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HAM RADIO TODAY

HAM RADIO TODAY VOLUME 13 NO.10 OCTOBER 1995

REGULAR COLUMNS

REVIEWS

FEATURES

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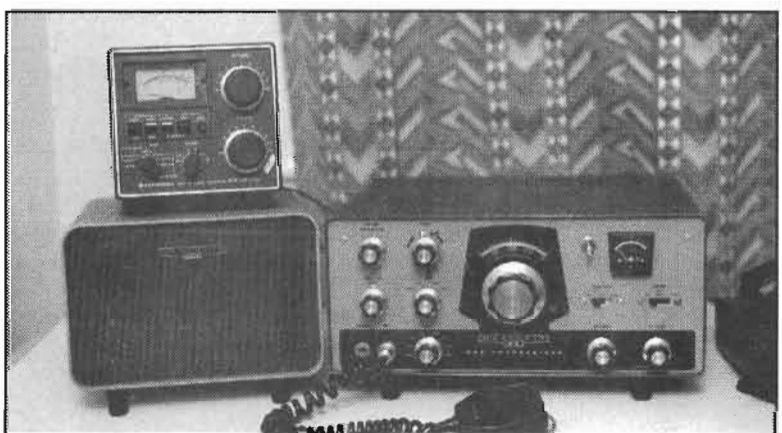
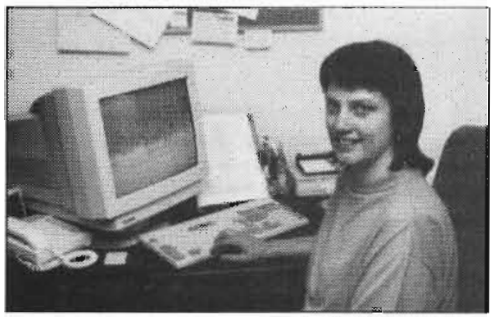
NEWS & VIEWS



The Heathkit HW-100 Transceiver



CQ de G8IYA

Editorial

We all face challenges, some large, some small, but all worthwhile

What made *you* become interested in amateur radio? For some readers, it's purely a *pastime*, but more often than not it's a personal *challenge* as well, at least in part. The RAE and Morse test are certainly examples of these. But often this is just the *first* challenge that many of us decide to take on. If you're a HF operator, then DXCC, i.e. working and confirming contact with at least 100 different countries, is often the next step. It's something to strive for, something which gives a great feeling of personal pride in achieving. VHF and UHF operators often face different, sometime technical, challenges. Getting that ex-PMR rig you bought for a few pounds at last week's rally, and successfully operational on packet, is an typical example. At the other end of the scale, managing to work all continents on EME (Earth Moon Earth) is another, possibly 'ultimate', challenge. If you're the first to work the US from the UK on 2m 'terrestrial modes' you'll even get a nice Waterford Crystal Brendan Trophy from the IRTS. Who will that be? Others get pleasure in the technical challenges in building amateur radio hardware, often for others in our hobby to use. Like repeaters, beacons, even satellites. Some amateurs are helped by their career, some are helped into a successful career from their work in amateur radio. I was very pleased to hear that Professor Martin Sweeting, G3YJO, Chairman of AMSAT-UK, has been awarded the high accolade of one of the Royal Academy of Engineering's inaugural silver medals, for his for outstanding personal contributions to British Engineering, in work with microsatellites. Ron Broadbent G3AAJ, the hard-working Secretary of AMSAT-UK, was recently awarded the great honour of an MBE.

Phase-3D

As I write this, I see that European Space Agency officials have confirmed that the launch of Ariane 502, the mission on which our Phase-3D AMSAT satellite is manifested, is set for the 29th May next year. This satellite will bring worldwide VHF and UHF communication to the reach of many more amateurs, large beam aerials will no longer be necessary. But someone has to pay for the hardware. There are lots of amateurs who've devoted hundreds of hours of their time on this, and some us put our hands in our pockets to help fund Phase-3D. But if it's going on the launch rocket, it needs to be paid for.

AMSAT-UK recently sent a mailshot to almost 700 amateur radio clubs and societies, asking if the club would consider giving a voluntary donation to help secure this part of our future hobby interests. The response I'm told hardly covered the cost of the stamps. *Give your club secretary a boot!*

Alternatively, how about having *your callsign* etched onto a metal plate carried on board the spacecraft? Cough up a reasonable donation, to AMSAT-UK (see this month's *Satellite Rendezvous*), and your callsign can be up there. Don't 'leave it to someone else'. If you work for a commercial company, your company's name could be up there. Think of the publicity! We all enjoy challenges, so how about the challenge of helping our future?

'Total Ham' cover disk

You probably won't have had to look too far to see there's something extra on this month's cover. Our last cover disk promotion was a huge success, and the feedback obtained from this has managed to secure another such promotion, for this month's cover and for next month's issue. What's on next month's disk? You'll have to wait and find out - but it'll be something of interest to *every* reader!

As for this month's disk contents, you'll find the fully-functional shareware program, ***Total Ham***. In fact it's the latest shareware version to this to be released, and it offers a complete record-keeping system for your station.

Also on the disk is the 'successor' to Total Ham, appropriately named ***Total Ham Plus***. This goes considerably further than *Total Ham*, by also offering such enhancements as computerised rig control, packet radio and DX Cluster terminal access, and the like. This program is limited to 100 log entries, however it's otherwise again a fully-functional program, as a 'try it to see if you like it' program for ham radio. I hope you enjoy using the programs.

With each issue of HRT, as a service to readers, we offer a 1.44Mb HD 3.5in disk packed full of the very latest ham radio software, every single month. These are available *only* to HRT readers, as a 'thank you' for buying or subscribing to the magazine. If you'd like to make sure *you* don't miss out on next month's front cover disk, and subsequent software offers, then why not call our subscriptions hotline for details of the latest HRT subscriptions offer - their details are featured every month in the 'who's who and what's what' section of HRT.

Disk problem?

If you have any problems in running the cover disk on your PC, i.e. on-screen text such as "Error reading Drive A", then return your disk to; *Readers Offers, Nexus Specialist Interests, Nexus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST*, and you'll receive a free replacement in the post. If you have any problems in running the programs themselves, which are of course beyond our control, you should contact the software author/program originator, these details are given in the documentation files on the disk.

Have you missed out?

If you've missed out on past issues, then don't worry! In this month's issue you'll see details of the past software offers we've featured, and for this month and next month *only* (providing you enclose the relevant 'corner flash' as proof of readership) you can take advantage of ordering *any*, or *all*, of the disks you've missed! Full ordering details are given in the 'Software Offer' section.

Please note that this software offer is totally separate from the 'cover disks' - you should contact our Readers Offers Dept. at the Hemel Hempstead office for a replacement cover disk if you have any problems. Have fun!

LETTERS

Dear HRT,

At our radio club we believe that all Rally Organisers should help each other and publicise each other's events. This helps with publicity for everyone (especially the smaller clubs etc.) and also helps avoid rally date clashes, which can be a disaster for smaller clubs, and has even lead to the cancellation of a few events recently. For this reason, on the back of the leaflets we distributed at the beginning of June, to advertise our rally due to be held in August, the club included a list of all the other rallies we knew of going on in our area over a four month period (June to September).

If we all helped each other it would help the attendances at rallies generally, as financing, advertising etc., can be a problem for smaller club rallies, and of course without their rallies the clubs would struggle to survive. Maybe there ought to be a national body (RSGB?) that could coordinate the rally calendar, avoiding rallies on the same date in the same area, which would help rally organisers when looking for a date etc. Long live the local Club Rally, a dying breed.

Yours sincerely,
Ian Cooper, G0BMS,
Hon. Secretary, Kings Lynn ARC

Testing the water

Dear HRT,

I am writing to 'test the water', if you'll forgive the expression. I am at present involved in CB radio, but I am looking forward to starting an Amateur Radio course at an evening class in a local college in the next few months. The reason that I mention all this is that I would like to find out the opinions of some of your readers to CB radio. Years ago, there seemed to be a lot of mistrust between the amateur fraternity and CB'ers in general, but I wonder how this has changed over the past 13 odd years that CB has been legal in this country. I am quite aware that a few amateurs came up 'from the ranks' of CB radio into the Amateur Radio hobby. I believe that a few are still involved in CB radio, in one way or another!

Quite a few amateurs see CB radio as quite a non-technical radio hobby as compaired to Amateur Radio. This is quite true in many respects, but there are quite a few CBers who can 'turn their hand' to quite technically complex subjects! Many CBers wrongly see Amateur Radio as an elitist and exclusive hobby, but I have found myself through friends and acquaintances, that this is not the case. Most of the people that I have heard on the amateur bands seem very down to earth.

73 from myself in Glasgow. Take care and may Amateur Radio and HRT go from strength to strength!!

Yours faithfully,
Ian McCallum

Editorial comment;
Judging by the huge amount of letters we get on this subject, it seems to hit a 'raw nerve' in most people. Many amateurs have naturally come into the hobby through CB, and it's good to see that opinions are changing.

Dear HRT,

With reference to G4XPP's letter (Jul 95), whilst I agree with most, I feel there is a code of conduct with Amateur Radio. Where this country falls down is enforcement, the same as it does with the rest of it's laws. In the US, we have a code of conduct which is refered to as the Amateurs Bible, we all know and abide by it, not by gentlemans agreement, but by law.

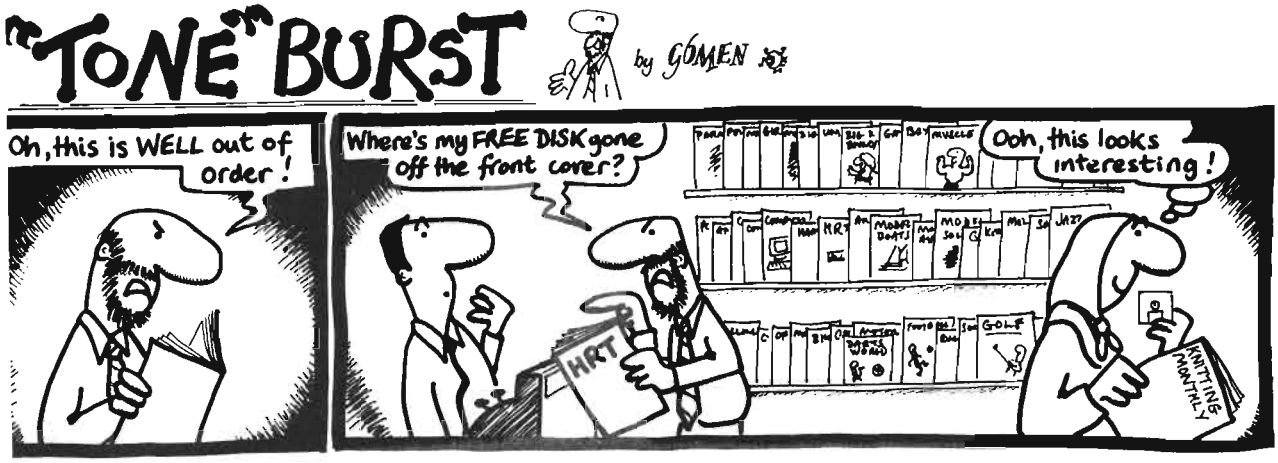
The set of rules, whilst not being a part of the FCC rules, do cover the main parts of FCCruling in Ham terms, so, are enforcable by law and are enforced. It doesn't matter if a judge feels that the general language used on our streets has fallen to a four letter average, so therefore it is not wrong to use on radio. In the US, the rules say it is wrong, break them, loose your licence, end of story.

As far as homebrew equipment is concerned, being into electronics, I enjoy building electronic equipment. I am at present building a CW transceiver, my only reservation is the drift in frequency, that can be minimised by adding additional circuitary. My grey box (boxes being grey in the States) doesn't drift and I hate having to tune my RIT whilst in QSO with a home brew contact that is drifting. Whilst I say best of British to the homebrewer, OK if you don't have a rig and that is your way onto HF, otherwise, practice on test equipment, which, you will need to build a decent rig. When you have it down and you have built all you need to test your radio, go to it and build one that doen't drift all over the band.

Dennis Barber, G0UFS/KB8GCF

£10 for 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 (normally paid during the month following publication). So write in with your views, to; Letters Column, Ham Radio Today, Nexus, Nexus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST, or fax your letter direct to the Editor's desk on 01703 263429, or email to chris@radshack.demon.co.uk. Please keep your letters short, we reserve the right to shorten them if needed for publication. Letters must be original and not have been sent to any other magazines, and must include names and addresses plus callsign if held. Reader's views published here may not necessarily be those of the magazine



Operating standards

Dear HRT,

May I offer a view on the debate on the quality of operating amongst newcomers to amateur radio?

I cannot agree that the vast majority of CB operators are highly technically qualified, but undoubtedly there are very many who are. It is impertinent to suggest otherwise. Perhaps the amateurs might consider those who have abandoned CB have more in common with amateurs than might be supposed from the correspondence in Ham Radio Today and other similar journals.

It is quite possible that some of those who criticise new converts to the hobby were themselves guilty of some of the practices which they now, with a wealth of experience behind them, decry. Dare one suggest that, when they began, their technical knowledge was no higher than that of current newcomers.

It should not be supposed that impecuniosity is synonymous with technical ineptitude, nor that the inability, or the lack of desire, to learn Morse is any detriment to one's ability in other modes. I cannot afford the excellent equipment favoured by the more affluent, and must build from scratch, an activity I shall enjoy.

The purpose of any hobby is to derive enjoyment there from, the duty of those engaged in it is to ensure that their own activities do not mar the enjoyment derived by others. Newcomers must conform to the established practices and regulations applicable to their hobby, the skilled and experienced should help, and be patient with, the new. Those who cannot are to be pitied as they leave the hobby.

It might be asked by what qualification I venture into print on this issue. At 77 years of age I am studying at evening classes with a view to eventually taking the RAE examination, following service as a First Class Wireless Operator in the Royal Corps of Signals (Morse test speed; 28WPM for three 15 minute periods each in sending and receiving in a 90 minute test), followed by 17 years in the Royal Naval Auxiliary Service as a Chief Communicator (systems used: W/T,R/T,RTTY,V/s by lamp, semaphore, International Code flags, Morse flag and, on one memorable occasion, by smoke), an instructor in Morse, operating procedures and wireless theory in both services, and a degree in Mechanical Engineering. I need the RAE in order to join the ranks of the amateurs. You may be able to name others amongst your readers in similar need.

D.T. Carr

Nothing for the men at rallies?

Dear HRT,

The letter from Mrs L. Seaton (letters June) reminded me that I must send off my annual letter of complaint to Needlework magazine. Every year I go to the Knitting and Sewing exhibition at GMEX, only to find that there are no items of interest to us blokes. No radio gear, no cars, no fishing tackle. Scandalous, that's what it is. Fashion shows are attended by those with an interest in fashion, vintage car shows attract car nuts - so why should Mrs. Seaton, who obviously has no interest in Amateur Radio, complain that there was nothing for her?

Radio rallies are not meant to be 'a family day out', they are supposed to be an opportunity for the dedicated amateur to grub around in boxes of junk, inspect new radios etc. I suspect it is pressure from ladies like Mrs. Seaton that has turned some rallies into craft fairs, more's the pity. Mind you, the thought of a gigantic cuddly toy stall instead of row after row of computers does have it's plus points....

Yours with tongue in cheek,
Andrew Howlett, G1HBE

Dear HRT,

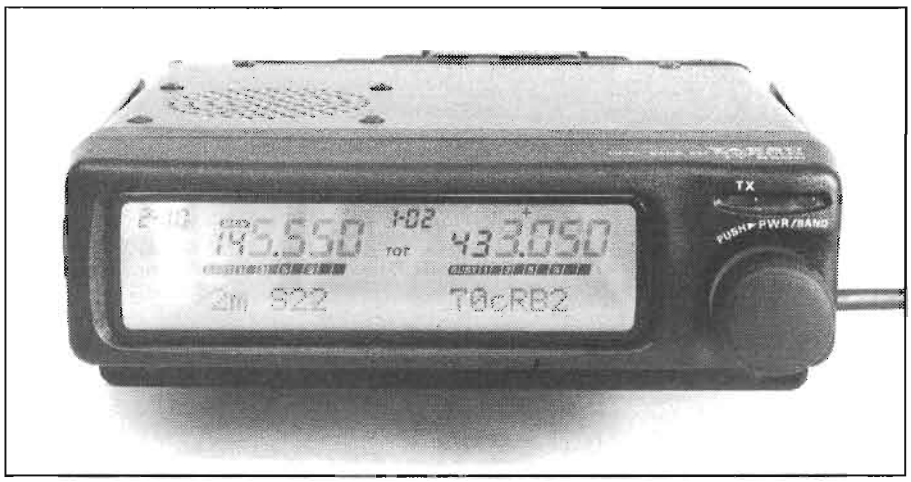
I am writing to thank you and Link Electronics for the prize of the PRO-39 scanner from the June HRT competition. You can imagine my surprize when the postman turned up with a shoe box addressed to me. Little did I know that the box would contain a scanner, as I have never won anything before. You can imagine my excitement at winning the scanner. It couldn't have come at a better time either, having just been made redundant and my 2m radio packing up, I had no radio and no funds to buy one to listen on, but better still I can listen on 70cm and 6m as well with the scanner, it's like having three radios in one. Once again thank you very much, it really made my day. I read the letter telling me I'd won about 500 times that day!

Yours sincerely,
Mr. C. Richmond, G0TOO

MORE LETTERS NEXT MONTH

Yaesu FT-8500 Review

Chris Lorek G4HCL goes into full command mode with Yaesu's new 'Smart Controller' mobile rig



Whilst browsing a UK Amateur Radio discussion group on the Internet, I came across a message header entitled "Have Yaesu Gone Mad?". Ever curious, I took a closer look, together with the many other messages in reply, and found an active discussion about the new Yaesu FT-8500, which these amateurs had seen advertised. The one point that was obvious however, was that not one of them had actually used the set. Always ready to rise to a challenge, at least one leading to something worthwhile, I thought "Better put this right". A phone call to Yaesu (UK) showed that the sets had only just arrived in the country and probably hadn't reached dealers' shelves yet (so everything was indeed 'hearsay'!). Further discussion led to a review sample of the set arriving at HRT the very next day (thanks for the timely service Barry!).

Cockpit control

The main 'talking point' was of course the 'fighter cockpit' type joystick-equipped controller, with its many buttons and knobs. Oh yes, they've fitted a microphone in there somewhere as well. Now, let's be sensible - if you want to use a mobile 'hands free' mic, then you simply use Yaesu's MEK-2 'Microphone Extension Kit' with your boom mic, headset mic, or whatever. This is a simple 'add-on' interface box, adding a screw-on mic plug facility in parallel with the push-in telephone type mic connector

used on the set. The sort of thing you'd have to use or 'knock up' with most other modern mobile rigs if you want to use a different mic!

The most significant, professionally confirmed and documented, cause of accidents when using complicated mobile radio gear on the move is looking away from the road ahead to use the controls of a set, these typically being underneath the dashboard on the set's facia. After a period of time, amateurs do get to know at least most of the set's operation by 'feel' alone, and this is something I always try to test when I review fully-featured mobile sets. The FT-8500 goes one further by bringing these controls to your hand, or to the controller mounted on the cup-shaped holder fixed to your dashboard, within sight or touch. But even without this, by using the single knob on the set itself you can switch the set on and off, and change between channels and bands - arguably the most common operations needed when you're not playing with the 'bells and whistles' of the set.

Fully equipped

The set certainly *is* full of bells and whistles, full to overflowing in fact! There are no less than 53 different sub-menus for control which you can access using the 'joystick', and from there change the functions to your liking. But added to this are 'quick access' functions which you get to by using various buttons, knobs, and other controls on the mic. For example, if you want to change to VHF to call someone, just press the VHF volume knob for a moment, you're then sure you're transmitting on 2m without the need to glance at the set's display. Likewise for 70cm. If you then want to instantly QSY to your local repeater, press the 'Home' button on the mic, and you're transported straight there, metaphorically speaking. To start scanning just one set of memory channels you've programmed, press the 'scan' button for a moment. To scan all the channels you've programmed in, keep the scan button held down for a second instead. If you find a busy channel during the scan that you'd like to ignore for the time being, just hit the 'skip' button while the set's on that channel, and it'll temporarily skip it until you decide you want to monitor it again. Now, all this sounds easy, but it can take a bit of learning. You'll see later how I got on.

Features

Here's some 'hard facts' on the set, to hopefully give you an idea of at least *some* of the many features inside the box. The FT-8500 covers the 2m and 70cm amateur bands, with 50W maximum out on 2m with 35W maximum on 70cm, 'mid' and 'low' powers levels of 10W and 5W

can be also be selected. Pressing a couple of buttons gives you extended receive capability over 110-174MHz and 410-500MHz, with AM receive capability as well, e.g. for airband monitoring in countries where this is allowed. Pressing the 'RPT' button on switch-on turns the set into an automatic cross-band repeater.

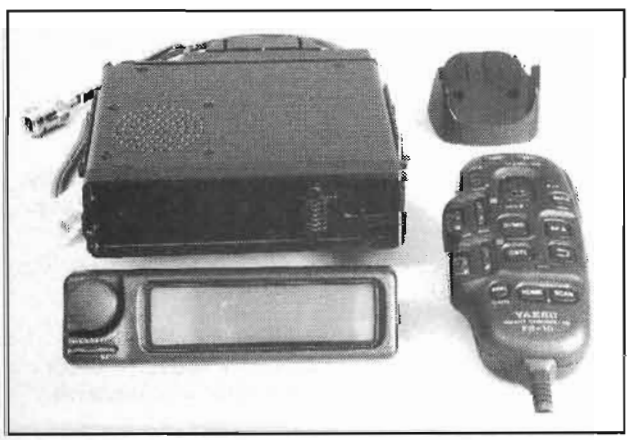
A 'Spectra-Analyzer' function gives you a graphical display of activity above and below your channel in a 'bargraph' format, a one-button push on the mic switches this in for you, and you can vary the width and spacing of the display to suit your needs. There are 50 memory channels on each band, arranged into 5 banks of 10 channels each. If you need more than 50 channels on one band but less on the other you can vary the ratio of these between VHF and UHF. As well as these, five special purpose memories are fitted for each band, one instant-recall 'Home' channel plus two sets of upper and lower scan limit channels.

If you'd like to keep your ears open on two frequencies in the same band, the FT-8500 lets you, with it's VHF/VHF or UHF/UHF capability as well as VHF/UHF operation. Here, both bands can be set to the same frequency range, so you can monitor, say, your local repeater as well as keeping an undisturbed watch on S20.

DTMF selective calling, including group and individual paging, plus short text message capabilities of up to 8 characters, are fitted. On receiving a selective call with your ID, the set either bleeps at you with variable time periods, or it can even play a melody which you've programmed in. If it receives an alphanumeric message from other similarly-equipped amateurs, it can either alert you in the same way or even play the received massage to you in Morse code - you can even select the CW speed between 5WPM and 25WPM. The mind boggles!

For repeater access, a 1750Hz tone as well as CTCSS encode is fitted, CTCSS decode is available as a plug-in option. A transmit time-out timer can be switched in, which you can set between 1 minute and 60 minutes. This can be useful as an 'anti-waffle' reminder on repeaters, as well as preventing unwanted transmissions due to a stuck mobile mike PTT (it happens - sometimes in embarrassing situations as one amateur found to her cost on GB3PI!). The set can also be made to operate as a cross-band repeater in it's own right, by pressing the 'RPT' button when switching on. The various selective call facilities can also be enabled in this mode for 'private access.

The upper section of the set's front panel display indicates the channel and frequency, the lower section is a 'dot-matrix' type for the spectrum analyzer display and various text messages, including short alphanumeric 'channel names' which you can, if you wish, display along with the frequency etc.



The rear panel of the set has a 6 pin data jack, which can be used for 1200 or 9600 baud packet as well as for computer control of the set's functions using an optional RS-232 to TTL interface. External speaker sockets allow either one external speaker with combined audio, or two external speakers having separate VHF and UHF audio.

The set measures 140mm (W) x 160mm (D) x 40mm (H) and comes with a mobile mounting bracket, a hanger plus an adjustable bracket for the controller, a fused DC power lead, and a 74 page instruction book together with block and circuit diagrams.

Getting going

I suppose the '74 page' book says quite a bit about the extent of the set's capabilities. Although I managed to get the set connected up and on the air fairly quickly, I did initially get rather confused with the set's many, many features. I must also confess to still being rather confused after having read the manual cover to cover. This wasn't through not being able to understand what the instructions meant, as Yaesu have done a good job here in explaining things clearly. Instead, it was purely down to trying to remember the large number of operating modes available. After a couple of weeks of use I was still having to look down at the alpha-numeric display to see where the joystick had 'taken' me.

This was obviously no good at all for operation on the move so, book in hand, I went through the memory programming, step by step, and 'locked' the set into this mode for mobile operation. For base station operation, I used the set's spectrum analyzer, message capabilities, multiple scanning methods and the like to good effect, but I just couldn't do this on the move! But for mobile operation the set has a number of useful features, such as selectable automatic sub-band audio muting, or reduction to a preset audio level, when you're listening to a QSO on the 'main' band. Other niceties include automatic repeater shifts on both 2m and 70cm when you've tuned to the relevant UK repeater sections in 'VFO' mode, a large flashing frequency display, rather than a tiny icon indicator, to show which band you're hearing the received audio on, and a backlit display with automatic brightness adjustment as well as a backlit keypad on the mic controller.

The front panel quickly detaches - you can easily just take this off and pop it into your shirt pocket when

leaving the car, as a theft deterrent. An optional 'separation kit' is also available, so the front panel can be mounted, for example, on your sun visor with the set under your seat.

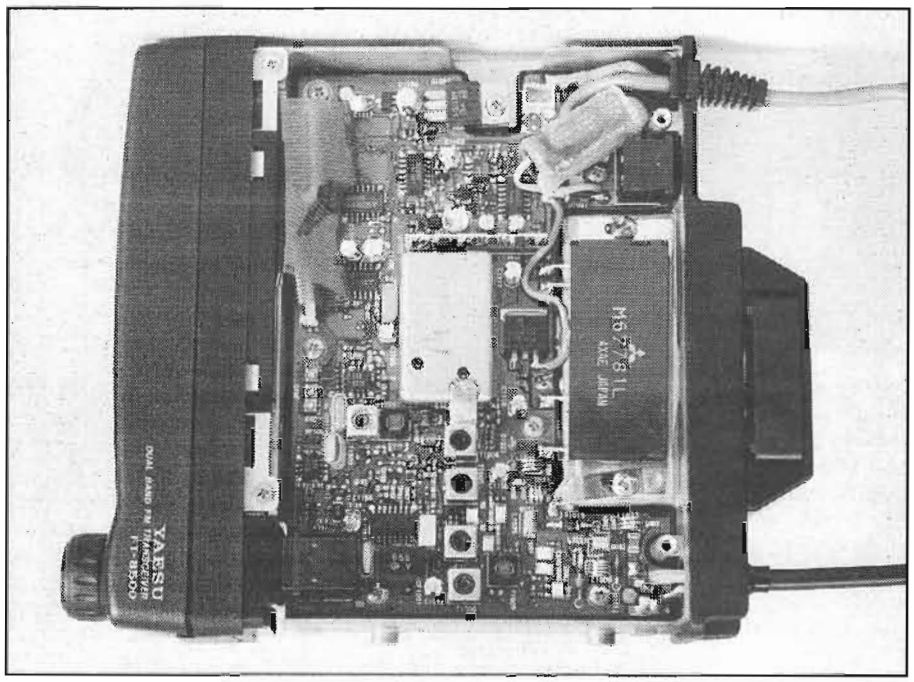
On the air

Even whilst driving around heavily congested RF area, I didn't get any problems with unwanted signal reception, such as PMR breakthrough. Many sets 'fall down' on this, for example I often can't use 2m with some mobile rigs when I drive near my local government emergency communications site.

I spent several hundred miles on the road with the set, and the rig was used by a number of other amateurs in the car besides myself to provide some 'second opinions' on audio quality etc. In all cases, the transmit audio quality was described as being very 'nasal', not good at all. Yaesu however have a documented modification to improve this, so by the time this review appears in print things should be 'sorted'.

At home, I found the operation using the spectrum display to be surprisingly useful, it certainly wasn't just a 'gimmick'. A quick press of the 'SPA' button showed me what was going on above and below my operational channel, control of the joystick then moved a small 'channel indicator' back and forth along the spectrum display, the set moving its operation frequency accordingly, which let me quickly 'home in' on a signal on the display. A further single button push then either took me back to where I started from, or centred the spectrum display on where I'd decided to QSY to. Very handy!

On transmit, a small rear heatsink cooling fan automatically came into operation the moment I pressed the PTT, remaining on for a while after to ensure the PA stayed cool. I found this worked well both on the move and at home, although I did find the slight noise a little annoying in a quiet shack. The small speaker on the top of the set wasn't up to mobile operation - instead I used a professional external professional communications speaker whilst on the move. Doing the same at home also improved the receive audio quality remarkably, although at low volume settings in a quiet shack I noticed a slight background hiss plus a trace of a high-pitched 'whine' here. A quick check with a Yaesu external speaker gave the same result, although I'm being very critical here!

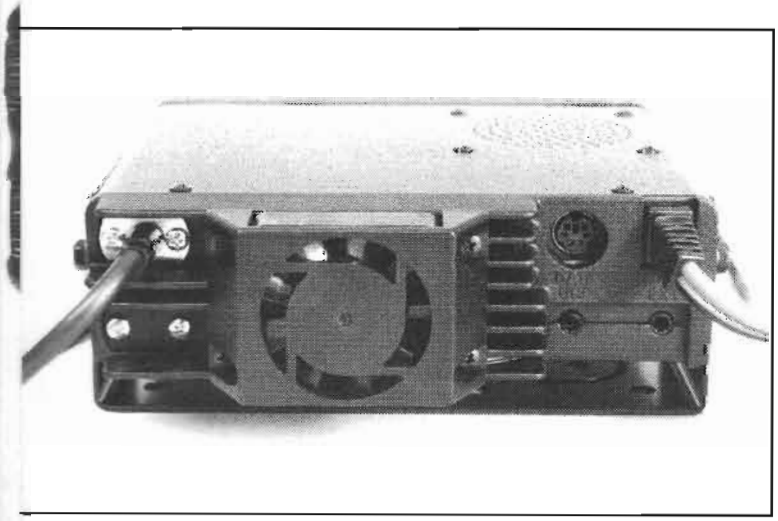


Technicalities

The insides of the set show a high standard of construction, and I was pleased to see a full circuit diagram was included with the manual. The set has a CAT (Computer Aided Transceiver) control input (the same as for data input), the manual also giving full details on all the commands, timings, etc. required if you're going to go the 'while hog' and want to write your own programs for rig control.

On receive, a dual conversion superhet is used with IFs of 45.05MHz and 455kHz on VHF, with 58.525MHz and 455kHz on UHF, to give good image rejection.

The measured lab results show a good technical performance throughout. The receive unwanted signal rejection was particularly good, and although the 12.5kHz rejection wasn't as high as some other sets, this would alternatively have probably made the set unusable for high speed 9600 baud packet, so, I couldn't complain at all here. Throughout the transmit tests the set remained reasonably cool even on extended transmission periods using high power. In all, a good performance.



Conclusions

The FT-8500 with its 'Smart Controller' mic is certainly a pioneering move by Yaesu in mobile rig control, and it will need the acceptance, or otherwise, of amateurs in deciding its popularity. As for myself, I found the rig easy to use if I wanted to use the 'basic' facilities, or filled to the brim with available 'bells and whistles' if I also wanted those, as long as I learned how to use them all!

My thanks go to Yaesu (UK) for the loan of the review transceiver.

LABORATORY RESULTS:

All measurements taken using stabilized 13.2V DC power supply and supplied DC lead, high power TX, otherwise stated.

RECEIVER;

Squelch Sensitivity;

	145MHz	435MHz
Thres;	0.11µV pd (6dB SINAD)	0.10µV pd (4dB SINAD)
Max;	0.27µV pd (26dB SINAD)	0.26µV pd (20dB SINAD)

Sensitivity;

Input level required to give 12dB SINAD;

145MHz4	35MHz
0.15µV pd	0.17µV pd

Intermodulation Rejection;

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

Spacing	145MHz	435MHz
25/50kHz;	78.0dB	65.1dB
50/100kHz;	77.1dB	70.9dB

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;

	145MHz	435MHz
+12.5kHz;	41.7dB	25.6dB
-12.5kHz;	31.9dB	36.4dB
+25kHz;	77.2dB	68.6dB
-25kHz;	78.0dB	70.4dB

S-Meter Linearity

	145MHz		435MHz	
	Sig Level	Rel. Level	Sig. Level	Rel. level
S1	0.26µV pd	-19.4dB	0.31µV pd	-18.5dB
S2	0.37µV pd	-16.4dB	0.41µV pd	-15.9dB
S3	0.47µV pd	-14.1dB	0.56µV pd	-13.3dB
S4	0.68µV pd	-11.0dB	0.83µV pd	-9.9dB
S5	1.01µV pd	-7.6dB	1.28µV pd	-6.1dB
S6	1.56µV pd	-3.9dB	1.84µV pd	-3.0dB
S9	2.43µV pd	0dB ref.	2.59µV pd	0dB ref.
S9+	3.50µV pd	+3.2dB	4.12µV pd	+4.0dB
S9++	5.89µV pd	+7.7dB	7.10µV pd	+8.7dB

Blocking;

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

	145MHz	435MHz
+100kHz;	91.4dB	80.3dB
+1MHz;	96.9dB	93.1dB
+10MHz;	94.7dB	94.5dB

Image Rejection;

Increase in level of signal at 1st and 2nd IF image frequencies, and half 1st IF, over level of on-channel signal, to give identical 12dB SINAD signal;

	145MHz	435MHz
Half 1stIF	>100dB	96.2dB
1st Image	85.1dB	83.1dB
2nd Image	>100dB	>100dB

Maximum Audio Output;

Measured at 1kHz on the onset of clipping, 8 ohm load;

145MHz	435MHz
3.38W RMS	3.47W RMS

RECEIVER;

TX Power and Current Consumption;

Freq.	*Power*	*10.8V Supply*	*13.2V Supply*	*15.6V Supply*
145MHz	High	28.3W/7.05A	46.9W/8.15A	50.3W/9.35A
	Mid	10.4W/4.60A	10.4W/4.60A	10.4W/4.70A
	Low	5.56W/3.65A	5.56W/3.65A	5.56W/3.65A
435MHz	High	19.9W/6.0A	31.1W/7.20A	31.6W/7.20A
	Mid	8.47W/4.1A	8.47W/4.10A	8.47W/4.20A
	Low	3.93W/3.15A	3.88W/3.15A	3.88W/3.20A

Harmonics;

	145MHz	435MHz
2nd Harmonic;	-78dBc	-76dBc
3rd Harmonic;	-81dBc	<-90dBc
4th Harmonic;	<-90dBc	<-90dBc
5th Harmonic;	<-90dBc	-
6th Harmonic;	<-90dBc	-
7th Harmonic;	<-90dBc	-

Peak Deviation;

145MHz	*435MHz*
4.74kHz	4.96kHz

Toneburst Deviation;

145MHz	*435MHz*
3.26kHz	3.49kHz

Frequency Accuracy;

145MHz	*435MHz*
-276Hz	-390Hz

Icom IC-T22E and IC-T42E Handhelds Review

Chris Lorek G4HCL looks at two tiny new powerhouses from Icom

There's a definite 'trend' in amateur handhelds nowadays. Gone are the square 'brick' type units, in come the new tiny, smartly styled sets complete with alphanumeric displays and keypads. The latest 2m and 70cm handheld rigs from Icom, the IC-T22E and IC-T42E, are no exception here. They're small, thin, smart, and despite their possibly complicated appearance they're also quite easy to use. Each has identical operating features, apart from the frequency coverage of course, here's a run-down of what they can do;

The IC-T22E covers the 144-146MHz 2m amateur band, likewise the IC-T42E covers the 430-440MHz band. Plus a bit more - it surprised me to find the tuning didn't stop at 440MHz - it went right up into the 900MHz range on the review model, with full receive capabilities. All I needed was a suitable transmitter and I could have possibly had a few interesting two-way cellphone conversations as well!

Back to the amateur bands, (where transmit *is* enabled), with the supplied 4.8V 700mAh nicad the IC-T22E is specified as offering a power output of 1.5W, with 1.3W for the IC-T42E, and around 5W from each when using either an optional 9.6V nicad or an external 13.5V DC supply. A switchable low power level of 500mW can also be selected in all cases.

The accompanying photographs show the control and keypad arrangements. The top panel has a click-step 'tuning' knob, with an outer concentric squelch control. For volume adjustment, you can use the panel-mounted volume up/down buttons, which vary the audio in 17 steps, alternatively the tuning knob can be used for volume adjustment by keeping the 'MONI' (squelch defeat) button pressed in and rotating the knob accordingly.

As well as changing frequency with the up/down tuning knob, you can also use the keyboard up/down button, plus the numeric buttons for direct frequency or memory channel number entry. The set has 40 memory channels, which can also store an alphanumeric channel 'tag' of up to 6 characters, i.e. a channel name as well as a memory channel number. If you don't need this facility, you can set the rig to instead have 80 'number/frequency only' memory channels. In addition there's a quick-access 'call' channel, and three pairs of scan limit channels.

Scanning and searching

You can perform quite a range of scan and search options with the set, such as an 'all memory' scan, selected memory scan, priority watch, and so on. In VFO mode, as well as an 'all frequency' scan you can search between any two programmed frequencies, three pairs of such frequency limits being available in the set's memory. Another useful facility is a 'frequency skip' function, where if the set finds a channel, or several channels, during a search which you don't want to monitor, e.g. a busy repeater or a beacon, a two-button push then stores each of these as 'skip' frequencies, into the highest empty memory channels available.

In either VFO or memory scan mode, the scan can be set to resume either after 5, 10, or 15 seconds after finding an active channel, or to remain on the channel until it becomes silent.

Selective calling and messaging

DTMF selective calling, using the same 3-digit type of calling sequence as used by several other amateur rig manufacturers, is built-in, with various 'individual' and 'group' calling and paging modes available. The set can also be used as a simple 'message pager', with a six character alphanumeric readout of DTMF paging messages sent to it by users of other compatible sets.

A 1750Hz tone encoder is fitted for repeater access, but if you'd also need CTCSS encode you'll need to fit the optional UT-94 CTCSS unit, which gives the added advantage of CTCSS decode as well for an alternative form of 'quiet channel monitoring'.

Power saving

A built-in 'battery saver' cycles the set's receive power on/off on a quiet channel, the duty cycle of this can be varied right up to 40:1. Usefully, this can be set to be automatically disabled when an external DC power supply is plugged in. Further battery saving measures include the facility to turn

the green 'busy' LED permanently off (which lights when the squelch is raised), the LCD backlight permanently off, plus an auto power-off mode where the set goes into 'sleep' mode after either 20, 40, or 60 minutes of no operational activity

Remote control mic

An optional remote control speaker microphone is available for the set, this having up/down channel/frequency buttons together with two further buttons for monitor and VFO/memory operation. A combination of the monitor and up/down buttons also lets you change the receive volume remotely with the mic. Further options include two varieties of 'normal' speaker-mics, a VOX headset, external DC power cables, plus 9.6V and 7.2V nicads and a battery case to fit four AA cells.

The set comes supplied with a BP-171 4.8V 700mAh nicad, belt clip, carrying strap, plug-in AC wall charger, 42 page instruction manual, and a small pocket-sized 'fold-out 'operating guide' to act as a 'memory jogger' of the set's operating modes and functions when you're out and about. The set measures 57mm (W) x 110mm (H) x 27mm (D) with the BP-171 battery fitted. Each set comes with a similar looking rubber set-top aerial, the difference just being the frequency band of operation. This is fitted with a BNC connector, thus allowing external aerials to be connected easily for base and mobile operation.

In use

As soon as I'd opened the boxes, I found the rigs to fit very comfortably into my hand - someone's obviously done their homework here! I found memory programming was quite easy, and I quickly filled up around 30 channels in each set with my most commonly-used frequencies. I was pleased to see that, when I'd initiated memory 'scan' mode (as I usually do when walking around with a handheld), after switching the set off and then on again some time later, it automatically started scanning again without me needing to start hitting various buttons, which I appreciated. I must however confess to not liking the volume up/down buttons, I'd have preferred a dedicated volume knob instead.

Out and about, both of the sets operated quite well, although I found the 2m set a little less sensitive than some others I'd tested - surprising considering the lengthy aerial. I could still of course hear distant repeaters perfectly well when the set's low power wouldn't even let me access them, so I can't complain! The 70cm set brought in plenty of signals - here the extended aerial length (around a full-length quarter wave) must have helped somewhat. On repeater channels, the 'Moni' button usefully switched to the repeater input frequency, to act as a quick check to see if a direct contact was possible - again very useful.

At night, I found that a press of any keypad button, or adjustment of the click-step tuning knob, brought the timed LCD backlight into operation, again saving a few more 'button pushes - the LCD itself being very readable with large, easily-seen digits. The bargraph S-meter often seemed to be either reading nothing or full scale most of the time, with rather little signal range in between, but I find this is common to a number of handhelds.

With the sets at home, operating into my rooftop 2m/70cm colinear as well as tower-mounted 2m and 70cm beams, the only problem I noticed was a very slight degree of paging breakthrough when operating on some 2m channels. However this was only just enough for me to turn the squelch up a little higher when scanning (unlike some other handhelds which simply 'curl up' from such breakthrough and totally disrupt all operation! Each set worked well on packet, with the battery saver disabled to prevent missing the beginning of some packets, the automatic 'disable' facility with an external supply was very useful here. However when powered from an external 13.8V DC supply, long 'ragchews' did cause the set's case to get fairly hot due to the higher resultant transmit power, which isn't surprising. I usually had to switch to low power in such cases, or alternatively just keep my overs shorter!

Overall, the sets operated quite well, with no major problems at all, and with just enough nice 'features' to enable them to be easy to operate without having to constantly refer to the instruction book each time.

Lab tests

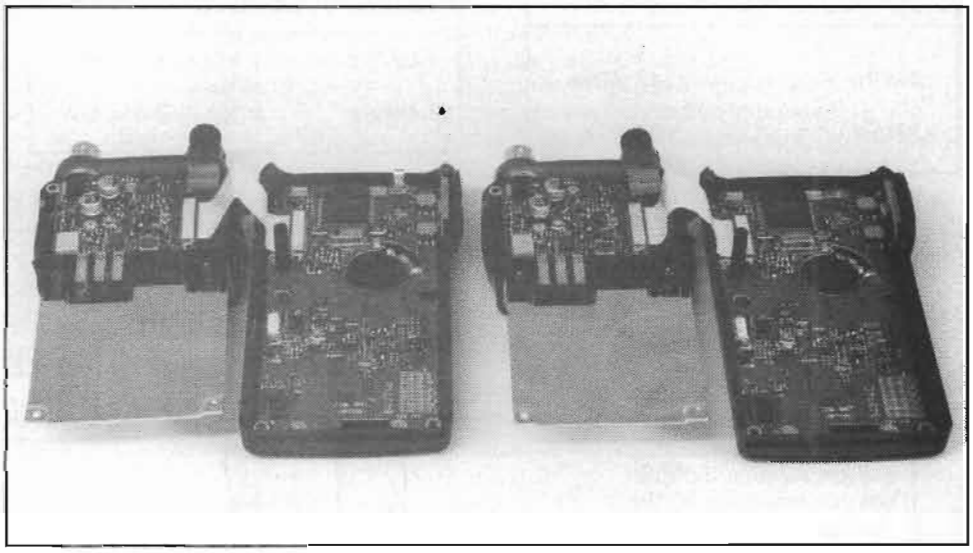
I found each of the receivers to be fairly sensitive, the strong signal rejection being quite adequate for a handheld. The slight breakthrough I received on 2m was apparently a 'half IF' effect on spot frequencies rather than any overall blocking limitations or whatever.

On transmit, each set gave a respectable amount of power - each uses an FET PA stage for high output power and good efficiency for a given voltage. A point to note here is that spare battery packs are of course rather cheaper for a given transmit power than in the 'old days' of higher voltage packs, something to bear in mind! The transmit harmonics were also quite well suppressed, no problems here.

Conclusions

Icom's new single-band handhelds offer smart styling, a good technical performance, and enough 'bells and whistles' to make them useful and quite flexible without being overcomplicated to operate. I found they worked well on the air, they fitted nicely in my hand, and above all they were reasonably easy to operate despite their 'fully-featured' operability. The pricing seems very competitive indeed, although note that CTCSS doesn't come as 'standard' in UK models.

The IC-T22E and IC-T42E are priced at £259.00 and £269.00 respectively, with the UT-94 optional CTCSS unit at £32.00. *My thanks go to Icom (UK) for the loan of the review equipment.*



LABORATORY RESULTS:

All measurements taken using fully charged 4.8V nicad as supplied, high power TX, unless otherwise stated. 145MHz figures refer to IC-T22E, 435MHz figures refer to IC-T42E.

Sensitivity;

Input level required to give 12dB SINAD;

145MHz	*435MHz*
0.14µV pd	0.15µV pd

Maximum Audio Output;

Measured at 1kHz on the onset of clipping (10% distortion), 8 ohm load;

145MHz	*435MHz*
145mW RMS	163W RMS

S-Meter Linearity

	145MHz		*435MHz*	
	Sig Level	*Rel. Level*	*Sig. Level*	*Rel. level*
S1	Sq. open	-	Sq. open	-
S3	0.46µV pd	-5.6dB	0.51µV pd	-6.5dB
S5	0.53µV pd	-4.3dB	0.62µV pd	-4.8dB
S7	0.68µV pd	-2.1dB	0.86µV pd	-2.0dB
S9	0.87µV pd	0dB ref.	1.09µV pd	0dB ref.
S9+	1.27µV pd	+3.3dB	1.68µV pd	+3.8dB
S9++				

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;

	145MHz	*435MHz*
+12.5kHz;	29.2dB	31.4dB
-12.5kHz;	26.5dB	16.9dB
+25kHz;	61.1dB	56.2dB
-25kHz;	61.3dB	55.0dB

Squelch Sensitivity;

	145MHz	*435MHz*
Threshold;	0.11µV pd (7dB SINAD)	0.10µV pd (6dB SINAD)
Maximum;	0.24µV pd (23dB SINAD)	0.22µV pd (21dB SINAD)

Current Consumption

	145MHz	*435MHz*
Standby, squelch closed;	45mA	54mA
Receive, mid volume;	77mA	86mA
Receive, max volume;	145mA	152mA

Blocking;

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

	145MHz	*435MHz*
+100kHz;	75.2dB	68.1dB
+1MHz;	90.2dB	80.0dB
+10MHz;	94.1dB	77.6dB

Image Rejection;

Increase in level of signal at 1st and 2nd IF image frequencies, and half 1st IF, over level of on-channel signal, to give identical 12dB SINAD signal;

	145MHz	*435MHz*
Half 1st IF	71.1dB	56.1dB
1st Image	68.3dB	61.4dB
2nd Image	>100dB	>100dB

Intermodulation Rejection;

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

Spacing	*145MHz*	*435MHz*
25/50kHz;	62.6dB	54.1dB
50/100kHz;	63.3dB	54.9dB

TRANSMITTER

Peak Deviation;

145MHz	*435MHz*
5.06kHz	5.27kHz

Toneburst Deviation;

145MHz	*435MHz*
3.48kHz	3.64kHz

Frequency Accuracy;

145MHz	*435MHz*
-15Hz	-320Hz

Harmonics;

	145MHz	435MHz
2nd Harmonic;	-75dBc	-62dBc
3rd Harmonic;	-72dBc	<-90dBc
4th Harmonic;	<-90dBc	<-90dBc
5th Harmonic;	<-90dBc	-
6th Harmonic;	<-90dBc	-
7th Harmonic;	<-90dBc	-

TX Power and Current Consumption;

Tested with stabilised 4.8V and 9.6V DC supply applied directly to battery connection terminals, and external 13.2V DC applied to ext. power connector.

Freq.	*Power*	*4.8V Supply*	*9.6V Supply*	*13.2V Supply*
145MHz	High	1.97W/1.04A	5.25W/1.57A	5.25W/1.65A
	Low	320mW/480mA	340mW/440mA	340mW/500mA
435MHz	High	1.56W/1.00A	4.57W/1.32A	4.62W/1.25A
	Low	480mW/460mA	500mW/420mA	520mW/510mA

The Heathkit HW-100 Transceiver

Ben Nock G4BXD describes a popular secondhand set that's ideally suitable for those new to the hobby or on a tight budget

The HW-100, belonging to G0GGV, and SB-600 speaker with HP-23 PSU inside

The Heathkit HW-100 transceiver is a slightly earlier version of the SB-101 detailed in the April 95 edition. Basically a low cost version of the same transceiver design, this set again is ideally suitable for those on a tight budget or new to the hobby.

The Heathkit HW-100 HF transceiver, incorporating a double conversion receiver section, is a valved, table top set. It's designed for mains operation and covers the 80, 40, 20, 15 and 10m amateur bands in 500kHz sections, four of them on 10m, with CW and SSB modes.

The layout and component count is similar to the SB-101, but of course I should say that the other way around. The SB-101 closely resembles the HW-100, and more so its following set, the HW-101.

The Heath Company was started by Edward Heath (!) in Benton Harbour, Michigan, after the second world war. Starting in the selling of war surplus equipment, the company soon progressed to producing kits of test equipment and amateur gear.

The set was marketed in the UK by the Gloucester based Daystrom Ltd., a member of the Schlumberger group, and was intended as a kit, though it could also be bought pre-built. The performance of any HW-100, and for that matter any Heathkit gear acquired, must depend to a large extent upon the soldering abilities of the original assembler. However, all the Heathkit products came with a very comprehensive instruction and assembly manual, ensuring even the amateur constructor a good chance of a worthy finished item.

The style and general appearance of the set is again very smart, a light and dark green fascia with a dark green coloured perforated case and dark green and silver knobs. The appearance of the HW series as against the SB series is somewhat square. The perforated case is very square with vertical sides.

The set, utilising some 20 valves, has provision for normal PTT operation, from the mic, or VOX operation including the usual features, anti-trip etc. As on the later set, there are no provisions for a PTT override, one has to hold the button continuously. The various VOX controls are located along the right hand side, somewhat difficult to reach and adjust if the set is boxed in on the shelf amongst other items.

The mains power supply, the HP-23B, was also used on the SB set, producing 800V HT, 300V HT, -100V HT for biasing and muting, and 12.6V AC for the heaters.

Again, as on the SB-101, the S meter is only switched in when the front panel METER switch is set to ALC. On receive the meter acts as the S meter and on TX as the ALC level indicator. To monitor the PA current on transmit, the METER switch has to be set to extreme right position.

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 8.895 MHz. 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 filter is in the 3.395MHz side, which is also the initial sideband generation frequency, the filter being used in both the receiver path and the transmit path. The SSB filter gives a quoted selectivity of 2.1kHz at 6 dB down, 5kHz at -60dB.

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

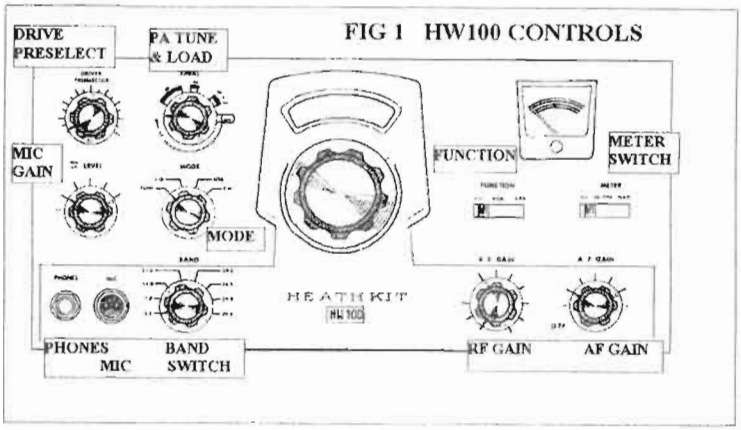
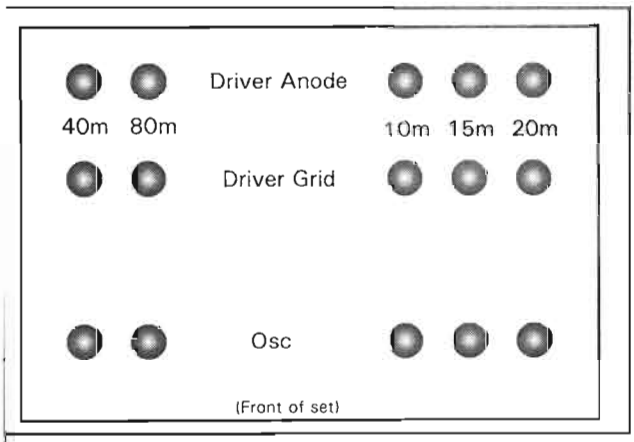


FIG 1 HW100 CONTROLS

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.



The set is very nice to operate, the drive mechanism on the reviewed model was slightly coarse but was still quite acceptable. The tuning rate is reasonable and the readout accuracy is better than 500Hz, more than adequate.

For those more familiar with the broadband outputs of modern equipment, the PA stage does require adjusting for each band used, and if a large change of frequency on any band occurs. Tuning up is straightforward though. Switch to TUNE, and adjust the mic gain control until the PA current starts to increase, then adjust DRIVE PRESELECT for a peak in current.

The PLATE TUNE is rotated for a dip in the current or a peak on an in-line SWR/Power meter. The LOAD control is then advanced, the TUNE re-dipped and this process repeated until maximum output is achieved. After practice, this operation can be completed quite quickly. Care should be taken not to hold a high current during TUNE for too long otherwise damage to the PA valves can occur.

Long 'overs' on the air gave great strain to the thumb and I would have liked a manual override on the set. All the other controls are most effective. A high impedance microphone, the Shure 444 or 202, is ideal for this set, the more recent 500 ohm varieties found on many modern and PMR rigs are not suitable without modification to the HW-100 itself.

Second opinions

After packeting an enquiry about the HW series onto the network I had replies from Alan, G3NYK, Rex, G0MWH (ex VE3DPD), and Don VE3HUR, making the following comments on the HW series;

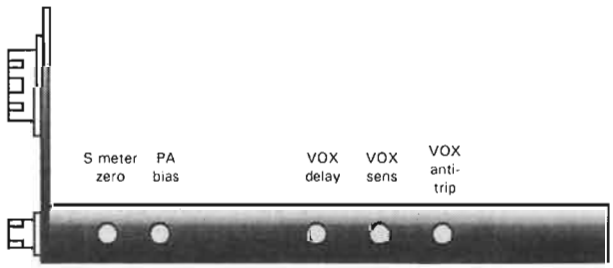
Alan, G3NYK, says "My HW-100, which I bought and built in 1969 has a manual dated 1/5/68, I'm not sure if the dating is European or American. I bought mine in either late 68 or early 69. The 101 is a little later, and I do not think it differs very much. The rig is obviously an economy version of the SB series as the metalwork has cut-outs for switches that select the CW filter, which is not an option on the HW series. The big problem was VFO drift (I used it on 170Hz shift RTTY) and found I had to feed the PSU from a 'Constavolt' regulating transformer."

Rex, G0MWH, comments "The HW's were the king rigs when I started out as VE3DPD in the early 60's. They are basically the same, but the main differences are in the VFO area, the HW-100 had a lousy dial drive, and it had a lot of play, it was difficult to tune after a while. Also the VFO drifted more in the 100. The HW-101 looked more professional, with a better case. Both are all tube rigs (valves!), and put out a lot of heat, with 600V power supplies....!

The one thing very wrong with them was the bandswitch, which was printed on the wafer somewhat like a printed circuit, but thicker material. Over the years the printing gets worn, and then the switches become intermittent. There's nothing you can do about it other than replace the whole switch with a different design, as the inductors were mounted on the individual wafers (boards) of the switch this is a mechanical nightmare."

Don, VE3HUR, had the following to add. "The ARRL reviewed the HW-100 in January 1969 and the HW-101 in January 1972. Aside from appearance, they have different tuning ratios (18kHz vs 14.15kHz/revolution), receiver RF and mixer tubes (6AU6 vs the higher performance and temperamental 6HS6), plus upgrades, I've seen at least one - to allow preselector and driver to peak at same setting.

The 6HS6 vs 6AU6 is interesting since I've seen articles advising HW-101 owners to return to using 6AU6s! The HW-101 shares the same circuit boards as the SB series and may be upgraded if desired - I've added 600 ohm audio and sidetone volume control to mine. For an idea of patch levels of the HW and SB series, the Heathkit modification kit SBM-102-1 applies to all HW-100, SB-100, SB-101, SB-101W, and SB-102 below sn 5446, so the HW-101 seems to have benefited from the experience of several predecessors."



HW100 preset controls

In Conclusion

Obtaining a rig such as this will give one many

hours of fun operating on the band. It lacks digital readout, the umpteen memory channels, FM or AM facilities, there's 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 previously mentioned SB-101, the SB-301 receiver and the matching SB-401 transmitter. 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 are also worth investigating if you get the opportunity.

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. There were the dire warnings from Rex about the bandswitches, something changed on the SB series, but, considering the price you're going to pay for one of these sets, it could well be worth the task involved. It is obviously 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.

My thanks go to Barry, G0GGV, for the opportunity to photograph his set, after I had repaired it, and to Alan, G3NYK, Rex, G0MWH (ex VE3DPD), and Don VE3HUR for their helpful comments.

Specifications: Heathkit HW-100 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 output 80-15m, 80W output 10m

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

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

Modes of operation: CW, USB, LSB.

Sensitivity: Less than 0.25µV for 10dB S+N/N for SSB

Overall gain: Less than 1.5µV for 0.5W audio output.

Image rejection: 60 dB or better

Dial accuracy, Elect: Within 400Hz on all bands
Visual: Within 200Hz on all bands

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

Rear apron connections: HF aerial, speaker 8 ohm, power input socket.

Dimensions: 380mm wide x 170mm high x 340mm deep

Weight: 8kg

Valve compliment;

1 - 6CB6: LMO
2 - 6AU6: RF Amplifier, Buffer
1 - 6AU6: 1ST RX Mixer
2 - 6EA8: 2ND RX Mixer, 1ST TX Mixer
1 - 6CB6: 2ND TX Mixer
1 - 6CL6: TX Driver
2 - 6146: 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

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

A Direct Conversion Receiver for 80, 40 and 20m

Raymond Haigh gives an introduction to Direct Conversion receivers, and commences with part one of a modular receiver project for three popular amateur bands

Although a little more complicated than a straight receiver with a regenerative detector, this direct conversion circuit is much simpler than a conventional superheterodyne. Sensitivity and selectivity are good, alignment is an easy matter, and the components are readily available from a number of sources.

With any receiver dedicated to the amateur bands, be it TRF, direct conversion or superhet, setting the tuned circuits to the correct frequency can be the biggest problem if a signal generator or another receiver with the required coverage is not available. However, constructors who don't have access to items of this kind should not be discouraged from attempting this circuit, because a simple and very inexpensive marker for all of the HF amateur bands is described later.

Direct Conversion receivers

Basic Direct Conversion receivers are elegantly simple. A local oscillator is run at (or very close to, in the case of SSB and CW signals) the signal frequency and the two are combined in a mixer. Mixer output is at audio frequency, hence the term 'direct conversion', and low-pass audio filters are used to determine the selectivity of the system. A mixer used in this way is called a product detector.

The direct conversion principle is not new. Almost 50 years ago circuits of this kind were developed for the reception of AM broadcast transmissions. The need to lock or synchronize the local oscillator with the wanted carrier gave the name synchrodyne to early receivers of this kind, and it is still sometimes used. To further confuse the issue, the term 'homodyne' is often applied, presumably because the arrangement can be perceived to be a superhet with an IF of zero.

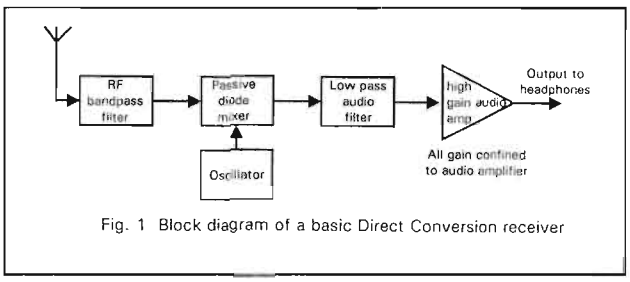


Fig. 1 Block diagram of a basic Direct Conversion receiver

Although direct conversion, synchrodyne or homodyne receivers never became popular for the reception of AM broadcast signals, during the sixties they began to be adopted by radio amateurs as an effective means of processing SSB (single side band) and CW (Morse) transmissions.

Published designs vary widely in complexity, and a block diagram of a very simple receiver popular during the sixties and seventies is given in Fig. 1. An RF tuned circuit is coupled to a passive diode mixer or product detector, and this is followed by a low pass audio filter and audio amplifier. It will be appreciated that not only is all of the gain at audio frequencies, but the amplifier has to overcome the losses in the passive mixer and audio filter. Amplifier gain must, therefore, be very high, typically in excess of 100dB, and this only ensures adequate earphone volume. Mains hum and microphony pose problems, and the performance of these very simple receivers usually leaves something to be desired.

More complicated circuits incorporated a stage of RF amplification to help offset the losses in the passive mixer and filter stages, and an active MOSFET mixer was sometimes substituted for the passive diode arrangement in order to secure some conversion gain. These measures reduced the need for such high audio amplification and, together with the use of varicap diodes in place of mechanical tuning capacitors, did much to ease the problems of hum and microphony.

Basic circuit

The block diagram of the receiver which is the subject of this article is given in Fig. 2. An RF amplifier precedes an IC mixer capable of yeilding a high level of conversion gain (typically 18dB). This combination improves the gain distribution, and no microphony problems were encounterd with prototype receivers, even using mechanical tuning capacitors and with the loudspeaker mounted directly on the chassis. A simple low-pass filter precedes the audio amplifier, and a further stage of filtering is included between amplifier and speaker or headphones. This last filter can be switched in or out of circuit to best suit reception conditions.

Simple direct conversion receivers, and this one is no exception, respond to signals on both sides of the local oscillator frequency. No matter how good the audio filtering is, they cannot reject the image signal. This is no great drawback in practice, but it does mean the selectivity is only half as good as the best theoretically attainable. More complex designs incorporating circuit features similar to those used for SSB generation can overcome this limitation, but it is arguable that the additional cost and effort may as well be

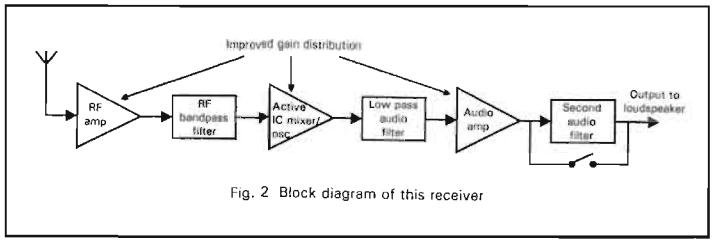


Fig. 2 Block diagram of this receiver

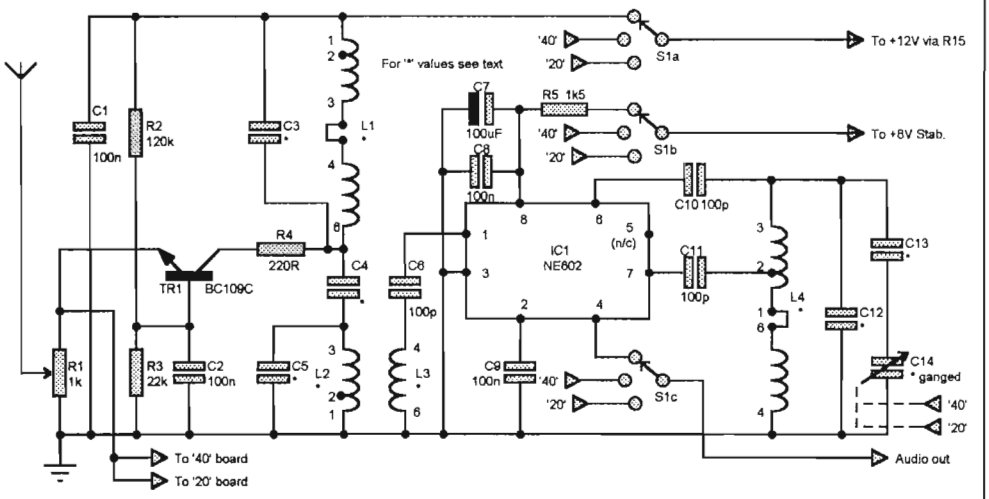


Fig 3(a) RF and Mixer circuitry

expended on an advanced superhet design.

Another problem with direct conversion circuits is a tendency for strong broadcast signals on adjacent channels to drive the mixer or product detector into non-linearity. In this condition the detector, no longer controlled by the local oscillator, demodulates the signals directly and they can be heard as a faint (sometimes not so faint) background interference over a segment of the amateur band. The use of a variably tuned rather than a pre-set bandpass filter helps to reduce breakthrough. But no significant problems were encountered with this design and it was thought that the additional cost and complexity of variable tuning to the RF stage were not warranted.

Running the local oscillator at, or close to, the signal frequency makes direct conversion mixers or product detectors prone to interference from other circuits within the receiver.They are particularly susceptible to modulation hum when mains power supplies are used, and the problem tends to get worse as the frequency of operation is raised. However, provided simple precautions are taken with the earthing arrangements and the design of the power supply, this receiver can be powered from the mains without any hum problems. Details of the features which must be incorporated in a mains power unit are given later.

I adopted a modular form of construction for the receiver to give constructors the opportunity to build it gradually, or to select parts of the design to suit their particular needs. In the interests of simplifying tuning and band switching arrangements, coverage has been limited to 80, 40 and 20m. These are arguably the most popular of the HF bands. Activity on 160m tends to be local and limited, and holding the oscillator at signal frequency without excessive drift can become a problem above 14MHz.

RF, Oscillator and Mixer stages

The circuit of the RF and mixer circuitry is given in Fig. 3a. Signals from the aerial are coupled to the emitter of the grounded base amplifier, TR1, via RF gain control R1. Almost any small signal NPN transistor will function in this position, but the inexpensive and widely available BC109C is recommended. This is a 'hot' device (h_{FE} of 520 and an f_T of 300MHz) and a slight tendency to instability may be noticed on the 20m band. Simple measures for dealing with this, should it arise, are described later in the setting up procedure. R2 and R3 determine the base bias, and C1 and C2 function as RF byepass capacitors.

The RF transistor is coupled to a pre-set bandpass tuning unit comprising L1, L2, C3, C4 and C5. Stopper resistor, R4, inhibits a tendency to parasitic oscillation at high frequencies (it is a misconception that grounded base amplifiers are unconditionally stable), and the tuned circuit formed by L1 and C3 acts as the required high-impedance load for the collector of TR1. All of the windings of the Toko coil used for L1 are connected in phase to maximise inductance and Q. 'Top' coupling capacitor, C4, feeds the signal to the second tuned circuit formed by L2 and C5.

The prevailing trend is to omit the RF amplifier stage and simply connect the aerial to an active IC mixer via a bandpass filter. The RF stage does, however, give a worthwhile increase in sensitivity, and this is particularly desirable when indifferent aerials have to be used. It also increases the isolation of the oscillator from the aerial and enables a simple but effective RF gain control to be incorporated. If the transistor is omitted, R1 has to be connected across a coupling winding on L1. Apart from the undesirable damping of the tuned circuit, the action of potentiometers connected in this way can vary with frequency and different aerial and earth combinations. Moreover, the cost of the transistor, three resistors and two ceramic capacitors is modest, and a case for omitting the RF amplifier can hardly be made on economic grounds.

Coupling winding, L3, applies the amplified RF signal to an NE602 mixer/oscillator IC via DC blocking capacitor, C6. With this single-ended or unbalanced injection, input pin 2 of the IC is grounded via C9. Used here as a product detector, the Philips IC constitutes the heart of the receiver, its seven transistor circuit providing an 18dB conversion gain. Although the chip is intended for high performance communications systems, the manufacturers are cautious about its large-signal-handling capability. However, no overload problems were encountered, despite the inclusion of the RF stage.

The oscillator section of the chip is connected in the Hartley mode, with L4, C12, C13 and C14 forming the frequency determining tuned circuit. As might be expected, the chip seems to perform best in this

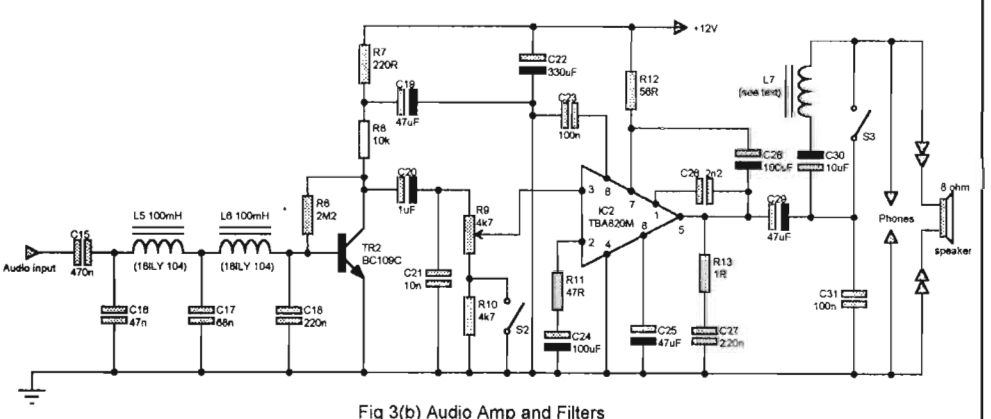


Fig 3(b) Audio Amp and Filters

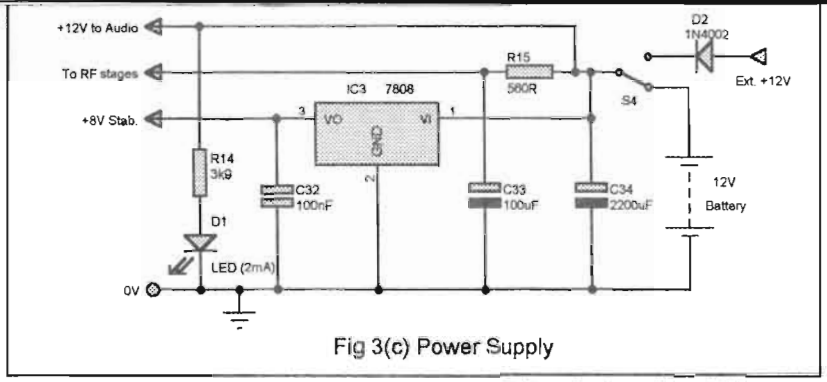


Fig 3(c) Power Supply

application when the oscillator stage is working vigorously, and the windings of the Toko oscillator coil are connected to ensure a high feedback level. Most of the direct conversion designs featuring this chip adopt a Colpitts arrangement with capacitors providing the feedback tap. I tried this circuit, which has a slightly higher component count, and decided it had no advantages over the Hartley oscillator. Blocking capacitors, C10 and C11, are fairly critical and the suggested value should be adhered to.

Fixed capacitor, C12, enables L4 to be set to the desired amateur band. Air-spaced capacitor, C14, provides the necessary variable tuning, and C13 restricts its maximum value so that the band is spread across its entire swing.

R5, C7 and C8 reduce and decouple the stabilized 8V supply to the chip. The 100µF electrolytic, C7, is required to prevent modulation hum when the receiver is powered from the mains.

Separate front-end boards are used for each of the three bands, and the different inductor and tuning capacitor arrangements are given in the components listing. I fitted a three gang VHF tuning capacitor in the prototype receiver, one of the gangs being permanently connected to each of the boards. Similarly, the emitters of the RF transistors are all permanently connected to the RF gain control. These measures eliminate band switching in the RF circuits, and the front-end boards are simply connected in and out of circuit by S1A, B and C which control the power supply and audio feeds.

Leaving all three boards permanently connected to the power supply would eliminate switch-on drift, but the possibility of interference from oscillator harmonics and the additional current drain on battery supplies prompted a decision to disconnect unused boards.

Constructors who decide to use the front-end circuit with other amplifiers must fit a DC blocking capacitor in the audio output lead from pin 4 of IC1.

Filter and Audio Amplifier

Audio output from the product detector is coupled, via DC blocking capacitor, C15, to a simple low pass filter comprising L5, L6, C16, C17 and C18 (see fig.3b). The Toko 10RB type inductors, L5 and L6, are inexpensive and make an audible improvement to the response curve of the filter. They are not essential, however, and constructors who do not want the bother or expense of obtaining them should delete C16 and C17, connect C15 directly to the base of TR2 and increase the value of C18 to 330nF.

TR2 is a simple, grounded emitter audio amplifier. R6 biases the device, R8 is the collector load resistor, and R7 and C19 provide the necessary supply-rail decoupling. Again, most small-signal NPN transistors will function in this position, but the low noise, high gain BC109C is recommended.

Output from the stage is coupled, via DC blocking capacitor C20, to AF gain control, R9. Fixed resistor, R10, increases the resistance of the lower arm of the potentiometer, and switching it in and out of circuit by means of S2 provides instantaneous changes in output level. This simple receiver has no AGC system, and the ability to rapidly adjust gain to compensate for weak and strong signals in a net (a group of amateurs having a conversation) is a useful feature.

Final audio amplification and power output stages are combined in IC2, a TBA820M. The gain of the device has been set high by selecting a low value for feedback resistor, R11. High and low audio frequency response has been restricted by increasing the value of C26 to 2n2 (it is normally 220pF), and by reducing the output capacitor to 47µF (normally 1000µF). C25 is a supply ripple rejection capacitor, R13 and C27 form a Zobel network to ensure stability under all output loading conditions, and C23, which must be mounted close to pin 6 of the IC, prevents HF instability.

Other circuit features restrict the frequency response of the audio section. The low value DC blocking capacitors, C15 and C20, limit low frequency response, and C21 adds to the other measures taken to curtail response to the upper audio frequencies.

With a 12V power supply, the amplifier is able to deliver a clean 2W into the 8 ohm speaker; more than enough for a receiver of this kind.

Final Audio Filter and power supply regulation

Man-made and atmospheric interference, and 'twittering' from signals on adjacent frequencies, can be distracting when listening in on the amateur bands. After demodulation, the interference spreads across the entire audio spectrum, and a further narrowing of the receiver's passband can significantly improve clarity. Capacitor, C30, restricts the passage of the lower, and inductor, L7, the upper audio range (Fig.3c).

These additional measures, although simple and inexpensive, are particularly effective in the low impedance speaker circuit, and their inclusion is worthwhile. Details of L7, which is wound on a short length of ferrite rod, are given later. Under noise-free conditions, this final filter can be shorted out of circuit by S3. There is a small insertion loss, and SSB signals sound a little more natural without it.

Speaker impedance must be at least 8 ohms when a 12V supply is connected to the TBA820M amplifier IC, and a switched socket should be fitted to isolate it when earphones are being used. Most earphones are now 30 ohms impedance and fitted with stereo jacks. Wiring a stereo socket to connect the earpieces in parallel will reduce the impedance of the headset to about 15 ohms. This ensures the effectiveness of the final filter which works best into a low impedance.

The power supply to the mixer/oscillator IC must be stabilized in order to minimise oscillator drift. The 7808 regulator chip performs this function very effectively and also provides a high degree of isolation from the supply line for this critical section of the receiver. C32 shunts to ground any 'noise' in the regulator output and prevents HF instability. R15 and C23 decouple the supply to the grounded base RF stage, and C34 ensures the stability of the receiver when dry battery supplies are beginning to 'age'.

The receiver is completely silent at low gain settings under no-signal and quiet band conditions, and it can be

accidentally left on. LED indicator, D1, helps to prevent this. The consumption of the recommended low current type is a mere 2mA. (The value of R14 will need reducing to about 1k if a standard LED is fitted). Diode, D2, protects the receiver against reverse polarity connection.

Tuning the oscillator

A good quality air-spaced tuning capacitor must be fitted if the receiver is to perform well. A capacitance swing of 20pF will cover the 80m band (3.5-4 or 3.5-3.8MHz in the UK) and a swing of 10pF will more than cover the 40 (7-7.3 or 7-7.1MHz in the UK) and the 20m (14-14.35MHz) amateur bands. Most of the air-spaced variable capacitors fitted in VHF/FM tuners will meet these requirements, and I used an inexpensive three-gang component retailed by J. Birkett in Lincoln, listed as a 10+10+20pF variable. If only one board is constructed, a Jackson type C804 capacitor can be used. They are retailed in a range of values: 10, 15, 25pF, etc., by Maplin, Cirkit and others. A 25pF unit would be suitable for any of the front-end boards, and swing-reducing series capacitors, C13, for use with this component should be 68pF for 80m, 15pF for 40m, and 12pF for 20m.

A spare set of contact positions is available on the specified band switch wafer, and this could be used to switch a Jackson C804 from board to board. Care would have to be taken with the layout, and this is very much a last choice arrangement as it involves extending and switching leads carrying RF currents.

Single side band transmissions have to be tuned in very precisely or they cannot be clarified, and a good slow motion drive is essential. A reduction of at least 30:1 is desirable, and this can be achieved by connecting two 6:1 epicyclic drives in tandem to give 36:1. Alternatively, use an epicyclic drive in conjunction with a salvaged cord drive and tuning drum. I fitted a drive salvaged from government surplus equipment, but the arrangements described above would be as good or better.

The tuning range is confined to a known and narrow band of frequencies and a calibrated dial is not essential. However, a dial graduated from 0-100 or 180 is most desirable in order to facilitate resetting the tuning to a particular transmission.

Next month, Raymond Haigh continues by describing the construction and alignment of the receiver. If you have any queries regarding this project, please address them to the author c/o the Editor at the HRT address, enclosing an SAE if a reply is required.

Components list;

Resistors *(all 1/4 Watt, 5% tolerance or better).*

R1	1k lin pot.
R2	120k
R3	22k
R4	220R
R5	1k5
R6	2M2
R7	220R
R8	10k
R9	4k7 log pot.
R10	4k7
R11	47
R12	56R
R13	1R
R14	3k9
R15	560R

Capacitors *(all 16V working or greater).*

C1	1OOnF (0.1µF) ceramic.			
C2	100nF (0.1µF) ceramic.			
	80m	*40m*	*20m*	
C3	33	68	68pF	All close tolerance ceramic
C4	2.7	5.6	3.3pF	with zero temperature coefficient
C5	47	120	120pF	
C12	27	33	68pF	
C13	-	68	47pF	
C14	20 +	10 +	10pF	ganged air spaced variable: see text.
C6	100pF ceramic.			
C7	100µF electrolytic (radial lead).			
C8	100nF (0.1µF) ceramic.			
C9	100nF (0.1µF) ceramic.			
C10	100pF ceramic.			
C11	100pF ceramic.			
C15	470nF (0.47µF) polyester.			
C16	47nF (.047µF) polyester.			
C17	68nF (.068µF) polyester.			
C18	220nF (0.22µF) polyester.			
C19	47µF electrolytic (radial lead).			
C20	1µF electrolytic (radial lead).			
C21	10nF (.01µF) ceramic.			
C22	330µF electrolytic (radial lead).			
C23	100nF (0.1µF) ceramic.			
C24	100µF electrolytic (radial lead).			
C25	47µF electrolytic (radial lead).			
C26	2.2nF (2200pF) polyester.			
C27	220nF (0.22µF) polyester.			
C28	100µF electrolytic (radial lead).			
C29	47µF electrolytic (radial lead).			
C30	10µF electrolytic (axial lead).			
C31	100nF (0.1µF) ceramic.			
C32	100nF (0.1µF) ceramic or polyester.			
C33	100µF electrolytic (radial lead).			
C34	2200µF electrolytic (radial lead).			

Inductors;

	80m	*40m*	*20m*	
L1	6438EK	6439EK	3767EK)	All tuning
L2/L3	6438EK	6439EK	3767EK)	inductors
L4	6440E	6441E	3766EK)	by Toko
L5	100mH, type 181LY-104 by Toko.			
L6	100mH, type 181LY-104 by Toko.			
L7	see text.			

Semiconductors;

TR1	BC109C
TR2	BC109C
IC1	NE602 by Philips
IC2	TBA820M
IC3	7808
D1	Low current (2mA) red LEDA
D2	1N4002

Switches;

S1A,B Maka-switch shaft assembly plus one, 4pole 3way wafer.and C

S2	on/off toggle switch.
S3	on/off toggle switch.
S4	single pole change-over or 'on-on' toggle switch.

Sundry items;

26SWG (or thicker) enamelled copper wire and 50mm length of 8mm ferrite rod for L7.
Aerial and earth terminals, switched stereo phone socket, external power supply socket and LED holder. Two 8 pin DIL sockets for the ICs, Vero pins and PCB making materials. Slow motion tuning drive (see text). Four control knobs. Loudspeaker, 100mm diameter and 8 ohms impedance. Aluminium chassis, 203 X 152 X 63mm, and construction and finishing materials for front panel and case (or use ready made chassis and instrument case assembly). Nuts, bolts, ST screws, stand-offs, battery holder, battery connector, hook-up wire.

Please see HRT display and classified ads for sources of components etc.

Scanner/Receiver Reviews in HRT

Missed that review? Here's a list of the very large number we've featured!

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Alinco DJ-X1D handheld receiver	Dec 92
AOR AR-800E handheld scanner	Sep 88
AOR AR-900 handheld scanner	Aug 89
AOR AR-1000 MkII handheld scanner	Scanners Int.Sep 90
AOR AR-1500 handheld scanner	Aug 92
AOR AR 2002 base scanner	Oct 86
AOR AR-2800 base scanner	Jan 92
AOR AR-3000A base scanner	May 92
AR-3000A upgraded	Jul 95
AOR AR-8000 handheld receiver	Oct 94
Bearcat BC50XLT handheld scanner	Apr 88
Bearcat UBC70XLT handheld scanner	Jul 88
Bearcat BC100XLT handheld scanner	Apr 87
Bearcat BC200XLT handheld scanner	Scanners Int. Nov 89
Bearcat BC580XLT mobile receiver	Sep 88
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Bearcat BC890XLT base scanner	Nov 93
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Bearcat DX-1000 HF receiver	Mar 87
Bearcat BC-2000XLT handheld scanner	Jan 89
Bearcat BC-2500XLT handheld scanner	May 94
Black Jaguar BJ200 handheld scanner	Jun 88
Commutech FCR 130 receiver (kit)	Oct 84
DCRX 20m direct conversion receiver (Howes Kit)	Feb 87
DXR10 receiver (Howes kit)	Apr 93
Drake R8E Receiver	Feb 92
Drake SW8 HF receiver	Jul 94
Eddystone 1650 base receiver	Aug 87
Fairmate HP-100E handheld scanner	Apr 90
Icom IC-R1 handheld scanner	Scanners Int.Jun 90
Icom IC-R72 HF receiver	Sep 90
Icom IC-R100 base scanner	Scanners Int.Jun 90
with SSB Option	Scanners Int.Sep 90
Icom IC-R7000 comms. receiver	Feb 89
Jandek 20m modular receiver with PSU (kit)	Feb 90
Jupiter MVT-6000 mobile scanner	Jan 90
Kenwood RZ-1 car radio sized mobile receiver	May 88
Lowe HF-125 receiver	Apr 87
Lowe HF-150 receiver	Sep 92
Lowe SRX-50 portable HF receiver	Oct 92
Maplin reflex receiver kit	Aug 91
Netset PRO-44 handheld scanner	Jul 93

Description	*Issue*
Netset PRO-46 handheld scanner	Jul 93
Netset PRO-2032 base scanner	Mar 94
Ramsey 80m Receiver kit	Oct 93
Realistic PRO-35 handheld scanner	Feb 92
Realistic PRO-39 handheld scanner	Apr 95
Realistic PRO-43 handheld scanner	Feb 93
Realistic PRO-62 handheld scanner	Jul 95
Realistic PRO-2005 base scanner	Sep 89
Realistic PRO-2006 base scanner	Jun 91
Realistic PRO-2025 mobile scanner	Oct 91
Realistic PRO-2035 base scanner	Mar 95
Realistic PRO-2036 base scanner	Jul 95
Realistic PRO-9200 base scanner	Apr 92
Regency HX-2000 handheld scanner	Jan 87
Regency MX-7000 base scanner	Oct 86
Shinwa SR001 mobile scanner	May 91
Sony Air-7 handheld scanner	Sep 87
Sony ICF PRO-80 handheld scanner	Dec 87
Sony ICF-2001D portable receiver	Jan 89
Sony ICF-7600D portable receiver	Jan 87
Standard AX-700 base scanner	Scanners Int.Nov 90
Tatung TMR7602 portable receiver	Feb 89
Yaesu FRG-100 HF receiver	May 93
Yaesu FRG-8800 general coverage receiver	May 85
Yaesu FRG-9600 receiver	Oct 85
FRG-9600 (updated) a reassessment	Dec 86
FRG-9600 HF upgrade	Jul 87
Yupiteru VT125 handheld scanner	Aug 91
Yupiteru VT225 handheld scanner	Jul 92
Yupiteru MVT-3100 handheld scanner	Dec 93
Yupiteru MVT-5000 (Jupiter 2) handheld	Nov 89
Yupiteru MVT-7000 handheld scanner	Sep 91
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SCANNERS

Bill Robertson reminds us that airband comms are not all the same!

A common question I'm asked is "Which is the best scanner to buy"? This of course is a wide-ranging question, and much depends upon the individual and their listening interests. I'd suggest buying a good book first, try 'Scanners 3' which you can buy in Tandys, and then making your mind up. Rather than buying a scanner and a book at the same time, then finding you'd have been better off buying a different set! Several readers also have become introduced to the scanning hobby, with a set bought in the 'high street' sometime on impulse or of course just curiosity, which is then found to be lacking. Much better spending a little more time choosing in the first place!

One comment I read during the summer airshow season was that scanner owners visiting an airshow sometimes find their set doesn't pick up the military aircraft comms being used (on UHF AM), unlike the enthusiast standing next to them who's happily listening to the Red Arrows. The shop's salesman gladly sold them a scanner for "airband", which, of course, was only the civil (VHF) airband! However if you'd like honest and expert advice on sets suitable for airband, both VHF and UHF, I'd heartily recommend giving scanner dealers Javiation in Bradford a ring (01274 732146). Jonathan Clough at that firm is a known authority on military airband scanning amongst of course other scanning matters, and the number of scanners they export to the US must be a testimony to their success! A useful 'snippet' from Jonathan incidentally tells us the Commtel 204 scanner is in fact identical to the Realistic PRO-43, but is packaged for a different company.

Aircraft phones

If you're fortunate in having one of the new breed of scanners which cover up to 1800MHz, you may have heard of the new 'Airphones' as used by various airlines. They operate with an 'uplink' of 1670.000 - 1675.000MHz and 'downlink' of 1800.000-1805.000. I'd have imagined they'd use digital technology, rather than analogue, however they reportedly use narrow band FM with 12.5KHz channel spacing. As they often operate from a very high altitude, they should have quite a wide coverage area. If you have any luck with these - do let me know!

VOLMET broadcasts

Many readers will know of the VOLMET airband weather broadcast system. These operate on;

London Main; 135.375MHz
London North; 126.600MHz
London South; 128.600MHz
Scottish; 125.725MHz

If you're having trouble deciphering the various 'codes', then here's a guide to the order of the information broadcasted, and what it means.

a) Station Name.
b) Time of Observation.
c) Surface wind details, direction of surface wind and speed.
d) Horizontal visibility, below 500m expressed in steps of 50m. Visibility more than 500m and less than 5km expressed in steps 100's of m. 5km or more but less than 10km expressed in kilometre steps. 10km or more is given as 10km except when Cavok conditions apply.
e) Runway visual range, given in metres. If more than one runway is in use then separate RVR readings may be given.
f) Weather details, in 'plain language'.
g) Cloud details, the amount of this is given in abbreviations; "SCT" (1 - 3 oktas) means scattered, "BKN" (4 - 7 oktas) means broken, "OVC" (8 oktas) means overcast, and "SKC" means sky clear with Cavok not appropriate. The cloud type should be identified only for cumulonimbus and towering cumulus when observed at or near the aerodrome.
h) Temperature, in degrees Celsius
i) Dew point, in degrees Celsius
j) QNH; the local atmospheric pressure setting given in millibars. This gives feet above sea level, and is used in conjunction with QFE to give height.
k) Trend;

No-sig - No significant change in weather conditions
Gradu - The change is expected at a constant rate
Rapid - Change expected in a short period of less than thirty minutes
Tempo - The change is expected to last for less than one hour
Inter - Frequent changes are expected fluctuating almost constantly
Tend - A change is anticipated but expected to occur slowly throughout the period. In conditions where visibility is more than 10km, the lowest cloud is at a minimum of 5,000ft, there is no cumulo-nimbus cloud, and there is no precipitation, thunderstorm, shallow fog or low drifting snow, then the relevant parts of the VOLMET transmission will be replaced by the expression 'Cavok' derived from 'Cloud and Visibility OK' and pronounced 'kay-o-kay'

Grand Prix comms

Following on from the Formula One frequencies given in this column, an Internet message from Scot Jones suggests these frequencies may be worth trying;

Williams; 168.3875, 173.1875, 168.400
Benetton; 169.4875, 467.7250, 462.250
McLaren; 414.4875, 415.9875, 419.9875
Ligier; 454.3125, 457.3125
Ferrari; 455.235, 456.615, 465.235, 466.615
Team?; 456.975, 456.475,
Minardi; 457.025, 457.050,
Lotus; 462.425, 456.925

I hope the above is of interest to readers - let me know if you have success! Please remember that reception of some services may not be permitted without appropriate authority. The RA's information sheet on 'Scanners' has full information for the UK.

Bill Robertson is pleased to answer reader's queries through this column - address your letters to: Bill Robertson, c/o HRT Editor, Nexus, Nexus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST, or by fax or email to the HRT direct Editorial contact points.

QRP corner

Dick Pascoe G0BPS returns with news from Friederichshafen

Some great news arrived here today. A good friend Peter PE1MHO, an ex-pat Englishman living in Holland is *very* keen on six metre QRP operating. He already holds many awards such as the 50MHz 2W WAC, and First QRP Master on VHF. Peter has just worked his 100th country, and is avidly waiting for his single band DXCC for 6m.

Unfortunately he is also finding a problem that many have found before. Getting the QSO is only half the battle, getting it *confirmed* is sometimes much more difficult. I well remember that the only way I got Malta confirmed on 2m was to knock on the amateur's door and ask him direct. I was there anyway on holiday.

I hear many horror stories of QSLs, and Peter may well have to work a few more before getting the certificate. Geoff Brown, our VHF columnist, had to do the same to gain his award!

Stan G6ZNW, an avid packet operator, informed me there's a lot of information on the hobby bouncing around on packet. Peter G3XJS keeps a regular DX list going for club members, he may be found at GB7MSW.

OM2ZZ is looking for skeds on Top Band. At this time of year the band will be opening up slowly and some good contacts made. He is in Stupava and may be contacted via OE3XBS.AUT.EU.

PA0RBC@PI8DHR.NLD.EU is looking for information and ideas on the Index Labs 'QRP Plus'. He thinks that there will be a few mods done to this rig and is hoping to keep an exchange of ideas going around to help all owners.

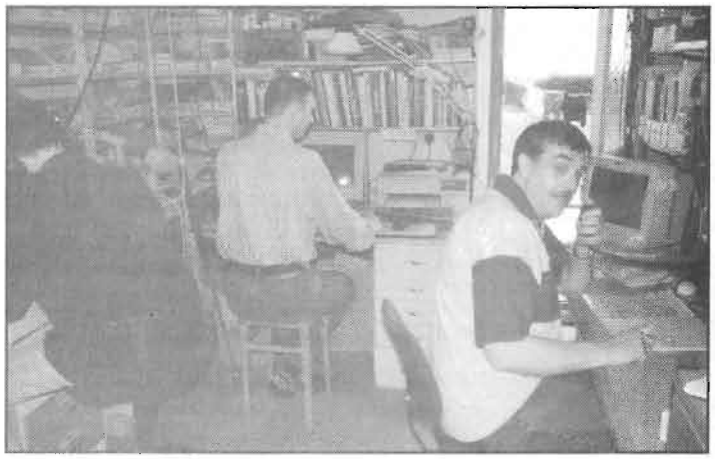
A letter from Eric, G0KRT, tells of his collection of QSOs with the 'QRP Plus' which he has owned since April 1994. He enjoys the rig very much, he tells of about 120 contacts with the rig, mainly on CW but also a few on SSB into Europe. Eric is very pleased with the rig.

QRP weekend

The weekend of the QRP contest was a great one for the Pascoe family. Two visitors from Germany and four from Holland arrived at my house to take part on Sunday 18th June. Marinus had visited before and was impressed with the take-off for VHF. The 12m tower with two Vargarta 9 element long yagis at the top appealed to him so much, that he got the gang to come over. Using the call G0ROO, members of the Dragonslayers QRP group fought to make as many QSOs as possible. This station was using a Czech rig called an R2-CW, a single band SSB/CW rig that is used by many European contest groups, as it has such a great front end. The owner, Edwin PA3GHS, is an avid contester. I did look for them at Friederichshafen but none were to be seen. This rig has the usual twin VFOs and an adjustable narrow filter, an optional speech processor is a very simple add-on.

The accompanying photograph shows the station in use. Operating is Harm, PA3AQO, beside him is the DX Cluster computer looking for any rare squares that may be about. On the logging computer is Marinus PA3LIF and to the left, on the other rig searching for unworked squares is Florian DL3OCG (son of Klaus DL8MTG, the other German operator). The party which took place after all the gear was packed was almost as good as the contest.

To the rear of this photo can be seen the main 'work' computer, this is where the column is produced.



QRP Contest station. Right; Harm, PA3AQO, centre; Marinus PA3LIF, left; Florian DL3OCG.

Dick G0BPS, George G3RJV, and Rudy Dell DK4UH, on the G-QRP Club stand at Friederichshafen.

The Czech R2-CW, a single band SSB/CW rig

Friederichshafen

As I write this part of the column, George Dobbs G3RJV is also in the shack with me after our trip to Friederichshafen. A very good event with many visitors from all over Europe stopping at our G-QRP club stand.

The club's German representative, Rudy Dell DK4UH, was also there to help together with other locals, including Norman G0NEE also known as DK6NEE. Norman now lives in Germany and speaks the language well, very useful!

Having just returned from the USA, one thing struck me about this particular show. It is *very* different to Dayton. Friederichshafen is much smaller, and the fleamarket is only a tenth of the size. There are still a huge number of visitors, and it's this that made the show so interesting.

Visitors came from England, Germany, France, Holland, Belgium, Austria, Italy, Switzerland, Spain, Saudi Arabia, Albania, Yugoslavia, Czech Republic, Latvia, Estonia, Finland, Norway, Hungary, Rumania, Croatia, USA, and a few more that I have forgotten. This is truly an international event.

The flea market was an eye-opener with all the Eastern block equipment available, much ex-military equipment was on sale. Whether the owners knew it was there may not be known, but much of it was at fairly silly prices. For example, simple, small tank transceivers on offer at DM100 (about £45). The Russian traders also offered many other items of interest such as the stacking dolls that fit into each other for a mere DM25 (about £10).

The parking lots are full of caravans and tents, which this year was maybe not such a good idea. The temperature, usually at about 25-30 deg. C, was down to a low 12-15 deg C this year. These parking lots are full of aerials and I would suspect that there would be a lot of RF floating around. Some of the masts fitted to mobile homes were huge, and I wondered if they were, in some cases, more for show than of practical use.

The bad aspect of the trip is the journey. It took George and I seven and a half hours to get to Ludwigshafen, where we stayed with Rudy DK4UH and his wife Rita. A further four hours got us to our hotel at an aptly named town, 'Kippenhause', for a stopover.. This provided a cheap hotel at DM27.50 (about £12.50) per night per person for bed and a typical German breakfast of coffee, bread, cheese and a range of meats. The petrol costs in excess of £100 are to be taken into account too! The drive back was enhanced by a further stopover at Rudy's and a visit to a local wine festival, where the local brew was served at very modest prices and in half pint glasses!

The journey back across Luxembourg, into Belgium and then France was a little more interesting. A stop in Luxembourg brought forth a few stations with a chat down into Madeira, into Wales and a few others. The rig was my TS50 with a Texas Bugcatcher aerial. It was amazing that on the way out that very little activity was found with the LX/G0BPS call, but as soon as we crossed the border and changed to DL/ we had a couple of pile-ups. I was pleased to remake the acquaintance of OE6ESG in Germany, who I also met in the USA at Dayton.

That's it for this month, as always please send your QRP related news, views, photos etc. to Dick G0BPS, Seaview House, Crete Road East, Folkestone, Kent CT18 7EG, or via Packet to GB7RMS, or Email to dick@kanga.demon.co.uk

From My Notebook

Geoff Arnold G3GSR rounds off his exploration of electronic circuit symbols

This month, I shall round off my exploration of electronic circuit symbols and references with a look at fuses, and then the sometimes baffling variations in component references which you will encounter in items of professional or military equipment which may come your way, rounding off with a few practices from years gone by.

Fuses

In its original form, the fuse consisted simply of a piece of thin wire connected between two screw terminals. Its symbol (Fig. 1a) reflected this accurately, although it has always been an absolute swine to draw accurately and neatly, as it involves a line (the weak link) which is drawn as a tangent to two small-diameter circles.

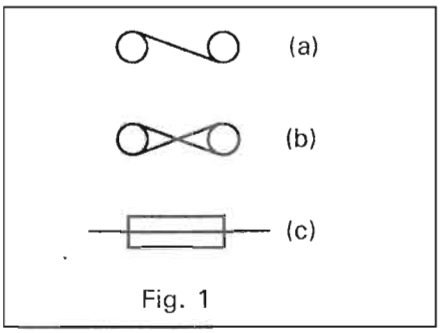


Fig. 1

A variation of this, which is even more difficult to draw, adds a second line between the terminals (Fig. 1b). I ve never understood the logic behind this variant, which you will find used in editions of the *Admiralty Handbook of Wireless Telegraphy* dating back to the early decades of this century, and also in the many books and magazines with drawings which were produced in years gone by in the editorial offices of *Wireless World*.

The symbol for the fuse as laid down in current British Standards (BS 3939) is shown in Fig. 1c. Now that virtually all fuses are cartridge types, rather than the old rewireable variety, I suppose you could say that it represents the cartridge with the wire running through the middle. I would be happy with that if the link was drawn thinner, but it isn t - that would be too difficult for the drafting machine!

Fuses on a circuit each have a numbered reference with a prefix of either F or FS . I ve never understood the use of FS, as there is no other component using F to cause confusion.

Batteries

The symbol for the humble cell or accumulator is about the only one you will find on radio and electronic circuit diagrams which has not changed since the earliest days (Fig. 2). In British Standard 3939, it has admittedly had its short, thick, negative plate shaved down to the same width as the long, thin, positive plate, but the Standard does say in the footnote to the symbol: The longer line represents the positive pole, the short line the negative pole. *The short line may be thickened for emphasis.* (my italics) This must be one of the few concessions to tradition in the entire Standard!

Over the past year or so, I have come across a small number of circuit drawings, obviously produced on a computer, in which the longer, positive lines of the battery symbol have been drawn thicker than the negatives. Since these drawings have not all come from the same source, I can only assume that there is a commercial circuit-drafting software package produced by someone who doesn t know his circuit symbols. Watch out for it!

Multi-unit equipment

In complex professional equipment with a number of units or printed circuit boards linked together by means of cable-forms, etc., the total number of components of a given sort can run to hundreds, which makes for large component references, cluttering up circuit diagrams.

Different manufacturers have different approaches to dealing with this problem; I know of two systems, one of which is very much better than the other in my opinion. First the good system, which is to number the units and use the Unit number as a prefix to each component reference where necessary, so that, for example, resistors in Unit 1 have references 1R1, 1R2 and so on, while in Unit 2 you would find 2R1, 2R2, etc. In the technical description in the equipment handbook, you have to use the complete component references, including the prefix, to avoid confusion, but on the circuit diagrams, it is sufficient to label the individual drawing sheets, or the boxes drawn around the circuitry forming each unit, with a large bold number to indicate which unit is covered. The individual component references on the drawings can then drop their unit number prefixes.

I will admit that since the adoption of British Standard 1852, there is a slight chance of confusion in using this system. BS1852 is the one that says that you use the multiplier in place of the decimal point in resistor values, so that a 4.7 kilohm resistor will be labelled 4K7 - a good idea, because it gets round the possible disappearance of a thinnish decimal point when a circuit diagram is printed or photocopied. BS1852 says that resistor values of less that 1000 ohms must be stated with the letter R after the whole number of ohms, so that 22 ohms would be given as 22R, or 6.8 ohms as 6R8. If resistor R2 in Unit 2 was 2.2 ohms - well, I ll leave you to work that one out!

Now to what I call the 'bad' system - which is to give the components in Unit 1 references beginning at 101, or worse still 1001, so that you have R1001, R1002, etc., with those in Unit 2 beginning at 201 or 2001, and so on. Although this positively identifies every individual component and its unit, it means that every single component reference contains a minimum of 4 or even 5 digits, and on a closely-packed and complex circuit drawing, that s not funny!

Military equipment

Most equipment used by the military is produced under contract by commercial firms, and being usually fairly complex, uses similar systems to those described above. However, there is a totally different system which you will come across if you take an interest in British

Fig. 2

military equipment of the valve era, and which is even more baffling than most when first encountered.

Say that you have a simple valved communications receiver, with a line-up of RF amplifier (EF39), frequency changer (ECH35), two IF amplifiers (EF39s), detector/AGC/AF amplifier (EBC33), BFO (EF39) and audio output (EL32). The army would have used a system under which an EF39 was called a V1, the ECH35 a V2, the EBC33 a V3 and an EL32 a V4. The RF amp would then be given circuit reference V1A, the IF amps V1B and V1C, and the BFO V1D. The frequency changer would be V2A, the Detector/AGC/AF amp would be V3A, and the audio output amp V4A.

All the other components, resistors, capacitors and so on, would be allocated references in the same fashion, so that all 3.3 kilohm 1/2-watt resistors in the set might be numbered R1, with the individual resistors identified as R1A, R1B, R1C and so on.

This is basically a type of stores reference system; because the last EF39 is identified as V1D, you know straight away that there are a total of four of them used in the set.

Strange multipliers

I ve already mentioned the multiplier system used in BS1852, which is fairly straightforward. The practice of adding the letter R as a suffix for integer (i.e. whole number) values up to 999 ohms is not always followed; sometimes the number is used without any unit or decimal point indicator at all. The letter R would still be used for values such as 4R7 (4.7 ohms) or 0R33 (0.33 ohms).

The use of a capital K for the thousands of ohms decimal indicator has always struck me as somewhat strange when the official SI multiplier for thousands is a small k. Very definitely a case of the standards authority not following standards!

The capital M for millions of ohms (megohms) presents no problems, but do watch out for the small m meaning milli or one thousandth of . It s not often used with resistors, though you will sometimes come across it in specialised applications involving very low values, such as continuity testing and instrumentation. It is, however, used fairly frequently for inductors, where a 4.7 millihenry choke might be labelled on a circuit diagram as 4m7.

If we go back in time, the letter m was used in a couple of different ways. Back in the 1920s and 30s, and to some extent still after World War II, it was the practice to abbreviate microfarad as mfd . Nanofarads and picofarads hadn t been invented then (or at least they weren t in widespread use), and very small capacitances were sometimes given in mmfd . This meant micro-microfarad, identical in value to a picofarad, but it was not used very often. Where we would now talk about a capacitor being a 500pF, in those days they were referred to as 0.0005mfd, frequently spoken as three-ohs-five .

In the USA in the 1930s and 40s (for example, in circuits for the AR-88 receiver, produced by RCA), the capital M was used as a very non-standard unit multiplier for

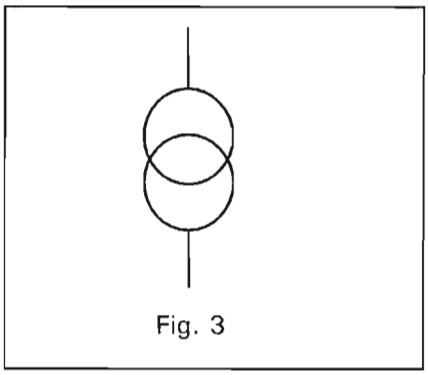


Fig. 3

resistance values. Instead of the usual million, they used it to mean a thousand. I puzzled for years over the logic behind this, before someone gently pointed out to me the obvious - M is the Roman numeral for a thousand! To avoid totally confusing the circuit diagram user, RCA used the abbreviation MEG. for megohms, other manufacturers would specify something like a 2.2 megohm resistor as 2,200M. Providing you are looking at the circuit diagram of a fairly large item of equipment, you can usually tell whether the draughtsman used M to mean kilohms or megohms. For smaller circuits, where there may be fewer values to compare with your knowledge of normal circuit practice, the answer is not always immediately obvious!

Abbreviated references

When I was talking about relays, I mentioned that the prefix RL would sometimes be left off in tightly-packed circuit diagrams. Very occasionally you will find the same done with resistors and capacitors.

A variation of this, which seems to have been a particular fondness of some manufacturers of domestic broadcast receivers at one time, was to number all components in the same numerical sequence, regardless of whether they were resistors, capacitors, inductors, valves or whatever. There would be no values given on the circuit - I really hate circuit diagrams that don t have values on, don t you? - instead the poor service engineer had to refer to a table to find out all about each component.

Confusing symbols

Finally, back to symbols once again. In particular the possibility of confusion between identical symbols used on electronic and electrical drawings, but having different meanings.

The first that springs to mind is one you won t come across all that often, as its use in electronic circuits is usually in block diagrams and occasionally in diagrams being used to explain a circuit function. In this application, the symbol (Fig. 3) means a constant-current source, although I ve never understood what relevance the shape has.

In electrical circuits, its use is confined to what are known as one-line diagrams , where it means a transformer. The overlapping circles seem to me to convey the idea of the coupled windings of the transformer very well.

That s all folks!

I think that just about rounds off what I want to say about circuit symbols and references, but I shall leave you with a question.

Does anyone know the origin of the use of the letter Q to identify a transistor on circuits of American origin, instead of the TR or Tr (depending on the publisher s style) used in the UK? I d love to find out.

DATA CONNECTION

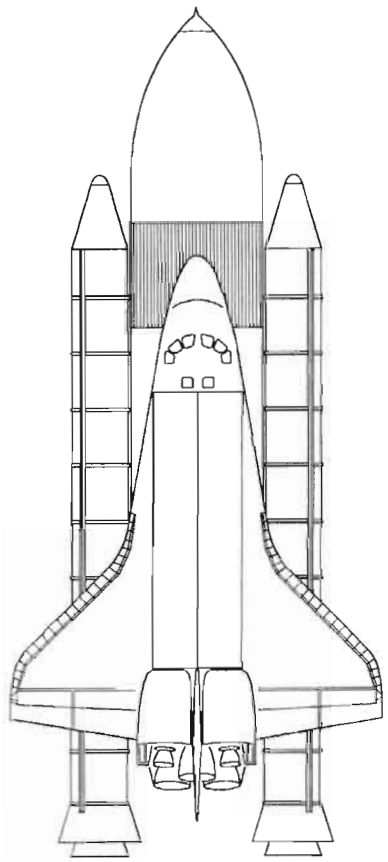
HRT's resident datacomms enthusiast looks at packet from space, and investigates a new version of APRS

The Space Shuttle *Discovery* lifted off from the Kennedy Space Centre on 13thJuly (after it's bird adventure - see *Satellite Rendezvous* - Ed), carrying ham astronauts Don Thomas, KC5FVF, and Nancy Sherlock Curie, KC5OZX who were are operating the SAREX package on Discovery in both Voice and Packet modes. The following packet text from the shuttle was copied the next day by Dave, N6JLH:

W5RRR-1*>QST <UI>: Greetings from the STS-70 Crew aboard the Space Shuttle DISCOVERY !! We had a fantastic launch yesterday and a successful deploy of the Tracking and Data Relay Satellite. It was spectacular watching it move out of the payload bay. We look forward to making contact with as many people as possible during the next week. Thanks for your interest in our mission. 73's Don and Nancy (KC5FVF and KC5OZX).

The following packet downlink was later copied by Gil Carman, WA5NOM:

This is STS-70 SAREX Robot station W5RRR-1onboard the Space Shuttle Discovery.



12:38:17 W5RRR-1*>QST <I;0,6>: Greetings from the STS-70 Crew aboard Space Shuttle Discovery! We are into our fourth day in orbit and we are continuing to perform the numerous experiments we have on board. Besides the five crew members on board, we are carrying 10 pregnant rats investigating bone loss and muscle atrophy. These studies may some day help us understand muscular diseases and bone loss mechanisms which can lead to osteoporosis, or weaking of the bones which is experienced by many elderly adults. Space Shuttle Discovery continues to perform flawlessly and is an excellent laboratory for conducting Earth observations and our microgravity experiments. The crew is doing well and we pass our best wishes to you all!! 73s, KC5FVF and KC5OZX (Don and Nancy).

If you heard, or worked, the STS-70 mission on packet or voice and would like a QSL card, then the Sterling Park Amateur Radio Club, Sterling Park, Virginia has generously volunteered to distribute the QSL cards for this mission. Send reception reports and QSLs to ARRL EAD, STS-70 QSL, 225 Main Street, Newington, CT 06111, USA. Include the following information in your QSL or report: STS-70, date, time in UTC, frequency and mode (FM voice or packet). In addition, you must also include a large, business sized self-addressed envelope with sufficient IRCs for return postage to you. Thanks to John KD2BD the editor of 'Spacenews' for the above information. 'SpaceNews' incidentally is claimed to be the first amateur newsletter read in space!

APRS 7.1 now available

Barrie G4CZJ sent me a message to say he'd seen version 7b of the Amateur Packet Reporting System (APRS) being available. I gave a brief insight to APRS in this column in the June 95 issue, and it really seems to have 'taken off' in the UK as well as around the world. I've now downloaded APRS version 7.1 from the Radio Shack BBS (with its HRT conference group - Tel. 01947 897551 with your landline modem, see HRT March 95 for a complete feature on this superb BBS). Updates include major changes to the map distribution, plus an optional map compression feature, and of course lots of other additions. APRS 7.1 comes ready-loaded with packet maps of UK and Europe, and it really is unique to see, on your PC screen, the mapped location of the station, BBS, or DX Cluster you're connected to (or of course a complete 'packet network map'). There's plenty of general information files on the disk as well - in all a superb reference source of information on a wide range of packet activity. It's currently available from the HRT software service on a 'cost only' basis, i.e. £1.00 inc. HD disk and p/p. All APRS disk requests sent out from mid July have automatically been updated with this latest 7.1 version, but if you have an earlier one there's no problem - see the 'Software Offer' this month for your copy.

On a related subject, Ger, PA0RYS @ PI8RYS asks who is active on APRS in Europe, and who has made maps for Europe? Ger says he has maps available maps for the Netherlands. Drop a packet to Ger, PA0RYS@PI8RYS.#NH1.NLD.EU if you'd like to exchange APRS maps!

JVFax WXSat AM interface

A letter arrived from Greg Jameson, who is the designer of the very useful synchronous JVFax AM interface I detailed in this

column in the August 95 issue. Greg says that it's been pointed out to him there are a couple of errors in the circuit diagram he produced (the circuit being available as a disk-based file). He tells us there is a component shown without a value, and a value shown without a component! The capacitor from pin 6 of IC2 is a 100n, and there should be a resistor connected to the wiper of P1 to the +ve input of IC7b (although the resistor is not strictly necessary). Greg adds that the circuit will also work with an I/O card such as the Maplin LP12N, but only with 'live' signals as the ACK output would not then be used (JVFax set up for parallel input at 301H). I'll attempt to update Greg's disk-based circuit, so that the updated circuit will be available via the HRT Software Service from the date of this publication for the benefit of HRT readers. Thanks for your information Greg, there should be a 'little something' in the post to you courtesy of the HRT Editor.

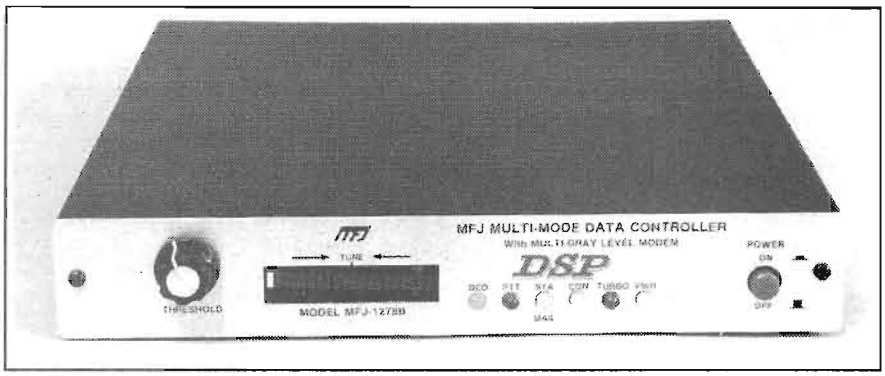
G-TOR comes to MFJ

News from Kantronics is that they have licensed MFJ to include the G-TOR mode into their multi-mode radio data controllers. the MFJ 1278 with DSP unit was reviewed in the August 95 issue, so no doubt there'll be a plug-in EPROM available on the cards soon! I'm told by Kantronics that once the G-TOR mode is implemented on their 1278 series, MFJ will offer an update package for previous versions of the 1278 series.

Paul EI9GL @EI7GM.#81.IRL.EU asks if there is anyone active on G-TOR in EI/GI? he would be interested in hearingfrom you if you are. He also asks if has Kantronics published anything useful, as he'd be interested in reading something about it. See below, Paul!

New Kantronics disk

The Kantronics *Program and Information Disk 1* which I'm told is included with Kantronics' latest TNCs, besides having a number of useful packet and data terminal



G-TOR coming soon to an MFJ-1278 near you!

driver programs, now also has a number of interesting information text files contained on it. Included are articles on high-speed packet, GPS, G-TOR, Weather Fax information and frequencies, even the HRT review by your's truly on the KPC-9612! Contact any Kantronics dealer for more information, my thanks go to Ruth Hull of Kantronics for the air-mailed sample disk.

BayCom WWW Page on Internet

A bulletin from Ian GM1XOG tells of a BayCom 'WWW' page on the Internet currently under construction. If you have access to the net, try http://www.baycom.de

BayCom on the C64

A message from 2E1CCZ asks if there is any software available for the BayCom board on the Commodore C64 and the Amstrad CPC64 (tape drive), and if so how can he can get hold of some and where from? 'Digicom', which is indeed the forerunner of BayCom, was designed for use with the C64. I reviewed this in the See *Packet Radio Roundup* in the December 1989 HRT for more information on the disk-based software. alternatively, Digiprom, a plug-in PROM unit, was available for the C64 or 128, from JSM Electronics (PO Box 26, Billingham, Cleveland TS23 3FT), I reviewed this in the September 1990 issue of HRT. I hope the above is of use to non-PC owning amateurs who'd like to get onto packet without going out and buying an expensive TNC!

UltraPak users

If you currently use, or are trying, the *UltraPak* packet program, then Tim Kearsley G4WFT says it has come to his attention that a few copies of the UltraPak file distribution have "escaped" which have an old version of the THREED.VBX file included. The symptom which this causes when the program is run is that the status displays which are 3-D panels are white rather than grey, with the result that the program looks terrible! If anyone has the demo version of this program on trial and has this effect, you need the THREED.VBX file which is dated 17/07/93, size 64432 bytes. If you have difficulty getting it, Tim says he will gladly forward a new file distribution on receipt of an SAE.

CTRL-Z, end of message

Remember that the BARTG's annual rally takes place on Sunday 10th September at the Sandown Exhibition Centre, Sandown Park Racecourse, Esher, in Surrey, doors open 10.30 to 17.00 - see HRT's 'Events' diary for more details. I'll be there, will you?

As always, if you've any thoughts on data modes over ham radio that you feel would be of interest to others, pleased do let me know, I'll also be very pleased to keep other informed of what you, or your local packet group is doing - as long as you send me the information! You can contact me either direct by packet, or via Ham Radio Today Editorial by fax or email. Until next month, it's 73 from Chris G4HCL @ GB7XJZ.#48.GBR.EU.

VHF/UHF Message

Geoff Brown GJ4ICD with news of the Europe-wide 2m opening, and asks who will be first to work the US on 2m?

Simon GM4PLM reports that GM4ISM, Mark at Larkhall, is active off the moon on 10GHz now, he is the only GM known to be on 10GHz EME. He's quite active on 10GHz terrestrial too, Simon wrote "there are a couple of us who are interested up here but no one ever seems to point the dishes north".

Simon will also be active on 10GHz by the time you read this, with 250mW from the G3WDG NB transverter system, with a travelling wave tube amplifier. Mark is also active on SSB and CW and has also got a large 40W amplifier.

Martin G3USF put out the following on the Internet which will be of interest to 144MHz DXers. The Irish Radio Transmitters Society has announced an award for the first stations to establish two-way communication across the Atlantic on 2m (EME and satellite excluded). This will be known as the Brendan Trophies, and will be a pair of Waterford Crystal cut-glass vases. named after St. Brendan, the fifth century Irish monk, who voyaged widely in the Atlantic. Full rules will be available shortly.

Brian G7LIJ reports that he had 2m ES propagation to IT9 during the morning of the 20th May. He worked IT9IPQ/9 in JM78SE on 144.300MHz, Brian said that he was audible for 10 minutes prior to hearing a lot of Band II FM broadcast throughout the morning. Also IT9FDR/IG9 was worked from JM56; look on your QRA maps, it's a 'once in a lifetime' square!

Peter, G4MJS reports the following on 50MHz on May 31st, SM0KCL (JO99), I5FLN (JN53), I0JX (JN61), 9A2DB (JN95), 9A3HZ (JN86), YL3AG (KO26), OZ1DJJ (KO26), SP8MMZ (JO65), OZ3SDL (KO11), SP4CHY (KO03), SP7BCA (KO01), SP4MPB (KO03), SP6GZZ (JO81), ES1CW (KO29), also stations from LA were heard but not worked. Beacons heard: 4N1SIX (KN04), ES0SIX (KO18), ES6SIX (KO37) amongst others.

Signals were generally weak and variable all the way through the opening. The first station was worked at around 1930z, the last at 2315z. There were periods of very strong vision buzz for up to 20 mins, and many periods of no signals at all. The exception was YL3AG, who was audible on CW for nearly an hour 2100-2200, with signals peaking S9+.

Mike G8TIC wonders if the following QSO was a first. On 1/6/95 at 10.31GMT John G6YIN (IO93) Leeds, worked 4U/KC0PA (IL46) on 50.110MHz. The QSO lasted about three minutes, starting off very weak (41) and ending at 59, later 4U/KC0PA faded out while calling CQ and not working anyone else.

Lars, OZ1CJX reports good ES on the 2nd June, between 7000 and 1300 GMT. OZ7DX worked 4X, OD5, 4K6, LZ, 5T5, and there was lots of activity from the Mediterranean area. The opening also reached 2m, OZ6OL worked 9H1.

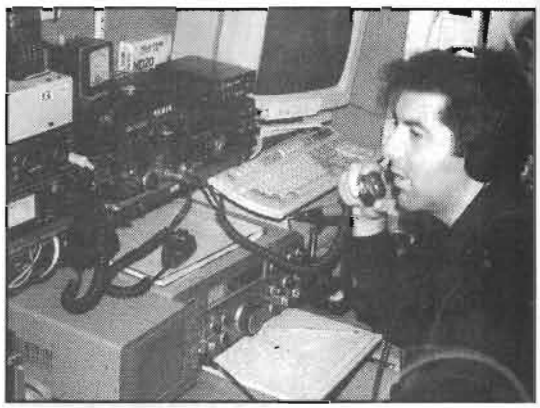
Dick G0BPS reported a good 144MHz opening on the 12th. He had a *huge* opening all over EU, starting towards Italy and Yugoslavia and swinging slowly through the Med to EA and CT.

I switched on at 0915 and started with: *0917*: 9H1GB 59/59 (JM75), that's going to be a different QSL. *1005:* IK7MCJ 59/59 (JN80) very strong, new square. *1032:* EA6XQ 59/59 (JM19), new country for me. *1125:* EA5CHT 59/59 (IM97), new square. *1136:* EA9MH 59/59 (IM85), wow! new continent / country / square. *1200:* EA7BV 59/59 (IM76), Another EA, new square. *1205:* EA9AI 59/59 (IM75), yawn, another African on 2m. *1213:* EA7DBH 59/59 (IM76), another.....

Not too many worked, but huge pile-ups at times. He prefers to hunt rather than call CQ. EA9AI was 1768km.

Lawrence, GJ3RAX reported working 3 9H's on 144MHz using only his vertical and 10W! Jukka OH6DD reported that he had contacted OX3LX on 50MHz at 1921z, on June 14th. Bo OX3LX was also copying OH9SIX/B. Herb W3IWU reported N4EJW contacted six or seven EA/CT stations at approx 2200z on the 14th June.

June 18th brought some new DX for your's truly on return from Cape Verde. 4U/KC0PA was worked for an all-time new country (149) on 50MHz, it was also a new square.



Renny 9A3FT, who is active on the VHF bands

Other new ones were 5T5BN in Nouakchott IK28 (Mauritania), and EH9IE in IM75 for square number 632 on the band. On the same day, Cedric CT3FT was heard working strings of USA stations on 50MHz, at the same time I heard the YV4AB beacon on 50.025MHz very weak for 14 minutes. Other stations logged on June 18th were; IT9, EH9, 4U, CT3, EH8, CU, CN, I, EH5, EH7, and CT. Bernard 5T5BN was S9+ using only 15W to a vertical.

GJ7UIT was heard working OE's on the same evening. The 19th brought Country 150 on 50MHz for me with HA8BE. Later in the afternoon W3EP/1 was heard and several VE's and W1/2/3/4/5 plus FP were heard and worked from Jersey and the UK. Lawrence GJ3RAX reported working 27 countries so far in June on 50MHz.

On the 20th things were still going strong on 6m. Steve G4JCC reported 4K6D on the band at 0715z. The rest of the day reports were received of Z32BU (KN01), EW7IM (KO53), ER5OK (KO34), LZ's, 9A's and in fact most of Europe. At 1800z OD5SIX was S5, 5B4CY was S6 and the SV9 beacon on 50.010MHz was S9+, followed by SV9ANK at S9.

Peter, G4MJS managed K8MPO and VE1PZ on 50MHz later that night. Herb, W3IWU reported hearing G0JHC, GD0TEP, GW3LDH, G4PIQ, G4CCZ, and PA0HIP in FN20FC. FP5EK was also around and heard by G0JHC.

The 21st started really good with the 5B4 and SV9 beacons in at 0800z. 4N5ZM was worked by many for a new grid square (KN02). ZB2VHF,

SV1SIX, and all the YU/S55 beacons were heard at S9. In the afternoon the band went mad to DL, OH, SM0/3/6/7, OZ, LA, ES, LY with S9+ signals all over the UK. Later at night GD0TEP worked ZF1RC, and Neil G0JHC worked many USA stations on 50MHz.

News from Julio D44BC was that he worked a French station on 50MHz SSB just after we had left for our journey home, great news! 50MHz news from Alain ON4KST is that D44BC was his 137th DXCC Country, his 605 locator and 67th field, not so bad, as he was first licensed in Belgium in February 1990.

On the 27th, 50MHz was really good, with W1/2/3/4 and VE being worked in the UK, the W's also worked well into Europe.

July 1st proved another great day on 50MHz with 9A6V (JN73) and T97V (JN84) being worked by many G's for new squares. In the morning GM's and GI's worked 9A (Croatia) on 144MHz SSB, during the afternoon Allan GJ4ZUK/P heard Italians also on 144MHz.

On the 2nd UT6X in KO41 was S9+ for most of the day, along with UX0FF (KN45) also at S9+. Others logged on the 2nd were LZ2FT, 9H's, 5B4CY (S9), OD5SIX (S9), OZ's, SP's, OK's, OM, EH6, S5, 9A, ZB2VHF, EA, CT, CN8 and SM, a truly widespread event. The Internet reported a large scale event from W7 to Japan, one 'W' worked over 120 JA's on 50MHz and commented that "It was like the F2 season".

The 3rd brought another W1/2/3/4 opening into the UK, and on the 4th VE's, W1's and FP5EK were worked.

Finally on the 5th mid-afternoon, S0RASD (Western Sahara) was S9, and the FY7 beacon was copied at my QTH for 3 hours at up to S4. CU3URA/6 was also a constant signal for many hours.

New 70MHz DX record?

News came to me that Martyn G3UKV worked 5B4 on 50MHz and 70MHz. If this is correct then it may well be a new 70MHz distance IARU R1 record. The previous record was held by Dave Butler GW4ASR/P, but it is believed that Martyn G3UKV is further north.

Cape Verde news

The results of the Cape Verde expedition are as follows; 26 DXCC countries were worked. Our first QSO was with GM3WOJ, followed by many GM, GD, GI, and G stations. The best DX was with SM3EQY (JP81) at a distance of 6000km on SSB. Only one US station was worked, K1TOL. A good Caribbean opening on Sunday 11th June produced VP2E, V44, and FG5, also heard was YV4AB in *Venezuela. The full report (2 parts) including some fantastic photos will appear in the November and December issues of HRT, don't miss it!*

News, views and reports please before the 5th of the month to: Geoff Brown, TV Shop, Belmont Rd, St Helier, Jersey. JE2 4SA. Channel Islands, or fax anytime to 01534 877067. Information can also be sent on the Internet to: equinox@itl.net, and to keep up with what's happening with beacons, radio etc try: http://user.itl.net/~equinox for the massive collection of radio pages.

Shirrow JF6DEA with the V31SMC beacon in Jersey

1995 VE3ONT EME Schedule

Again in 1995 the Toronto VHF Society, VE3ONT, will be active from the 46m dish in Algonquin Park. The purpose is to promote EME communications for all radio amateurs and especially small stations and OSCAR class users.

UTC DateU	*TC Start*	*UTC End*	*TX Frequency*	*RX Frequencies*
Oct 7	0000 (note 2)	0907	144.100	144.100-144.110
Oct 7-8	2306	1013	50.100	50.100-50.105
Oct 7-8	2306	1013	1296.050	1296.050-1296.060
Nov 4	0000 (note 2)	0804	432.050	432.050-432.060
Nov 4-5	2137	0907	144.100	144.100-144.110

Notes:

1. From rise to 1200 VE3ONT will be active mapping the moon on 10GHz, looking for 'hot spots' that return improved signal strength or frequency/time dispersion. Please do not call during this period. When ready for QSO's they will call CQ.
2. 0000 is the ARRL EME contest start time. VE3ONT will be active prior to 0000 for testing and random QSOs.
3. Times in the above table reflect a dish elevation limit of 9 degrees in FN05xw.
4. Use of the Algonquin dish is always subject to last minute cancellation for radio astronomy observations. There are no conflicts at the present time (June 26).
5. 10GHz and 50MHz operation will use horizontal polarization, 144 and 432 will use RHCP on TX and RX. 1296 will normally be RHCP TX and RX but can be switched to accommodate LHCP.
6. To maximize your probability of making a QSO, please select a random frequency in the receive window. Be patient.
7. QSLs to; Dennis Mungham, VE3ASO, RR #3, Mountain Ontario, Canada, K0E 1S0
8. VE3ONT is always happy to receive comments and suggestion from EME operators regarding past or future

Satellite Rendevous

Richard Limebear G3RWL with details of a 'Parrot' satellite-based repeater in this month's AMSAT-UK news

A 'Parrot' repeater operating on the 2m band will be the main payload of SUNSAT, a 60 kg, 45cm by 45cm by 62cm micro satellite being designed, built and tested by twenty two Engineering Masters students at the Electronic Systems Laboratory in the Department of Electrical and Electronic Engineering at Stellenbosch University in South Africa.

The detailed design of this actually started in back in January 1992. ***Sunsat*** was originally designed for a sun-synchronous type orbit on the Ariane 4 *Helios* mission, which is ideal for the main imaging payload. When launch costs became prohibitive, alternatives were sought and the flight will now be on the *Argos* flight on a Delta rocket from Vandenberg Air Force Base in January 1996 along with the Danish *Oersted* microsatellite.

In exchange for the launch, *Sunsat* will carry a precision GPS receiver and a set of Laser reflectors. These will enable NASA to study fine orbital perturbations for gravity field recovery, and for cross verification of GPS and NASA's laser tracking network. The orbit will be the same as *Oersted*, namely near-polar, 400km by 840km. The equatorial crossing will initially be at approximately 15:00, and will drift an hour earlier every 70 days.

A 'Parrot' repeater operates by digitizing audio sent to it on the uplink and then storing it in memory, of which Sunsat has 64 Megabytes. When the operator on the ground releases the PTT, the digital record is converted back to audio and fed to the transmitter which is on the same frequency as the receiver.

Sunsat's Parrot repeater will sample audio 8000 times per second and records will be restricted to five minutes each. The repeater will periodically announce that it is available for use. The voice system will also be used for transmitting messages which will be uploaded by the command team.

Pansat

The Petite Amateur Navy Satellite *(Pansat)* is a small, spread-spectrum communication satellite developed by the US Naval Postgraduate School as an educational project for officer students. Pansat will be a tumbling spacecraft with a weight of 68kg to be completed in 1996. Pansat will most likely be launched from the Space Shuttle by means of the HitchHiker program into a low Earth orbit with an inclination of at least 28 degrees. The spacecraft will supply direct-sequence, spread-spectrum modulation with an operating centre frequency of 436.5MHz, a bit rate of 9600 bits per second and 4Mb of message storage. Amateur radio ground stations will be able to utilize Pansat for store-and-forward communication.

A modified amateur satellite ground station is needed to communicate with Pansat. The NPS ground station utilizes off-the-shelf software, is microcomputer controlled, and is equipped with a spread spectrum modem.

Phase 3D - What's your club doing?

Amsat-UK recently sent a mail-shot to ***all*** RSGB affiliated societies appealing for contributions to the Phase-3D fund. That's 699 pieces of paper, 699 envelopes, 699 stamps (some overseas), plus of course the significant effort of folding these 699 papers, labelling envelopes, etc.

In total, AMSAT-UK received ***only 29 replies*** which raised less than £300. It would have been cheaper to have kept the postage etc. Club members please take note!

A reminder that, even if your club doesn't want to contribute, then as a part of Amsat-UK's fund-finding for P3D, it is now possible for *your callsign* to be included on a plate attached to the spacecraft, in return for a financial donation of a certain minimum amount. If you're interested, then contact the Amsat-UK Office (see below). People with even deeper bank balances will also get a smart plaque for their office wall!

Microsats

LuSat had a software crash during the latter part of June. At the time of writing, a software reload is in progress. Telemetry reports would be appreciated as usual.

The ***Dove*** voice experiment remains *off*, and due to seasonal power variations the S-Band transmitter has been turned off as well.

Webersat WO-18 appears to be operating again. Although I couldn't demodulate it myself, it sounds good by ear!

In view of the above it's also worth mentioning that ***OF-20*** seems to be permanently in analogue mode these days.

Oscar 13

To take full advantage of the current "good" phase on AO-13, Amsat-NA have restarted their operations net on AO-13, although note these are not always within range of the UK.

The primary downlink frequency will be on or near 145.950 MHz, with Keith, W5IU as net controller. Also the ZRO Memorial Technical Achievement Award Program, or just "ZRO Test", has restarted but at the time of writing no passes occur within range of UK in the near future. Contact Andy, WA5ZIB for more information on this.

Oscar 10

Oscar-10 is still operational in Mode-B. Despite good signals from the transponder, there are very few stations using it. Its currently available when in view but *please do not* attempt to use it if you hear the beacon or the transponder signals FMing.

A report in 'Spacenews' on this satellite says that Dave, G1OZO reports that AO-10 is working well. He made 45 contacts in 27 days which included the USA, Ukraine, Finland, Canada, Italy, U.K., Holland, Spain, Czechoslovakia, Belgium, Poland, Germany, Austria, and Saudi Arabia using just 25W of uplink

power. Dave has been active on satellites since the 4th May 1995, and it sounds like he is having quite a good time in his new activity.

Mir news

Future Mir operations will be on 70cm as well as 2m. The equipment has already been sent up and training is in progress; however, the dual band aerial base was broken in transit, and the aerial can't be mounted outside of the Space Station until a replacement is received. This however should happen before August, so by this time the system should hopefully be up and running.

Dave, N1PPP reports that Mir made a scheduled radio contact with Chris Edscorn at Crotched Mountain school in New Hampshire in the US recently. Chris teaches a special education communications class, and since there is no third party agreement between the US and Russia, asked questions of Dr. Norm Thagard, on board Mir, for the class. The contact lasted about six minutes. Dr. Thagard was very busy with a communications satellite and wasn't sure he would be able to make the contact, but managed to take a few moments to make the contact.

N2CQR/HI reports the Mir packet system has sometimes been turned off and voice contacts seem to have become less frequent, due to the crew having been busy with space walks and experiments. Also, Jay Apt N5QWL received in a packet message dated 14th Jun 95 from Dr. Thagard explaining that he has been turning off the Mir packet station to conserve space in the TNC buffer for uploads over Russia in the present busy period near the end of the MIR-18 crew's stay. He mentions that the packet TNC has only 14k of memory, and has been routinely filled in 10 hours. Many of the messages have been store-and-forward. This traffic might be handled via other means. He sends his best wishes to the ham community, and thanks everyone for the morale-boosting messages when he needed them most.

Mir fans were treated to a spectacular series of visible Mir passes during the June 11 - 14 time period. Mir was flying close to the day-night terminator, so shortly after the onset of darkness earthbound observers could clearly see the spacecraft zoom through the skies. With the Earth's axis in its summertime configuration, observers in northern latitudes were able to see Mir on successive passes late into the night - for them the spacecraft was illuminated by sunlight coming over the north pole.

'WiSP' tracking program update

WiSP users should note that there have been some updates recently. The module versions (available from Amsat-UK) current at the time of writing are as follows:

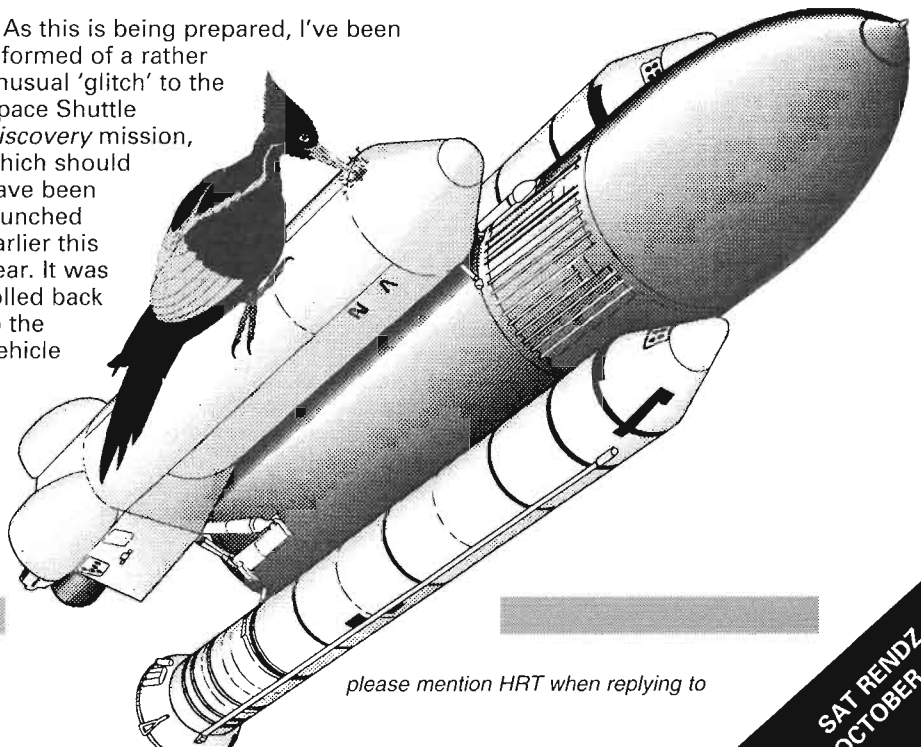
GSC 0.91c
MSPE 0.99g
VIEW-DIR 0.81
MSGMAKER 1.13
MSGVIEW 0.99
PROCMAIL 0.94
UPDKEPS 0.74
WISP-TLM 0.54
WKCTDRV 0.73b
WISP.HLP 4-14-95

In another development that will affect all WiSP users, in anticipation of programs being released for Windows 95, KB5MU has opened directories on the AMSAT ftp site for these files: /amsat/software/win95/

In the near future Chris, (G7UPN/ZL2TPO), will release a Windows 95 version of ***MSGMAKER*** which can be used with the regular Windows 3.x version of WiSP running under WIN95; and there may be other additions to the WIN95 version of WiSP, they may have version numbers beginning with a 2.

Shuttle 'Discovery' bird problem

As this is being prepared, I've been informed of a rather unusual 'glitch' to the Space Shuttle *Discovery* mission, which should have been launched earlier this year. It was rolled back to the Vehicle Assembly Building hangar to be inspected and repaired after some yellow-shafted flickers, a type of woodpecker, pecked over 100 holes, some as large as 10cm in diameter, into the foam insulation of the brownish-red external tank.



STS-70 was planned to fly configuration 'C' of the Shuttle Amateur Radio Experiment (SAREX). This configuration allows radio amateurs to communicate with the Space Shuttle Discovery Crew on 2m using packet radio and FM voice.

Latest Keplers available

Amsat-UK Keplers are put out on packet fortnightly, sent to KEPLER @ GBR. The latest satellite Keplers as supplied by Amsat-UK are also available by fax from the Ham Radio Today fax-back line, 01703 263429, request fax document 49 from the satellite menu for this month's. You can also get a copy in the post by sending an SAE together with the corner flash from this page to the HRT Editor, marking your envelope 'Keplers' and stating whether you want all *amateur satellites* (one A4 page) or *all satellites* (10-15 A4 pages).

If you're interested in amateur satellites and would like further information about Amsat-UK, contact: AMSAT-UK, c/o Ron Broadbent MBE, G3AAJ, 94 Herongate Rd., London, E12 5EQ. A big SAE gets you membership information. SWL's are welcome. All new joiners get the USAT-P tracking program on a 5¼in disk.