances are you've found the faulty section. The sniffer with probe can also be used to tune up a transmitter or the local oscillator section of a receiver. Remember though, it is not frequency selective, and where a stage can be tuned to more than one frequency, as in a frequency doubler, make sure you are peaking

the right frequency by using a general coverage receiver or a counter. Remember also, the sniffer is uncalibrated, meaning it will show an increase (or decrease) in the level of signal but not an accurate level.

You can also use the probe to check your finished transmitter projects for any leakage of RF from the cabinets, by running the probe head round all seams, hinges, meter and dial openings, key and microphone leads and incoming power cables. Too much leakage could indicate possible EMC problems.

There's nothing very new or original about this little project, but it forms an ideal start to homebrew, and with a multitude

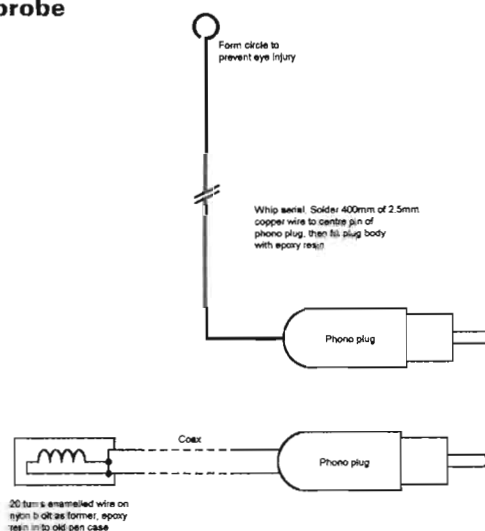
of uses. Get out the soldering iron and build one this weekend, you really will wonder how you managed without it!

(If you have any queries regarding this project, please write to the author, c/o the HRT Editor at the HRT address, enclosing an SAE if you require a reply - Ed)

Parts List

- D1,D2 OA47 or any similar germanium diode
- C1,C2 10nF 100V polyester
- R1 22k lin pot
- M1 50µA meter
- Phono plug and socket, knob for pot and suitable case.

Whip and probe



QRP Corner

Dick Pascoe G0BPS converts a computer mouse into a Morse key, and tells of Russian QRP operation from a kayak

As usual the G-QRP club's *Winter Sports* finished in a flurry after a rather slow start. This is quite normal, as many operators prefer to sit in front of the fire and digest their Boxing Day dinner before hitting the airwaves. I spent Boxing Day morning walking my dog on a local beach, watching braver folk than I, in fancy dress, raising money for local charities by spending at least two minutes in the sea. Over fifty adventurous souls took the plunge (literally) whilst I stayed much warmer and dryer a little higher up the beach! At this time of year I much prefer the radio waves to those very wet and cold ones.

Back to the Winter Sports; Victor G3JNB rang to tell me of his exploits on the air with a Heathkit HW8 with reduced power levels and also with his own homebrew 20m transceiver. With just one watt into his 85m long dipole he had plenty of fun working all over Europe, including a couple of contacts into the Isle of Man (GD0LQE and GD3FXN) for a 'first'. Wall to wall Germans dominated the first few days but holes appeared in their QRM for better things. Whilst in mid QSO with Damir (9A2RK Cyprus) heavy QSB caused the chat to fail, only to be resumed by chance a couple of hours later. LY3BA was also worked a bit later, but he seemed determined to work over 200 stations during the week, his 3W to a three element yagi seemed to be working well in the conditions. Another find was 2E0ACY picking up a lot of contacts on the QRP frequencies. Victor's delight was finding member No. 3 in the shape of Gordon G3DNF.

Chris G4BUE is an expert operator, both at QRP and QRO levels. He delights in getting the call GB0QRP for the Winter Sports and giving away points. He is also an early bird, often at the rig in the early hours. I have stayed with Chris at times and was amazed to see him operating at 5am after a hectic summer party.

The Italians have given notifications of a similar event to be held in June, Called the Elma Radiocommunicazioni QRP Marathon, CW stations only working

throughout the month of June and July. Details are;

1st June 0000 UTC until 2400 31st July UTC inclusive. Classes 1, Very Low Power (under 1W). QRP up to 5W and QRO over 5W. Points are awarded for each QSO as follows; Own Country = 1 point. Europe = 2 points with DX counting 3 points. Log must contain, Date, start time (UTC), call, frequency, RST, QTH, UTC end. Giving also claimed score by 30th August to IK0VSV PO Box 156, 06059 Todi PG Italy. As with the Winter Sports, no contest style operating as per '599 name QTH' type QSOs are permitted. This one is for fun too so have a go, needless to say I shall be there. Some other dates for your diary are; 9th to 21st May the Yeovil Fun Run, 21st May the Yeovil QRP Convention. 17th June, IARU Region 1 QRP Contest. 15/16th July AGCW DL QRP Contest. 17th Sept - 1st Oct Europe for QRP. Also for our German readers the German G-QRP members gathering will be on 20th and 21st May 1995, for details contact Rudy Dell DK4UH.

QRP in a kayak!

I have just heard that Igor RK3ZK and friends took time out to go maritime mobile with QRP equipment not too long ago in a couple of kayaks. His friends were not licensed so contact was maintained from boat to boat via 27MHz CB (not recommended though). His 40m contacts during the evenings from his homebrew rig were not too successful as the only aerial available was a 1.5m whip or a beverage. His trip along the Voronezh river took in about 120km of water, quite a trip. My own canoeing days were mostly white water with just the one (failed) trip across the English Channel. We would never had dreamt of taking a rig with us!

One idea that did come from this trip is quite a good one. Igor had problems with water getting into his keyer, (what a surprise!). He suggests taking the PCB from the box and coating it several times with

a complete layer of paraffin wax and then replacing it back in the box. The connectors will also have to be done and the whole assembly covered one last time before the lid goes back on. He says it works, adding that he could almost use it underwater. I do not plan to try this one out until the summer and the water gets much warmer!

Of mice and men

I read some time ago about someone who converted an old computer mouse into a Morse key. Having a dead rodent sitting in the shack prompted me to have a go and see if it would work. Much to my amazement it turned out to be a useful addition to the shack, for more reasons than might at first be apparent.

Let's take a look at the mouse. For the uninitiated, a computer mouse is a device that is connected to the computer with an on screen pointer that moves in sympathy with the rodent. Various things may be done with this including 'clicking' the mouse on required points to activate an event or sequence of events on the computer. Most mice are fitted with two buttons that activate two micro switches although some may be found that have three buttons.

These switches are connected to the computer via a cable and a nine pin plug. If we remove this plug, fit a stereo plug and rewire the mouse to match a simple Morse key will result. I opened mine to find a small printed circuit board with the micro switches connecting to the wire via selected circuitry. We need to bypass this circuitry and ensure that the two switches connect directly to the cable.

To do this I first scratched away the track from around the switches and also from around the connector plug on the mouse. This isolated both the switches and the connector. Four wires were then soldered to the two switches, two were joined to make the earth link and the other two to be the dot and the dash connections. These were then

ARE YOU MISSING OUT EVERY MONTH?

Are you having trouble getting a copy of your favourite HRT magazine every month? Are you missing out on the great news, views and features that we pack in these pages? Are you losing the race to grab the new issues? Do you want to help yourself or a friend keep in touch? If the answer to any of those questions is yes then simply fill in your name and address on one of these coupons and hand it to your local newsagent and he will order or save a copy just for you!

HRT *Incorporating SCANNED INTERNATIONAL*
HAM RADIO TODAY

Dear newsagent,

Please deliver / save me a copy of Ham Radio Today Magazine every month.

Name

Address

Ham Radio Today is available from: SM Distribution, 6 Leigham Court Rd., London SW16 2PG
 Tel: 0181 677 8111
 (ISSN No: 0269-8269)

HRT *Incorporating SCANNED INTERNATIONAL*
HAM RADIO TODAY

Dear newsagent,

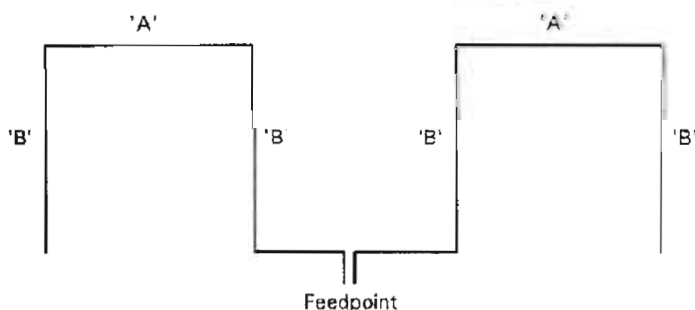
Please deliver / save me a copy of Ham Radio Today Magazine every month.

Name

Address

Ham Radio Today is available from: SM Distribution, 6 Leigham Court Rd., London SW16 2PG
 Tel: 0181 677 8111
 (ISSN No: 0269-8269)

Sides 'A' and 'B' are both 5.1m at 14MHz



The 'Bruce Array' Aerial

soldered to the plug.

It may be found that the micro switches are both push to make (PTM) and also push to break (PTB), a check with a multimeter will soon reveal which is which.

I also liked the way the keyer worked on the bench. Most paddles are heavily weighted with either lead infill bases, solid brass, or a chunk of steel. None of these are needed with the mouse key. It is easily held between the thumb and little finger using the palm of the hand. I kept the ball in mine as it makes it easy to move across the bench when

operating. As the mouse key is held it tends not to wander around when transmitting as others may do.

More importantly, most paddles today cost many pounds, my bencher cost over £50 and my Vibroplex over £60. My mouse key cost me pence! For those who do not have access to a mouse, deceased or not they are found at the rallies, sold as 'untested' for a couple of pounds. This often means tested and not working, but does not matter in this case as the innards are not required. Listen out for me on the HF QRP frequencies, you may yet work me with my

mouse powered keyer!

I recently acquired a couple of great computer programs. The well known Mininec and Miniprop are a boon to the aerial builder, as most QRP types are. These latest ones I have just acquired are Toroidal and Ariel16. Ariel16 was written by J. Scott Hedspeth WB4YZA, and provides 14 aerials displays to play with. Select the one you prefer, input the frequency preferred and up on the screen pops the full sizes of the aerial and an indication of its layout.

I tried it with the Bruce Array, selected 14MHz, and got the diagram shown with the following supplementary information; This array produces a bi-directional broadside pattern, it may be extended on both ends for more gain and directivity. For proper operation the lower (horizontal) portion should be one half wavelength above ground. The preferred feed is with a quarter wave matching stub.

That's it for this month, news, views and reports to me please. Via the editorial, or packet to GB7RMS, email to dick@kanga.demon.co.uk or even snail mail to Seaview House, Crete Road East, Folkestone, Kent CT18 7EG.

From My Notebook

Geoff Arnold G3GSR discusses local oscillator injection for SSB and CW use in receivers, and the alignment of local oscillator stages

Last month, I left you with a question - should we begin alignment of the variable tuned circuits in the signal-frequency and local oscillator stages of our simple superhet at their low-frequency (high wavelength) end, or their high-frequency (low wavelength) end?

As with any process, you've got to start somewhere. You can of course dive straight in and hope for the best, but it's better first to apply a little reasoning, with the aim of choosing a starting point which leads logically through the rest of the process. You don't want to be in the position of the lost motorist who enquires of a local how to get to his destination, only to be told: 'If I was going there, I wouldn't start from here!'

I gave you a clue at the end of Notebook in the February 1995 issue, where I said that trimmer capacitors - those connected across the tuning capacitor gangs - have the greatest effect when the gang is fully open (minimum capacitance), and minimum effect when it is fully closed (maximum capacitance). On the other hand, changing the effective inductance of the coil in the tuned circuit, whether by screwing its core in and out or by changing the value of a padder capacitor, has a significant effect throughout the range of the tuning capacitor.

Logically, therefore, we should start the alignment process at the low frequency end, using the coil cores or the padders, safe in the knowledge that: (a) any subsequent adjustment of the trimmers will have minimal effect on the alignment at that low frequency end, but (b) the trimmers will give a good range of adjustment at the high frequency end, where they have the greatest effect.

the signal-frequency circuits for maximum output from the receiver at a given frequency if the local oscillator is not running at the corresponding frequency (oscillator frequency = signal frequency + intermediate frequency).

So, we must align the local oscillator first, so that its frequency is always in step with the indicated frequency on the tuning dial. If you have a frequency counter, which you can use to measure the frequency of the local oscillator directly, you can carry out this adjustment quickly and easily, without need for a signal generator. The frequency counter must be lightly coupled to the local oscillator, to avoid disturbing its natural frequency. Usually it is enough to place the counter probe near the LO tuned circuit; if there is not enough pick-up a direct connection can be made via a capacitor of just a few pF and an appropriate voltage rating. The only other requirement is a pocket calculator or a little mental arithmetic, to calculate the required LO frequency (= signal frequency + intermediate frequency) at each alignment point on the tuning scale.

On a traditional scale and moving pointer tuning dial, you will usually find the manufacturer's recommended alignment points marked towards each end of the scale by little lines or blobs. In the absence of such marks, or a list of alignment instructions, choose your own frequencies, about 600 and 1500kHz for the medium wave band.

For these alignment frequencies, the corresponding LO frequencies calculated for a receiver with a 455kHz IF will be 1055 and 1955kHz. The procedure is: 1) - Set the tuning capacitor so that the dial indicates 600kHz and adjust the local oscillator

Signal or oscillator first?

Having sorted out one order of attack, we now have another decision to make. Should we align the signal frequency circuits or the local oscillator first? Again, we need to exercise a little logical thought - it is a waste of time trying to peak up

coil core until the counter indicates 1055kHz. Then: 2) - Set the tuning capacitor so that the dial indicates 1500kHz and adjust the oscillator trimmer capacitor for a counter reading of 1955kHz. The reason for choosing points a little in from each end is that the capacitor will no longer exactly follow its designed law as the plates reach the fully meshed or unmeshed condition.

Repeat as Required

Depending how far you had to adjust the trimmer, you may have upset the first adjustment at the LF end, so you repeat Step 1. This may upset the adjustment at the HF end, so you next repeat Step 2. If both repeat adjustments required only the slightest movement of the core and trimmer, this will probably finish the job; if bigger repeat adjustments were necessary to bring the local oscillator back to its correct frequencies, you should repeat 1 and 2 alternately until you can make no further improvement. There is no point being too picky about this - with the typical thickness of pointer and scale marks, plus parallax between pointer and scale, you won't be able to reset the tuning capacitor to exactly the same point each time any way!

If you don't have access to a frequency counter, you will not be able to measure the oscillator frequency directly. Instead, you will have to adopt the traditional (pre-digital era) approach of injecting a test signal at the frequency indicated on the receiver dial, then adjusting the LO until the difference between the two frequencies lies within the IF bandwidth, peaking for maximum output.

When I began talking about alignment of the local oscillator and signal frequency stages last month, I said that you should connect the signal generator via a dummy aerial to the receiver aerial and earth terminals. However, if you need to use the sig gen for the LO adjustment, and the alignment of the signal frequency stages is way out, it may be necessary to connect it first to the control grid of the mixer valve. In those days before frequency counters, it was traditional to carry straight on from IF alignment to LO alignment, simply changing the signal generator setting from the intermediate frequency to the signal frequency. You also had to remember to remove the disabling

short-circuiting link from across the LO section of the tuning gang at the same time!

Having got the LO tracking nicely with the tuning scale, it's time now to get the signal frequency circuits tracking with the local oscillator. We do this by injecting a test signal at the aerial and earth terminals via a dummy aerial as described last month, with the signal generator and the receiver tuning set to the appropriate alignment frequency. The adjustments of coil cores and trimmers follow exactly the same procedure as described above for the local oscillator, except that it's now the signal frequency tuned circuits that have to be peaked for maximum output from the receiver.

In theory, tracking between the signal frequency and local oscillator circuits can be correct only at three points, one at each end of the band covered and one roughly at its middle. This is the so-called three-point tracking principle which you will find described in textbooks. In practice, the tuning of the signal frequency circuits is generally so flat that this factor can be ignored. There have however been receivers in which the designer prescribed a third alignment point, usually about 25 to 30 per cent down from the top end of the band, and another pre-set control to adjust for best tracking.

If your receiver has an RF amplifier stage ahead of the mixer, or a multi-tuned bandpass tuned front end, the signal frequency adjustments will have to be repeated for each set of tuned circuits.

This description of tracking adjustment at points near the top and bottom of the band applies particularly to the medium-wave broadcast band, where the frequency span (520-1620kHz) exceeds 3-to-1. For the long-wave broadcast band, where the span is much less, and on short waves, alignment instructions often call for adjustment at one frequency only, usually near the middle of the band.

The other way round

Before we leave the subject of local oscillator and signal frequency alignment and tracking, I should mention that some manufacturers recommend in their receiver service sheets that the HF end of each band should be trimmed before the LF end. In a quick survey of both broadcast and communications varieties for which I have data, the split seems to

be roughly 50-50. I have never seen an explanation given for this difference in approach, although presumably as these are instructions for carrying out realignment, rather than initial alignment, they expect that the adjustments required in service will be no more than a tweaking for optimum. In such circumstances, the order of adjustment would make little difference to the number of adjustment cycles required.

Monitoring the output

I've referred several times to monitoring the output level during alignment, without explaining how it's done. The professional technician will usually do it by connecting a calibrated audio output meter in place of the normal loudspeaker or headphone load (this has the advantage of keeping down the noise level in a busy workshop). The output meter will incorporate a load resistor of a value equal to the normal working load impedance of the receiver. A slightly less desirable means is to connect a multimeter on a low AC voltage range across the loudspeaker or phone terminals. The impedance of this load will vary across the audio band, but since we are not interested here in checking audio frequency response this is of no importance to us.

I mentioned earlier the need to keep test signals at a level below the point at which the receiver AGC (Automatic Gain Control) will start to operate. It's no good trying to monitor audio output level changes due to alignment changes on a meter, if the AGC is frantically trying to perform its usual job of compensating for changes in signal level at the output of the IF strip.

The alternative approach, and a very useful one if we want to do our alignment with an unmodulated test signal, is to monitor signal levels by measuring the changing DC voltage on the AGC line itself. If this approach is to work, the test signal must obviously be strong enough for the AGC to come into operation. It is the best method, too, if you are faced with doing your alignment using off-air signals. In the case of the medium and long wave broadcast bands, you can usually find a fairly strong and steady signal towards each end of the band during daylight hours, although it's not such a good idea in the hours from dusk to dawn.

BFOs and CIOs

Although for simplicity my description so far has been based on a broadcast receiver, I want to end with a few words about setting the beat frequency oscillator or carrier insertion oscillator which you'll find in communications receivers (or even some more up-market broadcast models). Whatever the transmission mode, we want the intelligence of the received signal, be it carrier-plus-sidebands speech from a broadcast station, the keyed carrier of a Morse signal or the sideband of an SSB communications channel, to be translated in frequency in the mixer and placed within the IF passband.

For the Morse (CW) signal, we need to heterodyne the keyed carrier with the BFO output to produce an acceptable audio beat note. Depending upon the personal taste of the operator, this note will usually lie in the range 600 to 1000Hz. The BFO therefore needs to be 600 to 1000Hz above or below the IF. Leaving aside problems with coping with interference from stations on adjacent frequencies, and also design techniques in combined SW/SSB receivers, it does not matter whether the BFO lies above or below the IF.

In modern receivers, with IFs in the region of 9MHz, the BFO is usually crystal controlled, so you can only adjust the received CW pitch by adjusting the main tuning, thus moving the signal within the IF passband. Older receivers often had BFOs tuneable by up to 5kHz above and below the nominal IF by means of a front-panel control. That way, the pitch of the beat note could be changed to suit the operator whilst keeping the incoming signal firmly within the IF passband.

For the SSB signal, it is important to have the reinserted carrier from the CIO on the correct side of the sideband, otherwise the demodulated audio will be frequency-inverted gobbledygook! It is convention to use lower sideband modulation for transmissions below 10MHz and upper sideband above 10MHz. For LSB transmissions, the reinserted carrier obviously needs to be above the sideband, and for USB it must be below the sideband. However, as I explained back in the June 1993 HRT, the sideband could well have been transposed in the receiver's frequency conversion process by the time it arrives at the demodulator. In that case, the output of the CIO would have to be on the opposite side of the sideband to what we might first

Data Connection

Our resident data SysOp asks "is this really a TNC I see before me?"

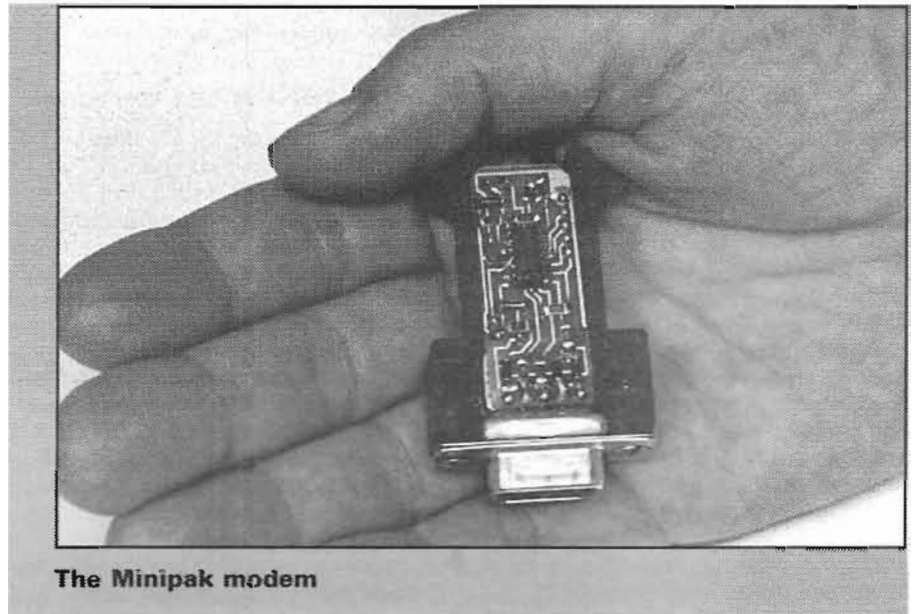
I recently received a fax from Rob G8VST asking whether the paKet V6.1 terminal program would work with a simple modem or whether it needed a 'proper' packet TNC (Terminal Node Controller). The answer regarding a simple modem is unfortunately 'no', because as with most other programs it's designed to purely offer a 'user interface' and use the PC's processing power for message storage and the like, rather than to 'emulate' a TNC.

There are, however, many programs that will do the latter, the most popular being the Baycom system. Here, a simple external modem is used, and connected to your PC's serial port. This modem just converts audio tones to and from logic levels, without any in-built 'intelligence', hence it can be quite small and uncomplicated. In fact, one such modem, the 'Minipak' from Siskin, is completely fitted within an RS-232 connector shell. A 'TNC emulation' (not simple 'terminal emulation') program running on the PC itself is then used to perform the required packet frame handling, timings, and the like.

Which brings me onto a word of caution. I've seen instances of so-called 'Packet TNC' kits being advertised (fortunately not in HRT) which are, in fact, just a modem as above and not a 'full-blown' TNC, the latter usually being rather more expensive. Beware any ad which states the necessary software is supplied "free" with your purchase of the modem - make sure it really is "free", not unregistered shareware which requires additional payment by you after initial evaluation. Also, if you want to try different programs, like Log-EQF, paKet 6.1, and so on, ask the dealer whether the "TNC" can be controlled by these, or whether it's totally reliant on running with the copy of software supplied with the hardware.

9600 baud with Baycom

There's a new 9600 Baycom modem available - good news for high speed users! This plugs into your PC's Centronics parallel (LPT printer) port, and runs under the Baycom 1.6 program, as commonly used with 1200 baud modems such as the 'Minipak'. Johannes DG3RBU of the Baycom team (who's also a HRT reader) tells me he is sending me a unit, and I understand there are



The Minipak modem

already a couple of these in use elsewhere in the UK, so I hope to report further on this system in a forthcoming issue.

Soundblaster card modem?

Another way of 'off-the-shelf radio data' on a PC would of course be the use of a 'standard' audio card fitted to a PC, with appropriate software. 'Multimedia' equipped PCs are becoming more and more popular, these already having audio out and mic input jacks (plus a 'game' port which can be used for TX PTT switching etc.). I was thinking about this a couple of weeks ago, wondering 'who would be the first', maybe with a version of the popular 'JV FAX' for weather fax reception but for a Soundblaster, when I came across the WXMAN program. You've guessed it, this uses a Soundblaster card for weather fax reception! Rather than describe all its features here, I've arranged for this month's HRT software offer to have this program included, so you can try it yourself -

see elsewhere in this issue of HRT for details on receiving it (plus several other programs also on disk) for just the cost of posting the disk to you.

Amiga packet

Bob Perks G0LBQ asks, with reference to the front cover disks and software offers "Why is only the PC supported with amateur radio software from the magazine?". The answer of course, which incidentally Bob fully agrees with, is that the PC is by far the most-used type of computer amongst radio enthusiasts worldwide. However there are plenty of other computers in use, and Bob, who looks after the Amiga Amateur Radio Users Group (AARUG), would be pleased to send HRT readers information on the group and their catalogue on disk, by return post. Send him a disk (with something on it!) inside a padded envelope together with a return address label and return postage, or for those outside the UK 1 IRC or \$1 US Dollar will cover postage, or 2 IRC or \$2 US will

SOFTWARE FOR THE RADIO AMATEUR

Europe's leading distributor of Amateur Radio, Engineering and Communications Shareware/PD programs for the PC - 100's of related program disks - FREE CATALOGUE

Transmit and Receive

SSTV - FAX - RTTY - CW - AMTOR

This BRITISH communications interface for the PC is built into a 25 way 'D' Connector. Comes complete with interface cable & 3 software packages. Reviewed in December Ham Radio Today. only £49.95 plus postage

VENUS ELECTRONICS

26 Pevensey Way, Frimley Green, Camberley
Surrey GU16 5YJ Tel/Fax: 01252 837860

★ FREE ★ FREE ★ FREE ★

ISSUE 1 OF OUR NEW
CATALOGUE FOR EX P.M.R. EQUIPMENT
OVER 1,000 UNITS AVAILABLE

EXAMPLE: MARCONI L/B FM 25WATT
MOBILES, IDEAL 4MTRS VOICE/DATA
£15.00 EACH

PLEASE SEND A4 S.A.E. (25P) TO

MTR

**PO BOX 222, NORTHAMPTON
NN2 6YU FAX: 01604 603866**

PARCEL POST & PACKAGING £4.50 PER RADIO

SERVICE MANUALS

We have what is probably the largest range of Service Information available anywhere. From the Earliest Valve Wireless to the Latest Video recorders, Colour Televisions, Test Gear, Audio, Computers, Amateur Radio in fact practically anything.

Write, Fax or Phone for immediate Quote. Originals or Photostats as available.

Also available. Our **FREE** catalogue detailing **Hundreds of Technical Books and Repair Guides** available.

STOP PRESS

Now Available. our Service Manuals Index on P.C. Disc (3.5") for use on your Computer. Just £3.50 with FREE everlasting Updates. Order MP-285.

MAURITRON TECHNICAL SERVICES HRT

8 Cherry Tree Road, Chinnor, Oxford OX9 4QY

Tel:- (01884) 351694 Fax:- (01884) 352554

Please forward your latest catalogue for which I enclose 2 x 1st Class Stamps or £3.50 for the Technical Books Catalogue plus Manuals Index on PC Disc(s).

NAME _____

ADDRESS _____

POSTCODE _____

Please photocopy this coupon if you do not wish to cut the magazine

cover the supply of disk and return postage. Bob's address is; Bob Perks G0LBQ, 120 Cranes Park Road, Sheldon, Birmingham B26 3ST, England, or for more information by packet; G0LBQ @ G0LBQ.GB7SOL.#29.GBR.EU

Packet group news

The inaugural meeting of GramPac, covering the Grampian Region of Scotland and its immediate vicinity and reformed from the earlier Nospac group, took place late last year, with elected officers of; Technical & Equipment Manager: Jim GM3ZMA, Secretary & Treasurer: Stuart GM7RBP, News Editor: Riley GM7GOD, and General Committee Members: Brendon GM0CQV, Jim GM0FET, and Duncan GM7IEU. They publish a periodic packet and email newsletter, their latest offering showing them to be a very active group. You can get further information on this from Riley GM7GOD @ GM7GOD.GB7ABN.#75.GBR.EU.

The Winter edition of Datacom, the journal of the British Amateur Radio Teledata Group, is, as usual, a

'bumper' information source, with over 100 pages of data-related articles and 'snippets' including a couple of interesting articles on PacTOR II, and the difference between TCP/IP and AX25. Unfortunately though, this issue ends the run of the once-regular 'Packet International' section of their journal, although packet will be covered in the 'main body' of future issues. If you're enthusiastic about data over ham radio, this is a society I'd certainly recommend. You can get BARTG membership information from Peter G6LZB @ GB7BST, or Tel. 01923 220774.

CTRL-Z, end of message

That's it for this month. Please do keep me up to date with what your group are doing, and if you have any questions on anything relating to data modes over amateur radio I'll be pleased to try and answer through this column.

BRITISH AMATEUR RADIO
TELEDATA GROUP

DATACOM



Digicom from the BARTG

You can contact me on packet; G4HCL @ GB7XJZ.#48.GBR.EU, email; chris@radshack.demon.co.uk, or mail via the Ham Radio Today Editor.

VHF/UHF Message

Geoff Brown GJ4ICD shows how to extend the capabilities of an FT-690, and gives an update on Sporadic 'E' cloud monitoring

Here's a mod for extended frequency range for the FT690R11, by courtesy of Costas Fimerlis, SV1DH. Originally the Yaesu FT690R11 covers 50 to 54MHz. You can extend this range so the radio will cover 6MHz, anywhere between 44 to 54MHz. With this you can also monitor video carrier frequencies (on 49.750, 48.250, or 46.250MHz). For this modification you need to change the crystal on the 55MHz VCXO (item X4002) on the PLL/PA unit with a new one, according to the following specifications: Frequency: 27.34925MHz, fundamental cut. Load capacitance: 28pf, series resistance: low (15-20 ohms), holder: HC-18/T/3P, middle pin to case. To modify the display and the PLL divider, first switch off the memory back-up battery (on the rear of FT690 R11) and then install a 1N4148 diode, soldering the cathode to pin 5 of P2501 and the anode to pin 6 of P2502 on the CPU unit. Turning the equipment back on, the VFOs will display 5.000.0 (this is 45.000.0MHz). The mark "HIGH" will be displayed above 0.000.0 (50.000.0MHz). Now adjust TC4001 on the VCO unit for the desired range. Next adjust T3018 and T3021 on the transmit path as well as T3001 to T3005 on the receive path for optimum flatness and sensitivity over the chosen frequency range. If the range 48 to 54MHz is required, there is no need for the above VCO and RF circuit adjustments. Please note that the useful bandwidth is suppressed approaching the lower 44MHz limit. For accurate frequency display, adjust T4001 on 0.000.0 against a known 50MHz signal and VR4004 for 25Hz frequency difference between 9.998.475 and 9.998.500 using the 25Hz step mode. This step (the forth click) when moving from 9.998.4 to 9.998.5 is the most critical, as it represents the maximum possible error of the display reading. This is why you have to adjust for real frequency values there.

Visual sporadic 'E'

Sporadic 'E', its mechanisms, movements, how it develops, and the numerous types of 'E' have been a puzzle for many years. After many

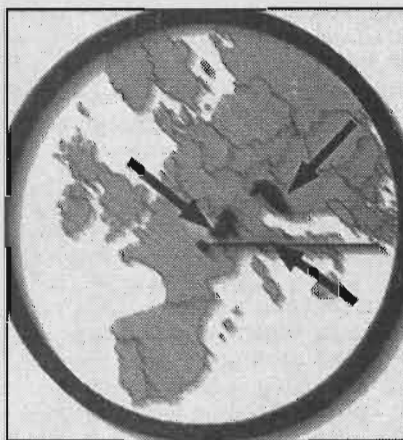
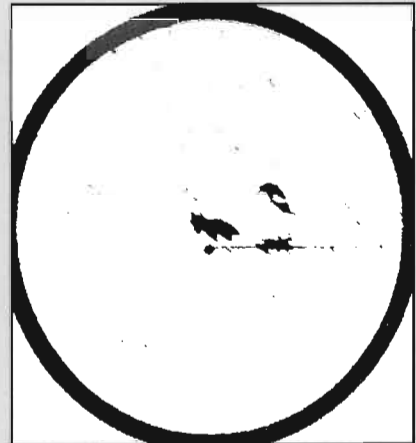
months of hard work, some fantastic results have been achieved to visually watch sporadic 'E' clouds form and move around. Using a modified radar unit coupled to an interface and computer (plus the software), visual images can now be displayed on a VGA monitor in full colour! George, F8OP and myself have been working on this idea for the past 6 months, and, with the help of some professional software writers, we have at last come up with the near perfect answer. This major discovery will help many to understand, and at last prove, how sporadic 'E' clouds form and when they form. It will also be an ideal predictor for openings. Our scans so far have been limited due to the fact

that there is not much sporadic 'E' around during the winter months. However, during October 23rd last year as George had just received the equipment from me, he did manage to catch two scans, showing and proving for the first time ever, that these ionised clouds expand and contract, and also move.

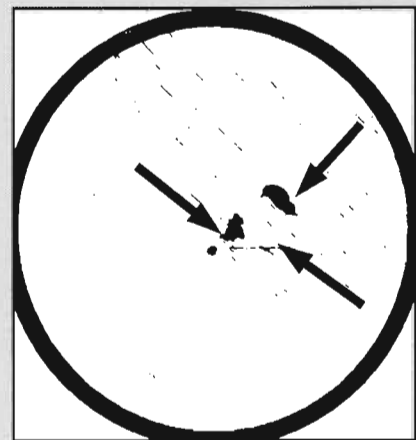
In the accompanying figure, after very careful conversion and enhancement, the scan shows three areas of dense ionisation, one stretching from the Swiss Alps to Luxembourg, another over Italy, and a third over Croatia. At the time of these clouds appearing there were extensive openings on 28/50MHz around Europe (see last month's *VHF/UHF Message*). In the next scan,



Scan during October 23rd opening.



Same scan 30 minutes later.



which was taken 30 minutes later, the Swiss Alp cloud has decreased in size, the Italian cloud has totally gone, and the Croatia cloud has expanded (apologies for the poor quality of pictures but we are only in the intermediate stages at present, plus map overlays are quite difficult at the moment). Distance calibration is unfortunately a little out, and the current software has yet to be rewritten. A full detailed article is currently being prepared for HRT in the near future, but all that is needed to receive these pictures is a) An old boat radar unit with x/y outputs, b) A small interface comprising of an A/D converter, and a PC with a spare serial port, plus the software.

During the festive season I left the 'transcanner' and computer running hoping that we may have a winter 'ES' opening. Sure enough on the 26th December 'ES' clouds were spotted over Denmark, these propagated OH1SIX on 50.025MHz at S9+ for the whole morning (also confirmed by Brian G3HBR). Unfortunately, despite numerous calls, not a single station was worked in Finland, but many OZ's were heard via M/S. On the 28th another long 'ES' opening occurred, Neil G0JHC reported Estonia, Sweden and Finland on 50MHz, down here in the south OH9SIX/KP36 was S9+, and LA1IC/J059 was very strong, not very much activity probably due to the fact that "who would think of turning the radio on during the festive season?" Later that day, at around 1800z, Polish stations were reported on 50MHz via 'ES'.

Snippets

A new station will operate from Casey Base Antarctica, OC53mm during the (Australian) summer 1994/95. VK0IX departed from Hobart on October 17th and has 6m equipment with him. The beacon VK0IX on 50.200MHz FSK is now operational. The location is 4000km south of Perth and can be worked via auroral-E extensions from certain areas of VK. The possibility of contacts with Europe seem rather distinct.

Cards from Bulgaria seem to be difficult to obtain. One station who returns a quick QSL is Savi Dimitrov, and he can be found at PO Box 23, S Boninica 3840, Bulgaria.

Mike VE9AA would like to alert Northern Europeans to the fact that Transatlantic Auroral Es QSOs should be possible during major events.

Mike has had great success working extreme west coast North American stations in call areas VE7/VE6/W7/KL7. He has also copied 49.750MHz video from Europe during several Auroral Es openings in the last two years (W1/2/3 have also reported 49.750 at these times over the pole). Mike wonders if any Europeans stay up to listen for AE late at night? K1TOL has speculated that there maybe a transpolar path to Siberia at times (or TF/JX/OX etc.) but no one is active to confirm this. LA9ZV has reported VE2TWO (FO13), OX3VHF and others during strong Auroras.

DXCC update

New awards have been issued to the following amateurs and include firsts from the Isle of Man and France; congratulations to: VE1ZZ, GD3AHV, ON4PS, DJ3TF, G3IBI, SM7FHZ, DK2PR, F6BSJ, JA7WSZ, G3TJW, S57AN, LU3DCA, DK5UG, DJ9ON, W2BXA, JA1UIU, W3EP, OZ8RW and PE1LCH.

QSL request; Jan NL-213, an SWL from The Netherlands, would like to ask stations who have received his reports via the bureau to send him a card (especially G stations). To date 400 cards have been mailed out but only 75 returned.

Samir, OD5SK has sent a postcard from his new QTH in Saudi Arabia. Samir has recently graduated after finishing his studies at Beirut University. He is now working in the Engineering industry based in Jeddah, this move means there is no 6m activity from the Lebanon at present. Samir wishes to pass on his good wishes to all UKSMG members and promises to write again if he obtains permission to operate on HF/6m from HZ. OD5SK QSLs go via his manager KB5RA who, incidentally has a new address: PO Box 877, Harrison, AR 72602-0877, USA.

R3VHF

The radio station callsign R3VHF belongs to the Nizhny Novgorod Regional Centre of Technical Creation. The amateur radio club began its work in 1947. Its first callsign was issued in 1958 and was 056055. Later calls have included RA3KON, UA3KON, UK3TAC, UZ3TXA, UZ3TXB and more recently, new calls of RZ3TXA and UA3T. The callsign R3VHF was issued to the VHF

Committee of Russia for use on VHF nets and for experimental QSO work. Thanks to the personal assistance of the President of SRR, Valery Agabekov (UA6HZ), a licence was received for the 6 metre band for amateur radio communication by R3VHF between May 15th and November 1st 1994. R3VHF was very active on Six between May and August from locator LO16XG, making over 600 QSOs with 38 countries in 154 grid squares, best DX included 5T5JC and JY7SIX.

Their equipment consisted of a home made transceiver (28MHz) plus a transverter using the RA3TES (15w PEP) design, and a five element rotatable yagi. What is expected in 1995? In spite of the economic problems in the country, the VHF Committee of Russia plans to build complex VHF radio equipment for use on expeditions and for 6m. They plan to go to the many 'white spots' on the map in their country, adding that documents regulating the use of 6m will soon be worked out. Due to the TV broadcasting on the first channel in many regions of Russia, there will be many problems to solve. It is also planned to have a beacon running soon on 50.043MHz, transmitting the call "R3VHF Beacon...".

News from Spain

Jorge EA2LU/EH2LU writes to inform readers that permission ended on July 27th 1994 for Spanish permit holders to transmit on six. All stations must now re-submit an application (the closing date was 29th November 1994) for a new permit covering 1995. The rules and regulations are unchanged, however the number of permits to be issued in 1995 will increase from 2 per 1000 Class 'A' amateurs to 5 in every 1000. All Class 'A' amateurs are invited to submit applications and those previously not active on six will be given first option. This could result in established stations on the band not being permitted to transmit, while allowing newcomers a taste of the band. Jorge also suggests any station heard on six after 27th July and up until November 29th (at least) was not authorised. Thanks to the UKSMG, and others for the information and news that was sent in.

News and views please to; *Geoff Brown, GJ4ICD, TV Shop, Belmont Rd, St Helier, Jersey. Channel Islands JE2 4SA, or phone/fax 01534 77067.*

Satellite Rendezvous



RS-15 is up at last. It looks like launch was from Baikonur about 0300utc on 26th December 1995; it was first heard by chance in London between 1124-1152utc that day. RS-15 was launched by the "Rokot" vehicle which is based on the SS-19 ICBM booster (1st and 2nd stages) plus a new third stage known as "Briz."

The satellite is spherical, about 1m diameter weighing approximately 70 kg (with the same body as RS-3 to RS-8). On board are a transponder, two beacons, CW-broadcast bulletin board (2kb), a control system and a telemetry system. The satellite has no orientation or stabilization system.

All the electronics on board were designed and built by a group of amateurs from Kaluga town (180km south west of Moscow). Full control of RS-15 as well as RS-10/11 and RS-12/13 is implemented by the RS3A control station in Moscow.

The orbit is not sun-synchronous so you won't see it at the same times every day. Based on present data the orbit precesses by a small amount daily; in a month's time the passes will come up about seven hours earlier than they do at present.

The telemetry seems to be composed of sixteen groups with the callsign RS15 as a separator, groups consist of three letters and two figures. I have also heard high-speed telemetry which *might* be the 1100 baud speed that fits the cassette port on some Russian computers. High-speed seems to be sent on ground command - it doesn't come down regularly.

The transponder has been on, but the throughput has sometimes been weak. At other times the satellite is very sensitive, and the noise floor is clearly audible. 10W ERP gave G3IOR 6db over noise on the downlink. Certainly no more than 100W ERP (10W to an 8ele) is needed, but RS-15 is currently tumbling and toppling, showing spin fading rather like AO-13 does; despite the lack of stabilization, this should slowly reduce.

Oscar 13 schedule

James Miller G3RUH of the AO-13 Command Team announces the

Richard Limebear G3RWL with the AMSAT-UK news including the new RS-15 satellite

following planned attitude schedule for Oscar 13 during 1995:
Feb 20 1995 to May 22 1995, 230/0;
May 22 1995 to Jul 31 1995, 180/0;
Jul 31 1995 to Oct 30 1995, 230/0;
Oct 30 1995 to Jan 1 1996, 180/0;
and beginning Jan 1, 1996, 230/0.

James points out that there is *no* alternative to this. It is necessitated by the fact that the Sun aligns with the apogee/perigee line twice per year. If they were to keep the satellite's attitude at 180/0 the solar panels would receive no sunlight during these periods.

Continuous up to date information about AO-13 operations is always available on the beacons, 145.812MHz and 2400.646MHz in CW, RTTY and 400 bps PSK.

Digital Satellites

I2KBD announces that the new command stations IK2VOO and IK2OYD have successfully reloaded IO-26 with the high level code IHT, and started it. Whole Orbit Data collections have been started and dumped to ground, allowing controllers to get a complete status of the satellite which is in good health. Transmitter B (435.822 MHz) is in operation and the digipeater is sometimes ON. Broadcast bulletins from the spacecraft provide information on current spacecraft operations.

KO-25 has crashed a couple of times and is now in the final stage of being reloaded. It is possible to get downloads between the 'ticks'. KO-23 also crashed a few times. At the time of writing the spacecraft is operational for downloads only. KAIST are still investigating both crashes.

UoS satellites

UO-11 has been receiving some work from UoSat Control and most of the anomalies have now been ironed out. A new version of the Diary has been uploaded and they are now able to restore the scope of services provided by UO-11. Changes have been made to the operational schedule of the spacecraft as follows:

1) The following 10 minute cycle has been programmed into the forth diary:

- 90 seconds - binary telemetry
- 120 seconds - binary WOD
- 60 seconds - ASCII bulletin
- 30 second - SEU dump
- 90 seconds - ASCII telemetry
- 120 seconds - ASCII WOD
- 60 seconds - ASCII bulletin
- 30 seconds - engineering blocks

2) The 'S' band beacon has been switched on. The unmodulated carrier is located at 2401.5MHz

3) The ASCII bulletin will be updated on a regular basis with material of a general interest to amateur satellite users worldwide. This activity is conducted jointly between UoSAT and AMSAT-UK and it is hoped to make uploads such that a new bulletin will become available before each weekend. 4) 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.

'WiSP' program

Chris Jackson, ZL2TPO, author of 'WiSP', the Windows Integrated

Satellite Program reports that there is a 'bug' in the GSC file. Users of GSC version 0.85 or older will find the schedule window filled with dates showing the year 1970. Users of version 0.86 will not get any pass schedules for the month of December.

The only way a user can correct the problem is by updating his/her version of the Ground Station Control (GSC) program. Versions of GSC older than V0.86a will not work during December due to a bug with one of the time routines. The MSPE program has also recently been upgraded. The latest versions of all WISP files can be obtained from the Amsat-UK BBS (0181 547 1479, set for 8N1). Thanks to Ken G4FIP who made sure that the latest versions of MSPE (099) and GSC (086C) were uploaded there.

Amsat-UK news

Ron Broadbent, G3AAJ, Honorary Secretary of Amsat-UK has been awarded an MBE for services to Amateur Radio in the New Year Honours list. Ron will receive his award from the hands of Queen Elizabeth II at a ceremony at Buckingham Palace later in the year. (We intend to obtain a photograph of Ron, complete with top-hat and tails, at the Palace, and to put it on the cover of Oscar News.)

The RSGB presented Amsat-UK with £3000 at the recent AGM but that only buys a few gallons of fuel for the Ariane-5 rocket (no, they don't get quad stamps over 10 gallons!). If you're interested in amateur satellites and haven't yet supported the amateur satellite movement, please consider doing so via AMSAT-UK, because at the time of writing (late Dec 94) we're still £250,000 short for the flight charges - have you won the lottery recently?.

A date for your diary; the Amsat-UK Colloquium '95 takes place from 26th to 29th July.

For further information about Amsat-UK contact: AMSAT-UK, c/o Ron Broadbent, 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.

Keplers

The latest Keplers are available on request from the HRT Editor, send an SAE marked Keplers together with the original corner flash from this page, to; Ham Radio Today Editor (Kepler Lists), Nexus Specialist Interests, Nexus House, Boundary Way, Hemel Hempstead, Herts HP2

7ST. When asking for Keplers please state either *all amateur* satellites or *all satellites* (about 200) are required - in the latter case you'll need to enclose at least an A5 sized SAE. Keplers for all amateur satellites are also available by fax on the HRT faxback and information service on 01703 263429.

RS-15 downlink frequencies

Downlink: 29.354-29.394MHz - up to 5W
Beacon 1: 29.352.5MHz - 0.4/1.2W
Beacon 2: 29.398.7MHz - 0.4/1.2W

Amsat P3D Bandplan

Downlink	Digital passband	Analogue passband
10m	29.330MHz (+/- 5kHz)	%
2m	145.955-145.990MHz	145.805 - 145.955MHz
70cm	435.900-436.200MHz	435.475 - 435.725MHz
13cm	2400.650-2400.950MHz	2400.225 - 2400.475MHz
3cm	10451.450-10451.750MHz	10451.025 - 10451.275MHz
1.5cm	24048.450-24048.750MHz	24048.025 - 24048.275MHz
Uplink		
15 m	none	21.210 - 21.250MHz
2 m	145.800-145.840MHz	145.840-145.990MHz
70cm	435.300-435.550MHz	435.550-435.800MHz
23cm(1)	1269.000-1269.250MHz	1269.250-1269.500MHz
23cm(2)	1268.075-1268.325MHz	1268.325-1268.575MHz
13cm(1)	2400.100-2400.350MHz	2400.350-2400.600MHz
13cm(2)	2446.200-2446.450MHz	2446.450-2446.700MHz
6cm	5668.300-5668.550MHz	5668.550-5668.800MHz

Note: all receivers are inverting

Beacons:

Down	Beacon-1	Beacon-2
2 m	none	none
70cm	435.450MHz	435.850MHz
13cm	2400.200MHz	2400.600MHz
3cm	10451.000MHz	10451.400MHz
1.5cm	24048.000MHz	24048.400MHz

Note: Beacon-1 (former GB) and beacon-2 (former EB) support command access and will be modulated in 400 bit/s BPSK AMSAT-format and possible other modes (CW, RTTY). NB. Due to limitations within the IF-matrix and 2m bandwidth there will not be any beacon on 2m.