HRT

HAM RADIO TODAY

Incorporating SCANNER

SEPTEMBER 1995 £1.80

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The 'what', 'why', and 'how' of using PCs to help in your hobby

Latest data radio reviewed

How to get going on high speed packet radio

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HRT CONTENTS

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HAM RADIO TODAY

HAM RADIO TODAY VOLUME 13 NO.9 SEPTEMBER 1995

REGULAR COLUMNS

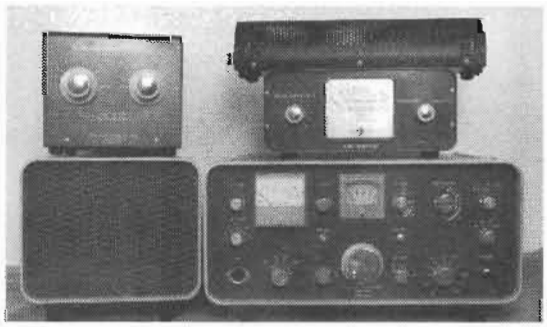
REVIEWS

MFJ-8621 VHF data transceiver reviewed

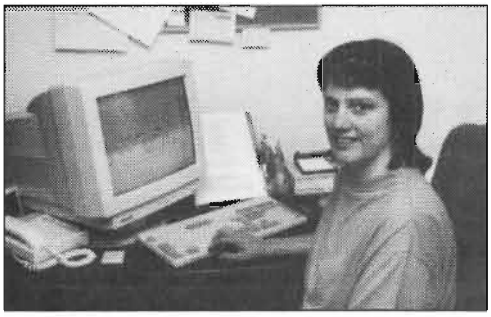
FEATURES

CONSTRUCTION PROJECT

NEWS & VIEWS



The KW2000A HF Transceiver



CQ de G8IYA

Editorial

Are you having fun in your hobby?

Picture the scenario; "CQ, CQ CQ North America, this is G8IYA calling on 2m EME" .... "G8IYA, this is AA0RX replying from Kansas, you're fully readable with a nice signal, go ahead" .... "AA0RX from G8IYA, roger and thanks for
replying, you're a nice 5 and 9 here. This is my first speech contact with the latest amateur radio DSP program I'm tryingwith my PC. It's linked to a converted PMR rig running 25W into a single 2m yagi on the chimney of the house, and it's niceto know I'm getting across to Kansas" .... and so on.

Distant dreams?

Is the above fiction? Maybe, at the moment. But how about in a few years time? You may already have seen example of the small hand-held GPS (Global Positioning System) units you can buy 'off the shelf' in the high street. Now, these have to receive signals from at least four orbiting satellites to get a geographical 'fix'. But if you tried tuning a 'normal' receiver to the frequency of even the nearest satellite being received, you'd hear absolutely *nothing*. That's because the signal is buried right *under* the noise, there's no way *whatsoever* you'd be able to detect *anything* with the human ear. But,add a microprocessor or two combined with a bit of pseudo-random code synchronisation, and that weaker-than-weaksignal, the one that's buried in noise and corrupted by ionospheric signal changes, Doppler shift, and signal fading, becomes fully coherent. In fact, multiple signals, all on the same frequency and all buried in noise and QRM, all come out OK, using the tiny battery-powered GPS unit you hold in your hand.

So what?

What's this got to do with amateur radio? Forward-thinking readers may already know. What's to stop amateur radio experimentation using the same spread-spectrum techniques? It's nothing new, it's been covered in texts (such as the ARRL Handbook) for several years now.

In case this is a few years 'too advanced' for us, let's take a glance at another, almost related, method of communication. Internet users have suddenly discovered a cheap way of having low cost long-distance telephone conversations. At each end, the computer and modem-equipped user connects into their local Internet point, and links to the 'distant' point, in real time. The users, or indeed group of users (a 'roundtable' or 'net') can all tap away on their keyboards and converse with each other in 'real time' via ASCII data. Add a speech digitiser, to covert speech to and from ASCII data, and they can talk to each other instead. Until the network overloads with all the data. Sounds just like packet radio. If you take a look back at the September 1992 issue of HRT (p. 13 - digital 70cm packet speech mailbox), and subsequent issues, you'll see we amateurs had this capability, and have been relaying such digitised speech between different geographical locations using our packet 'node' system, for several years.

Amateurs *are* continuing to show the way ahead. What's to stop us continuing. With the Phase 3D AMSAT satellite coming up, error-free, worldwide communication using DSP techniques and just a low power handheld, isn't technically impossible any more.

Where's the fun?

But, wouldn't this instant, perfect, communication to and from anywhere via amateur radio, whenever we want it, take the *fun* away? Isn't having fun in our hobby the thing that keeps us going? It is for me, I hope it is for you too, and we all have our fun in different ways. Some in developing new techniques, some in using them. Think about it.

This month's software offer

We provided LOG-EQF on the front cover of the February 95 HRT. This gave station logging, packet radio, rig control, DX information, QSL card labels and much more. Well ***LOG-EQF version 7*** has now just come out, it's fully updated, and it's on this month's disk - a *superb* program!

Also this month, for listeners, is ***SWLOGit*** version 1.19, described as "the *only* program shortwave listeners will ever need". This shareware program gives you an exceptional logger, world clock, VGA/EGA world maps, an extensive database search, MUF graphs, sun rise/set times, shortwave station addresses, a report script writer (which writes reports for you) and plenty more.

For this month's collection, supplied on a 1.44Mb HD PC disk and including UK p/p, send a £1.00 cheque or PO, payable to; *Mr. Steven Lorek,* together with your name, address (some readers are forgetting to include their address), and the original 'corner flash' from this month's 'contents' page, to; ***Software Offer, P.O. Box 400, Eastleigh, Hants SO53 4ZF.***

Overseas readers, including Eire, should send three US $1 notes, or for airmail (if required) outside Europe four US$ in notes. Other payment methods can't be accepted due to high banking charges - and *please do not* make your cheque or PO payable to any other individual or any company (as this is an 'at cost' service, we cannot pay to return letters, cheques etc. which do not comply with the above instructions).

UK readers who wish the added security of recorded delivery should enclose *a fully completed* PO recorded delivery form plus a further 55p (the current PO cost of this service). Queries regarding supply of these 'at-cost' disks should be sent to the above address with an SAE or IRC for reply, please don't contact the Editorial staff *or* the magazine publishers (Nexus), as they can't answer your queries. Your disk will normally be placed in the post to you within 7-14 days of receipt of your request, please allow up to 28 days for delivery.

Cover disk next month

Following the enormous success of our last cover disks, next month's HRT will again have a cover disk, this time featuring the comprehensive 'Total Ham' and 'Total Ham Plus' software packages - don't miss it! Why not take out a postal subscription to make sure you get your copy delivered to your door at no extra cost?

LETTERS

Letter of the month

Dear HRT,

I find myself very much in agreement with the opinions expressed by Ray Howes (July 95 HRT). In my youth, radio was regarded as being at the forefront of technology, and I wanted to be part of it. This same sentiment prompted me years later to take the RAE. I suspect that the motivation of today's youth is not dissimilar, but in making an evaluation now, one would probably compare handheld/repeater with Cellnet, Packet with Internet, Morse with Esperanto.

So what direction should Amateur Radio be taking? - exactly the same as Professional Radio. Digital Signal Processing for better, and cleaner use of the spectrum, and a Global Satellite Repeater System. The advantages of being an amateur remain the same, no labour costs, and a vast resource of skill. If our forefathers could take on the commercial technology of their day, is there any reason why we should not be able to do the same?

Steve Marshall, G1USP

Dear Editor,

Ever since you took over the Editorship of Ham Radio Today, I've known that I could rely on the Editorial column to bring controversial issues concerning our hobby to the fore, and the July issue was no exception! However, whilst I would not quarrel with your main theme of "use it or lose it" concerning 70cm, I feel that, by quoting just one of the recommendations of the DSI report in support of your argument, you are in danger of giving the impression that the faceless bureaucrats are trying once again to push us out of our bands, without us having any say in the matter or receiving any recompense. It's true that the report does recommend that four out of the ten megahertz currently comprising our 70cm band should be re-allocated for 'land mobile' (i.e. PMR) use, but this is just one of a total six recommendations, the others of which are, to my mind, wholly positive in terms of improving the Amateur Radio 'quality of life'. Unfortunately, many amateurs will not bother to read the report in full; the idea of any possible reduction of any band will fill them with horror, and they will adopt a seige mentality which regards these changes as unthinkable, regardless of other benefits which might be obtained.

As an example of how mis-information can spread, I can describe a conversation I had over the air with one of my normally well informed local colleagues shortly after the details were published. He had not had time to read the details himself at that stage, but had already been told by someone else that another of the proposals was to reduce the 4m band to just 100kHz! In fact, nothing could be further from the truth, the proposal in fact being that 4m should become a Europe-wide allocation of at least 100kHz, the exact size of the allocation in each country being left to that country's discretion. As you can see, this is a very positive proposal which the 'grapevine' had totally mis-represented.

So, what would we get in exchange for the loss of part of 70cm? The report's recommendations are as follows: The remaining portion of 70cm, namely 432 - 438MHz, would become a primary, exclusive amateur allocation. 6m would also become a primary amateur allocation, 50-51MHz being exclusive and 51-52MHz shared. A minimum of 100kHz would be allocated in the range 70-70.45MHz on a Europe-wide basis. 2m would retain its primary, exclusive status. An additional allocation would be made in the region of 40-68MHz for beacon use. A further additional allocation of 919.5-920MHz would be made on a secondary basis.

To my mind, the positive aspects of these proposals far outweigh the one negative aspect of the loss of part of 70cm. Apart from anything else, the proposals safeguard the future of the remaining portion of 70cm by upgrading its status to 'Primary', as well as confirming the continuing safety of 2m. In any case, those of us living in the south of England have already lost the use of 430-432MHz until further notice, with no such guarantee as to the future of the rest of the band.

Further good news is, of course, that these proposals are not set in concrete, but are simply a set of recommendations out forward for discussion. It is open to any of us to make our views known on the subject, and thus to influence the final outcome.

Keep up the good work!
Richard Davis, G3TDL

Editorial comment

Thanks for your kind comments Richard. On the date that issue of the magazine was to be published, it had been reported elewhere that the 'deadline' for comments on the DSI report was due to unfortunately just have expired. Information was however nationally broadcast on this via the GB2RS news, and the information on the report, plus a multi-page document giving details, was available on the HRT Voicebank and fax-back information service for the benefit of callers. Although the voicebank doesn't have such a wide monthly 'readership', it is of course is one of the excellent features of this service, which 'gets over' some of the publishing deadlines all magazines suffer from!

£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. 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

Is the Internet taking over?

Dear HRT,

I read the letter, written by Ray Howes G4OWY (HRT July 1995) regarding the impact of Internet with very great interest. As Ray rightly points out, Internet does give communications capabilities far in excess of those available via ham radio.

Will Internet be the death of ham radio as we know it, (or at least, the data comms aspects of ham radio)? I believe this is not the case. Ham radio caters not only for those who simply wish to communicate, (let's call these the communicators) but also for those who are interested in the technical aspects of communications (let's call these the engineers).

Yes, I agree with Ray that the communicators may well abandon the world of ham radio for the world of Internet (and the World Wide Web). I do not expect that the engineers will do likewise. I consider myself more of an engineer than a communicator. I have unlimited free access to the Internet via my university but I use it only to communicate with others. I cannot get involved in the technical side of the Internet. The actual routing used by Internet from Nottingham was totally unknown by me until a cable somewhere in the Midlands was cut and I lost my Internet link to the world. By contrast, with the ham radio packet network I can get involved with the technical aspects and comprehend more than just the screen and the messages upon it.

The communicator may well give up ham radio in favour of the Internet but I do not believe this would also be true of the engineer. Now, for me, ham radio is primarily about the technical aspects of communication by radio rather than simply about the actual exchange of messages. I would therefore suggest that those with a "passing" interest in ham radio are mostly communicators who will not stay with the hobby for a lifetime. It is therefore only natural that they migrate to the Internet.

Personally, having both the ham radio packet network and the Internet equally available, I tend to use the Internet instead of the phone (especially for messages between the UK and the USA). I still see the ham radio packet network as my primary means of contact with other hams in the UK.

This concept of communicator and engineer is certainly not confined to ham radio. In photography there are two prominent groups of photographer. One group enjoy pressing the shutter release and letting the camera and minilab do all the technical stuff. The other group enjoys the technical aspects as much as, if not more than, actually pressing that shutter release. Even the driving fraternity can be split along similar lines into two groups. One group simply uses the car as a means of transport and the most technical thing that they do to the car is to clean it. The other group usually have the car in pieces most weekends.

This concept of communicator and engineer is certainly not confined to ham radio, similar groups are to be found amongst other interests, e.g. photography and driving. I believe that Internet will not see the end of ham radio any more than has the phone (and the phone does pre-dates radio). Both Internet and ham radio offer world-wide communications but they have different attractions for different people. Everyone can choose according to their interests and that, surely, is one of the major virtues of any hobby.

As my name and callsign are well-known in connection with BARTG (British Amateur Radio Teledata Group) I must state that the views given above are my personal views. Finally, before anyone asks, I did send this letter to the HRT Editor via the Internet.

Ian Brothwell, G4EAN

Idea for a new competition?

Dear HRT,

I have noted recent correspondence on the subject of Novice licensees and the way some, at least, have been treated on the air by other licensed amateurs. I am sure most thinking amateurs would agree with me that it is the obligation of all of us to do all we can to encourage new entrants to the hobby.

Recognising that Novices are, at 3W out, inevitably a weak signal, and rare, with only a few hundred in the callbook we have the basis for a new competition. Why not set up a new award scheme for working Novices along the lines of other national awards? Cross-band working should be allowed to open the award to full B licensees and multipliers could be granted for distance, squares etc., as well as contacts with Novice A's (the rarest of all QRP stations). Points should be awarded to both Novice and full licence holder, with a winner from each camp declared annually.

Sounds like a barrel of fun, why don't we do it?

Yours sincerely,
William F.A. Steele

Editorial comment;

Well readers, what do you think? Write in and express your views!

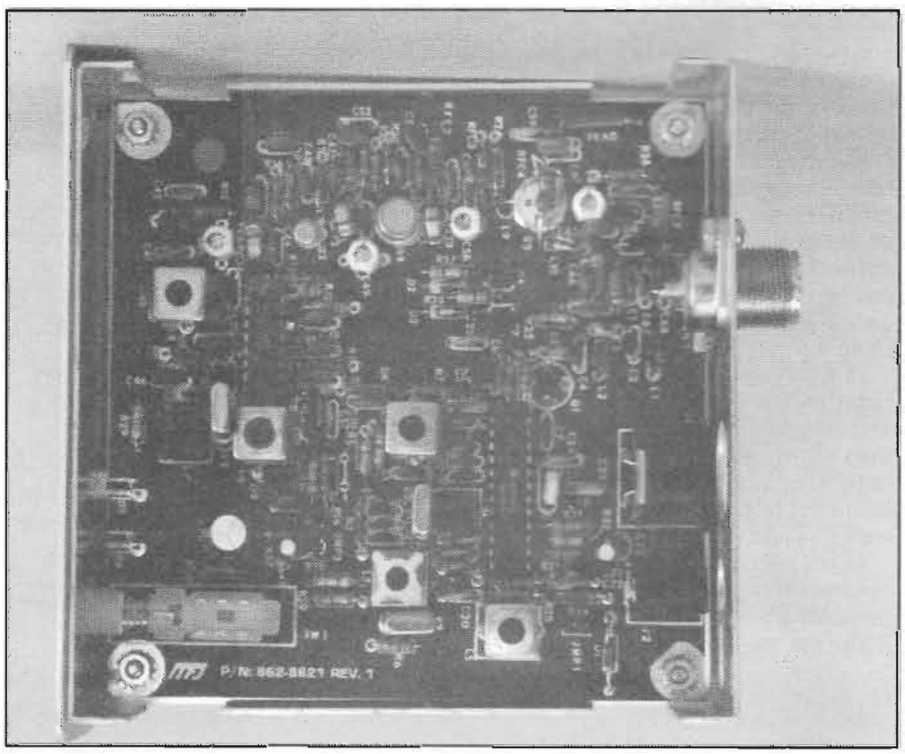
MORE LETTERS NEXT MONTH

MFJ 2m 'Data Radio' Review

Chris Lorek G4HCL examines a possibly easier way to get onto high speed packet on 2m

Many amateurs who are active on 2m packet quite naturally dislike having to 'tie up' their main 2m rig to their packet modem or TNC, 24 hours a day. Especially when it's just stuck on one channel all the time, as is usual. Higher speed 9600 baud packet, which is either already in use or coming into use in a number of areas, usually also means that you have to 'delve inside' your transceiver to make the necessary modifications and add suitable input and output leads. An ideal solution to overcome this would be a stand-alone 'made for data' radio. The MFJ Data Radio being designed for just this purpose.

It's a single channel, crystal controlled, 'data-only' transceiver, and comes supplied ready-fitted with crystals for 144.650MHz, a popular UK BBS 2m access frequency. The transmitter, which gives around 4W power output, is equipped with two purposed-designed modulators. One is a reactance modulator for 1200 baud, which accepts 'microphone level' audio, the other is a true FM varactor modulator which accepts the typically higher level of audio you'd get from a 9600 baud packet modem. The receiver section is fitted with 'wider than voice' filters at both the 1st and 2nd IFs, to allow better 9600 baud data performance.



Plug-in links on the unit's PCB change the transmitter modulators and receive audio characteristics accordingly between 1200 and 9600 baud.

As you can see from the photo, the unit is uncomplicated, and is obviously designed as a 'plug-in and forget' unit with just an off-off switch for control. Audio connections, common to both 1200 and 9600 baud, are on the rear panel-mounted 180 deg. DIN socket together with PTT and ground connections, plus a separate 12V DC input socket and an SO-239 aerial connector. A multi-way lead with a ready-wired DIN connector at one end (unterminated at the other end for

you to wire to your TNC) is supplied, plus a short DC lead also with a ready-wired plug.

The compact unit is smaller than most TNCs, measuring 125mm (W) x 130mm (D) x 36mm (H), and draws just 25mA when not transmitting.

Connecting up

I found connecting the unit up was quite simple, a single radio-to-TNC lead doing the job. As the receiver doesn't use a squelched output, a TNC with 'software DCD' is essential, i.e. one which correctly senses 'real' packet data on the channel, rather than just audio or noise for this 'Data Carrier Detection'. If your TNC doesn't have software DCD, you can't use it with the Data Radio, as the unsquelched output will simply inhibit your TNC from transmitting. Such unsquelched audio is, in any case, always used for 9600 baud packet and can also give better throughput with 1200 baud.

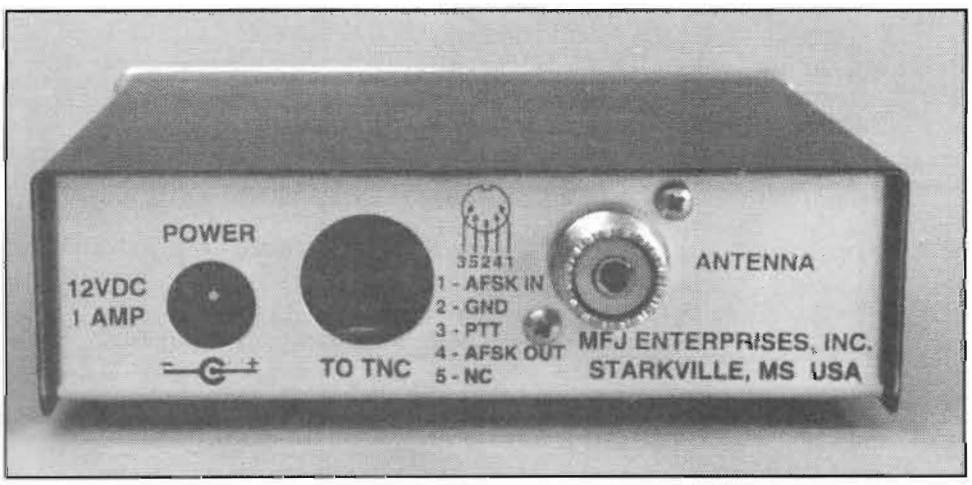
Then came the time to make a few necessary adjustments before going on air. First, I checked the TX frequency, a ferrite cored coil next to the transmit crystal adjusting this as required. Of note is that, when you switch between TX modulators for 1200 and 9600 baud, the TX frequency is changed slightly and thus has to be re-set. 'Netting' the receiver on frequency can be carried out with a multimeter, adjusting the RX crystal coil until exactly 2.5V is measured on a test point on the PCB whilst receiving an on-channel signal (this can even be the radio's TX if it's on the same frequency as the receiver). Here I encountered a problem, which to cut a long story short was a faulty RX crystal which had apparently been damaged in the post (it had become unplugged in transit and was rattling around inside the case when I received the radio). Fortunately the suppliers had also provided me with crystals for 144.675MHz, which I successfully used instead.

After that came the deviation setting. The radio has no adjustments for this - instead you have to carefully adjust the output level from your TNC to set the correct deviation. I found this went rather 'over the top' (over 15kHz deviation) if I just 'plugged in and transmitted'. An adjacent receiver, with preferably an oscilloscope or AF voltmeter connected, or even better a deviation meter, are virtually essential here.

On the air

After the necessary adjustments, I found the radio worked reasonably well on air, with instant connects to my semi-local 144.675MHz node on the Isle of Wight. For 9600 baud checks however I had to perform a 'back to back' test with another radio in my shack, due to the absence of such nodes on that 2m frequency in my area. This likewise operated quite well, and of course was extremely fast compared with 1200 baud.

Although difficult to check without an attached speaker, I did sometimes notice the odd receive problem, which turned out to be caused by strong signals on nearby channels. For example, local packet stations on 144.650MHz whilst I was operating on 144.675MHz. This I found to be due to blocking problems, the receiver's filters obviously not having the 'ultimate' rejection of voice-type sets. To be fair, the US-written user manual *does* warn of this, saying not to expect $5000 performance from a $120 radio!



Lab tests

The measured results show the set's audio characteristics, on both transmit and receive, to be very suitable indeed for both 1200 baud and 9600 baud packet. Gone are the days of 'delve inside with your soldering iron and hope' to try to get going on high speed packet! The receiver's sensitivity wasn't quite up to the high performance of more expensive radios, but it should be satisfactory for most purposes. Indeed too high a sensitivity isn't always a good thing with a relatively low output power transmitter. The receiver strong-signal handling performance I found to unfortunately be rather a trade-off between the 'flat' IF passband filtering needed for good data performance, and operation in busy areas. If you have problems here, then replacing the small 10.7MHz three-leg ceramic filter in the set's receiver with a two-pole monolithic dual crystal filter with suitable input/output matching would I feel be a rather beneficial move.

Conclusions

MFJ's Data Radio should be able to provide a relatively low-cost solution for the requirement of a 'stand alone' 2m single-channel packet radio, to mate directly with your software-DCD equipped TNC or 9600 baud modem. Once the required setup adjustments have been made, the radio is extremely simple in use, indeed it can be simply left and just forgotten about until you ever need to change the data speed.

The receiver circuitry may not stand up to demanding use in busy areas, for example operation at a hilltop packet 'node' site, so bear this in mind if you're a 'system planner'. It does however give the 'average amateur' the advantage of having a 9600 baud-ready packet radio, one that also ready for use on 1200 baud if your local BBS or whatever uses this speed at the moment but is 'thinking' of upgrading (as many are) in the future. .

The unit is priced at £139.95. My thanks go to Waters and Stanton Electronics for the loan of the review transceiver, who have asked MFJ to build in the crystal holder and crystal filter improvements.

LABORATORY RESULTS

All measurements taken on 144.675MHz, 1200 baud, with set powered from stabilised 13.2V using supplied length of DC cable, unless otherwise stated.

RECEIVER;

Sensitivity;

Input level required to give 12dB SINAD, 1kHz tone at 3kHz dev ;

1200 baud;	*0.64µV pd*
9600 baud;	*1.66µV pd*

Image Rejection;

Increase in level of signal at 1st and 2nd IF image frequencies (-21.4MHz and -910kHz respectively) plus half 2nd IF response (-10.7MHz), over level of on-channel signal, to give identical 12dB SINAD signal;

Half 1st IF	58.8dB
1st Image	32.2dB
2nd Image	44.8dB

Blocking;

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

+100kHz;	35.6dB
+1MHz;	74.5dB
+10MHz;	92.1dB

Intermodulation Rejection;

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

25/50kHz spacing;	Blocking limited
50/100kHz spacing;	Blocking limited
1MHz/2MHz spacing	57.1dB

Adjacent Channel Selectivity;

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

+12.5kHz;	9.8dB
-12.5kHz;	5.7dB
+25kHz;	31.4dB
-25kHz;	34.4dB
+50kHz;	30.5dB
-50kHz;	29.7dB

Audio Output;

Measured with 1kHz tone, 3kHz deviation, 8 ohm load;

1200 baud	435mV RMS (23mW RMS) @ 6.8% distortion
9600 baud	930mV RMS (108mW RMS) @ 9.98% distortion

TRANSMITTER

TX Power and Current Consumption;

Measured using stabilised DC supply connected to supplied fused DC lead

10.8V Supply;	2.67W/820mA
13.2V Supply;	3.57W/910mA
15.6V Supply;	4.34W/1.05A

Harmonics;

2nd Harmonic;	-56dBc
3rd Harmonic;	-57dBc
4th Harmonic;	-63dBc
5th Harmonic;	-64dBc
6th Harmonic;	<-80dBc
7th Harmonic;	-70dBc
6th Harmonic;	-65dBc
7th Harmonic;	-78dBc

TX Deviation;

TX output deviation level given for varying input level

RMS Input	*1200 baud*	*9600 baud*
50mV	2.36kHz	0.46kHz
100mV	4.63kHz	0.91kHz
150mV	6.81kHz	1.37kHz
200mV	8.95kHz	1.84kHz
300mV	12.2kHz	2.81kHz
400mV	13.6kHz	3.86kHz
500mV	14.1kHz	5.04kHz
750mV	14.5kHz	8.40kHz
1.0V	14.6kHz	11.6kHz
1.5V	14.5kHz	17.6kHz
2.0V	14.7kHz	22.7kHz

TX Frequency Response - 1200 baud

Measured with 50mV RMS i/p;

1200Hz;	2.35kHz
2200Hz;	2.38kHz

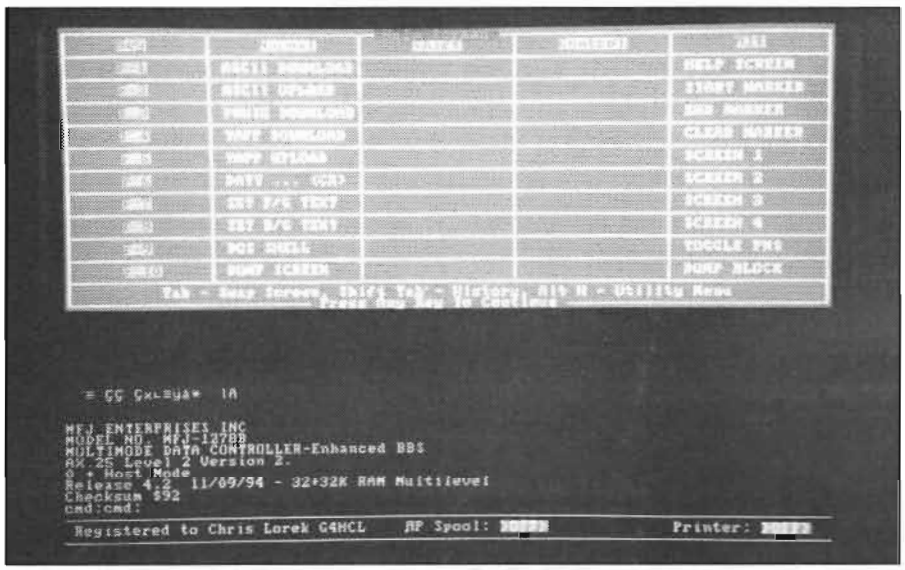
TX Frequency Response - 9600 baud

Measured with 300mV RMS i/p;

Audio freq.	TX dev.
10Hz	0.85kHz
15Hz	1.85kHz
20Hz	2.22kHz
25Hz	2.42kHz
50Hz	2.73kHz
100Hz	2.77kHz
250Hz	2.79kHz
500Hz	2.80kHz
1kHz	2.81kHz
2kHz	2.81kHz
3kHz	2.83kHz
4kHz	2.81kHz
5kHz	2.78kHz
6kHz	2.75kHz
8kHz	2.67kHz
10kHz	2.58kHz

Computers in Amateur Radio

We twisted the arm of HRT's Consultant Technical Editor to give an insight as to what computers can really do in amateur radio today, and maybe tomorrow....



Superb packet facilities from the G7JJF program

Many amateurs associate the use of computers in amateur radio as simply 'helping with the logging' or acting as a 'terminal' for data modes such as packet. Of course, some amateurs *do* use their computer only for this purpose. But this use is just the 'thin edge' of the wedge.

PCs can do a lot more besides in our hobby. For example they can often sometimes replace that 'black box' sitting alongside your rig. Or add the equivalent of such a 'black box', be it a packet TNC, weather fax decoder, CW memory keyer, or whatever. Let's take a short 'guided tour'....

HF

If you're either a keen DX chaser, or a ragchewer, you'll know the need, and benefit, of a good record keeping system, whether this be to check your 'worked' score or to quickly get details of the last QSO you had with the local station who replies to your CQ on 80m. You'll then impress them with a reply like "Hello again Bill, how's the boat you were building last month coming along?". Most of the amateur radio logbook programs have such facilities 'built in'. More sophisticated programs, such as 'Turbolog', 'Log-EQF' (see this month's software offer), 'Hyperlog' and the like can also print out QSL labels, provide a 'window' for PacketCluster linking, even automatically QSY your transceiver for you to the frequency and mode of the reported DX spot of the station you need on that band. The computer's already checked this for you, of course.

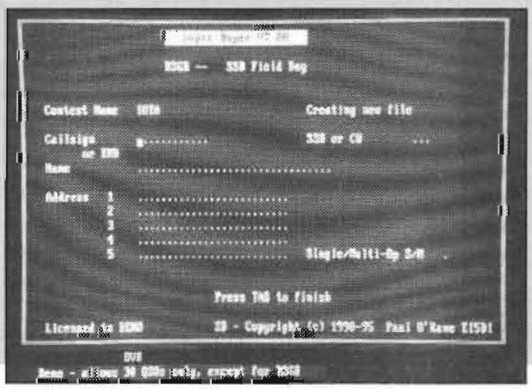
What's the best time for propagation to try to work that elusive country you need? Or the best frequency band for making that sked next week? Let one of the propagation prediction programs tell you, in an instant. Suffering from QRM off the back of your beam? The front-to-back ratio on your yagi is often optimised around the middle of the band. If you work in the CW DX section, moving the reflector just a fraction could work wonders. Again, one of the aerial optimisation programs, 'Yagicad' for instance, can save you a lot of hard work and experimentation.

VHF/UHF

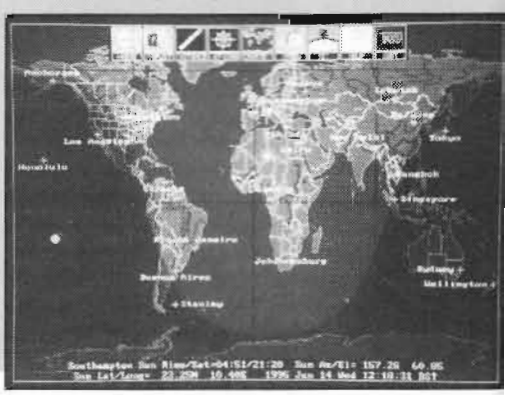
Much of the above is also true for VHF and UHF. But add moonbounce programs, and satellite tracking software which automatically steers your aerials in azimuth and elevation, whilst automatically

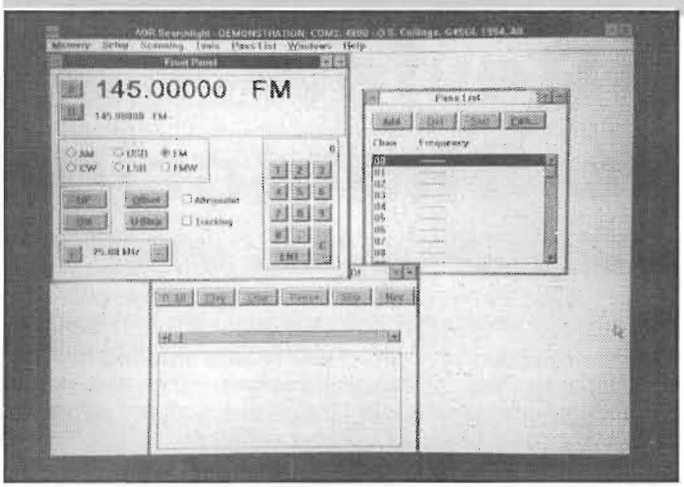
Let your PC do the SSTV processing

Contest logging with 'Super Duper'



Grey line propagation information at your fingertips





Automatic monitoring and audio recording to disk

tuning your rig to compensate for Doppler shift, to the list. If you think logging programs are tied into HF DX working, then think again. Try 'Ham-Map' by DL7FU and DL7AVQ which comes complete with 'worked fields' squares for each band, even an electronic European locator map in which you can keep track of the squares you need. There's even licensing and prefix information there, telling you which VHF/UHF ranges different classes of amateurs in their respective countries can operate on, and with what power levels.

Licence study

What if you don't have a licence, but would like one? You'll find plenty of ham radio study aids available, although most of these are based upon the US test system (the technical content of which does, of course, have many similarities to UK licence study requirements). There's even a UK Novice test 'on disk' with sample questions you answer 'on screen', the computer instantly telling you whether you're right or wrong.

Listening in

If you're a listener, or indeed an amateur who likes to keep in touch with what 'going on' on other modes, then special data decoders or whatever needn't always be necessary for weather fax, SSTV, packet, or whatever. Let the processing power of your PC do the work! You can use just a simple one-IC interface (e.g. the construction feature in the March 95 HRT) to link between your receiver's audio line and your computer's RS-232 serial connector. Running a suitable program, such as 'JVFAX' or 'HamComm', lets you use your PC for a variety of fax, SSTV, and data modes with just that.

If your PC also has a sound card fitted, the world's (almost) your oyster! You can just plug your receiver's audio output into your PC's sound card input, run a suitable program such as SB-SSTV or 'WeatherMan', and 'Bob's your uncle' - instant reception and decoding on your PC's screen.

There are already scanning receiver control programs which can use your PC to intelligently search across the frequencies you select, or of course find new active channels for you, and using your sound card record activity onto your PC's hard disk in digital form for later listening.

What of the future?

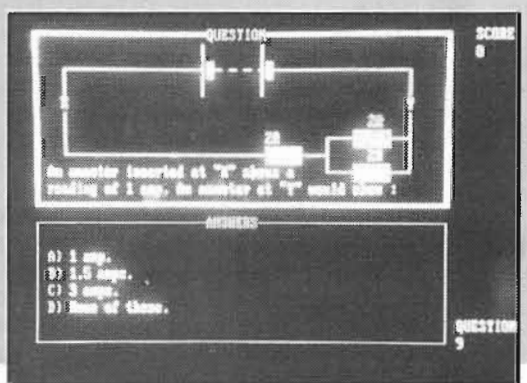
If you consider the progress that PCs have made in just the last few years, where a 100MHz Pentium is now the same cost as a 12MHz 286 was five years ago, think what the next few years will bring. There are already experimental amateur radio DSP programs 'doing the rounds', where again your sound card can act as a digital signal processor to pull CW, voice, data, or whatever signals right out of the noise. I can see the day where you'll be able to plug your aerial into a socket on your PC, which will then handle all the RF processing and 'brick wall' filtering, and give perfect audio straight out of the other end. Or onto your hard disk, or solid-state memory, or whatever we'll be using. It'll probably even use voice recognition and detection to see whether it's Fred, or Bill, or Sheila, calling you. The technology for automated QSOs, in any mode, will undoubtedly become available. Whether we shall use these are another matter. But then, if mankind were meant to fly.....I don't have wings.... yet.

Cover mounted disk next month

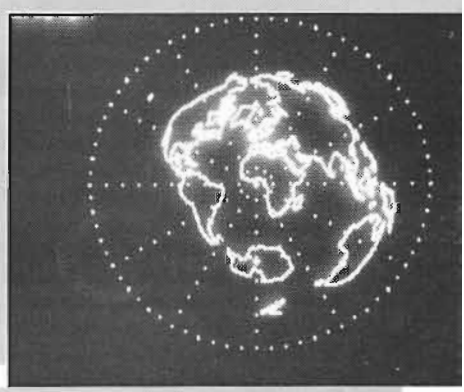
If all the above has whetted your appetite, the news is that on the front cover of next month's HRT you'll see a cover-mounted disk with the PC program 'Total Ham' on it. The title probably says it all, like log keeping, DX records, and so on. It should run on *any* IBM-compatible PC, with no fancy colour monitors or minimum speed or memory needed, although better specifications will of course enhance the use of the program. Also with next month's issue you'll be able to obtain a large collection of superb programs for just the equivalent cost of the blank disks and return postage - don't miss out! There'll be a further disk mounted on the cover of the following month's issue as well - you'll have to wait and see what that contains!

VHF/UHF 'squares worked' information

Even a 'mock' UK Novice licence



Print your own great circle map



Software Review - 'Sumo' Circuit Simulation

HRT's Consultant Technical Editor examines an easy-to-use package

Whilst looking around a large amateur radio rally, I happened upon an electronic simulation package that seemed remarkably powerful, and easy to use, at a very reasonable price. This was the 'Sumo' range, developed by Analogue System Engineering, who are a small British company and who say they are trying to bring analogue simulation up to date and down in price. Intrigued, I went away with a leaflet, which aroused my interest even more, I then thought I'd better try it myself!

Why simulation?

Many amateurs like to 'knock up' small circuits, often using 'junk box' components, but often don't have the large amount of test gear, like signal generators, oscilloscopes, and the like, to check the circuit's performance. Professional electronic engineers often use simulation - they save a lot of time (and 'blown-up' circuits!) by using computer simulation to 'fine tune' circuits (like varying capacitor and resistors values) before even building up the first prototype. Which then often works first time. This sounds just like what many home-brew enthusiasts could do with!

Loading up

As soon as I loaded up the Sumo program, I saw how easy it was to use. You just draw your ideas in using the built-in schematic diagram package, press 'simulate' and then instantly see the circuit's response. With the schematic editor, the components you select 'snap' to a grid, with wire links between them being easy to add, and within minutes I was drawing complete circuits. The interactive simulator then displays the specified outputs as I watched.

The graphics screen is divided up into three main sections. The large 'component drawing' area is supplemented by a 'menu bar' along the top which allows the selection of various menus required to use the package, and the box on the left hand side of the screen shows a collection of component symbols which you choose from as needed.

Even after you've drawn your circuit (there are even a number of sample circuits to help get you started) the program checks it for errors before being simulated. Here, the drawing is automatically converted into a 'netlist', and during simulation you actually watch the graphs being drawn, which can be plots of virtually whatever you want, i.e. output amplitude, phase, time or frequency domain plots, and so on. The accompany photos show you the type of output you can get.

Conclusions

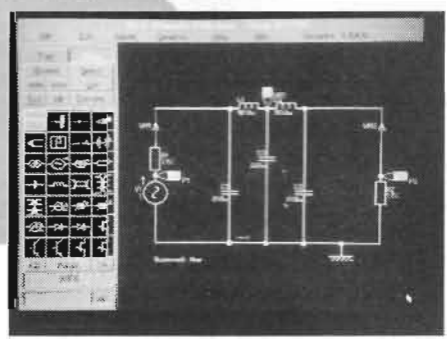
I was quite impressed with the performance of this software, for example 'knocking up' simple circuits such as an oscillator, or a low pass filter to place after a QRP transmitter, was extremely simple. It certainly saved hours and hours of experimentation and re-measuring with shack test gear!

The program's capabilities are very comprehensive, in the space available here I certainly can't do justice to them all. Why not try it yourself if you're interested? It'll only cost you the equivalent of a blank formatted disk....

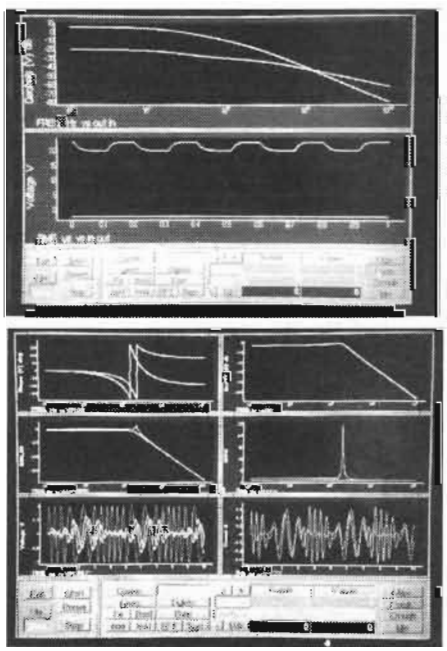
Sumo shareware disk for £1.00

Analogue System Engineering have kindly allowed us to offer their very latest 32 bit Sumo program in a shareware format, for the benefit of readers who'd like to try it out for themselves. You can receive a copy of the program, on a 1.44Mb HD disk, for just £1.00 inc UK p/p as a 'cost only' service from our software offer outlet, by requesting the 'Sumo' disk. This is in addition to this month's software collection offer, i.e. if you're also ordering this month's software then also request the 'Sumo' disk and add a further £1.00, no additional corner flash is needed. See this month's 'CQ de G8IYA' Editorial page for UK and overseas ordering details.

Sumo comes in several versions, such as Sumo Professional at £74.95, Sumo 32 lite at £94.95, Sumo Expert at £149.95 and Sumo 32 at £294.95. HRT readers can register their shareware version of Sumo for just £24.95, which brings a full user manual and the latest linear version. My thanks go to the above company for the loan of the software for review.



Schematic input of a low pass filter



Circuit output responses in time and frequency format

SCANNERS

Bill Robertson looks at the Aircraft Communications Addressing and Reporting System

Together with requests to extend a scanner's frequency range (unfortunately rarely feasible as the limits are often 'hard programmed' into the set's microprocessor), I'm also frequently asked "How can I modify my FM-only scanner to receive AM?". Many 'designed for the US' scanners omit AM coverage, either totally or just incorporate this on the civil airband range only. It's sometimes technically feasible, with skill, a fine soldering iron, and some added components, to add a hard-wired switch to manually (rather than automatically) change between the internal AM and FM demodulators in a scanner. However the large number of different models of these scanner types, with the internal circuitry of each often being very different, precludes a 'simple mod' being the answer!

However, you *can* add AM by using a small external unit with your scanner. In fact, HRT published a simple constructional feature for such a unit in the Jan 92 issue (pp 31 & 32), written by the late Peter Rouse (author of the 'Scanners' series of books). Copies of this article, if you missed it, are readily available from the HRT photocopy service (see flannel panel in back of this issue for details - ed).

Airband answers

With regard to airband terms heard on air, a message from Henry Brugsch asks what the phrase 'Band-boxing' means? The answer to this is that Band*f* boxing is a term, which has been used for many years, for when two or more active Air Traffic Control frequencies are linked together and operated by a single controller. This usually happens when air traffic activity levels are low and all the available operational positions don't need to be staffed.

Another question I've seen asked is what pilots mean when they say they are heading towards "Coxy". Andrew Hutchings from Newcastle reveals that 'KOKSY' is a Doppler VOR located on the Belgian Air Force base of Koksijde. It transmits on 114.5MHz using the coding KOK, and it's the first primary reporting point for aircraft heading east out of the UK on airway Golf 1 / Upper Golf 1.

Instant off-air reception 'at the event' with the Optoelectronics Scout when linked to an AOR AR-8000

At the event

Keen scanner users will probably know of the availability of sensitive and self-contained handheld frequency counters, which you can take out and about with you to instantly 'read off' the frequency of a nearby transmitting source. Of course, to then listen to the signal, you just tap the displayed frequency into your scanner. But the latest technology goes one step better than this, and I suppose it just 'had' to come. It's a direct link between an off-air reading frequency counter and a scanner receiver, to automatically program the 'located' frequency into your set for instant reception!

The Optoelectronics 'Scout' does just this when coupled to the AR-8000 handheld scanner (or the AR-2700 scanner fitted with the optional remote port). Days at the air show will never be the same again - no more 'hunting around' to find which frequency the pilot in the jet above you is using! It looks like I'll have to have a word with my bank manager....

ACARS

Keen airband enthusiasts may have come across the term ACARS, which stands for the *Aircraft Communications Addressing and Reporting System*. Alternatively, you may have heard bursts of

packet-type data around the upper frequency range of the civil airband spectrum, and wondered what it was. Here's the answer.

ACARS is text-based data transmission system used by civil aircraft to transmit data and messages between aircraft and airport ground stations. These messages deal with schedules, weather information, 'status' messages from the aircraft such as engine performance, fuel usage, emergency conditions and even exact times of takeoff, passenger door openings and so on. Other messages can include private or 'company' messages, either between airline staff or for passengers on the craft.

The system used is technically very similar to amateur 'packet', although the ACARS data rate is higher than 'normal' amateur packet at 2400 baud. In use, the aircraft usually responds to a 'poll' message, and sends the required information when the data channel is free, re-sending it as required if it doesn't receive a correct data 'ACK' acknowledgement. Alternatively a 'broadcast' form may be used, where the aircraft sends data depending upon an event occurring, such as 'wheels off the runway'.

Suitable decoders for ACARS are available from sources such as Universal Radio in the US, and a low-cost dedicated unit is available from Lowe Electronics in the UK. Keen aircraft enthusiasts may certainly be interested in 'getting going' with this system.

However, even when fully equipped you might find you're rarely able to make head nor tail of the information decoded onto your terminal screen, due to the abbreviations and codes used. But a new book, *Understanding ACARS* which the publishers kindly sent me a copy of, provides the very information you need to interpret and understand these messages. Within its pages ACARS message types and formats are defined, and the abbreviations explained. Useful tables of airline and airport identifiers are also provided, to make instant 'sense' of what you see on your screen. I found the book to be certainly very informative, and most useful, when used in conjunction with my scanner and ACARS modem linked to my terminal. The 92 page book is published by the US firm of Universal Radio Research (Tel. 00 1 614 866 4267), ISBN 1-882123-36-0. It retails at $9.95 in the US, you'll also find it's available on order from UK bookshops or 'off the shelf' at specialist dealers.

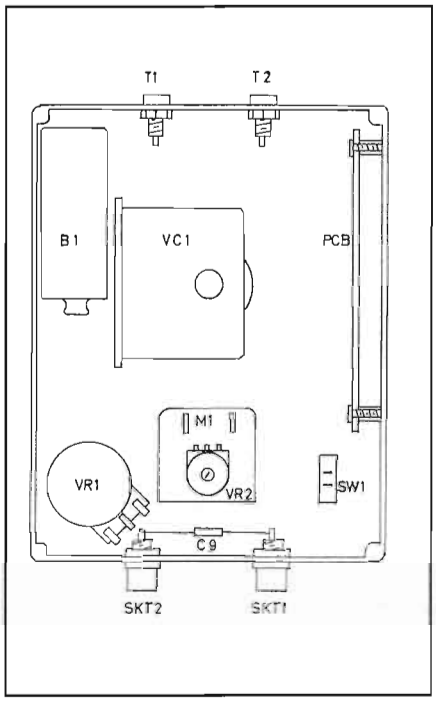
Scanner reviews lists

The HRT Editor tells me she's now extended the HRT Voicebank and Fax-Back information service (Tel. 01703 263429, 24 hr) to include a complete list of the very large number of scanners and receivers which have been reviewed in HRT. Just follow the voice instructions given to get a faxed list straight away, or details on how to get a free printed copy sent to you in the post.

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.*

Project - A 2-Terminal Test Oscillator (Part 2)

Peter Cole DA1PE continues with the testing and uses of the 2-terminal test oscillator for inductance measurement



Following on from last month.To test the oscillator it is best to use a coil/capacitor combination that will tune to the low or middle part of the HF range. Again, the exact values aren't at all important, but a coil of 50 turns of enamelled wire close-wound on a 2cm diameter former (about 33µH) and a 100pF 1% capacitor make a useful test standard.

Start by setting VR1 to its minimum resistance, and the wiper of VR2 to about half way. Then with a scope and counter connected to SKT1 and SKT2 respectively, switch on. If all is well reset VR2 to give a full scale reading on the meter and then check that the meter level changes as VR1 is altered. Don't be surprised to find that the output waveform from SKT1 is very distorted and varies in shape with the setting of the level control. This is quite normal. At the same time the frequency will shift slightly due to changes in the FET internal capacities with drive level.

Frequency Measurement

The easiest way to measure the oscillating frequency is to use a counter connected to SKT2. High accuracy is not necessary, but make sure that the reading is stable as some counters (like my simple homemade one) are quite temperamental when reading distorted asymmetrical waveforms like those generated by this oscillator. Another useful check is to see if the counter reads the same with different settings of the timebase switch, it is not uncommon to find frequency doubling on some ranges with non-sinusoidal inputs.

If you don't have a counter you can find out the frequency by searching for the oscillator signal on a general coverage receiver. To do this, replace the normal receiving aerial with a

2-Terminal Test Oscillator: Program Listing 1.

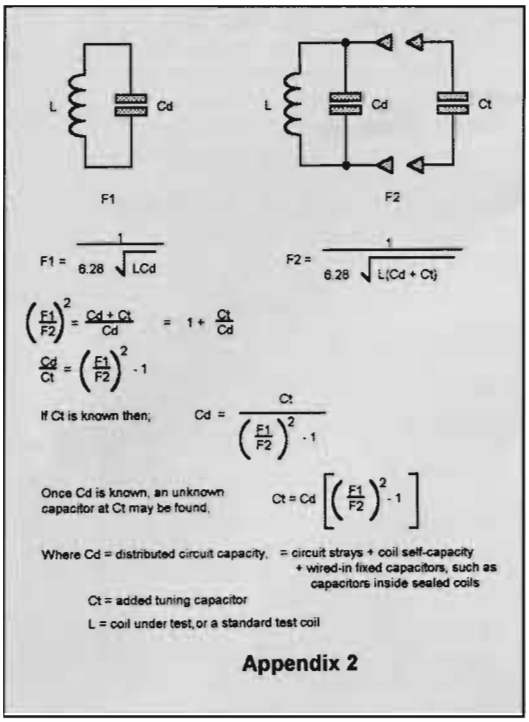
This program is written to run with QBASIC on a PC compatible. Although line numbers are not needed for QBASIC they have been used to make it easier to convert the program to other BASICs. PRINT USING "#######.###" is a formatting statement that can bereplaced by a simple PRINT statement in earlier BASICs.

```
100 CLS
110 PRINT
120 'CL_test.bas - P C Cole March 1993
130 'To find distributed capacity of 2-terminal oscillator.
140 PRINT "CL tests with 2-terminal test oscillator."
150 PRINT
160 PRINT "Tuning capacity(pF) "; : INPUT Ct
170 Ct = Ct * 1E-12
180 PRINT "Frequency at minimum C(MHz) "; : INPUT F1
190 F1 = F1 * 1000000
200 PRINT "Frequency at maximum C(MHz) "; : INPUT F2
210 F2 = F2 * 1000000
220 Cd = Ct / ((F1 / F2) ^ 2 - 1)
230 L = (1 / (2 * 3.142 * F2 * SQR(Cd + Ct)) ^ 2)
240 PRINT USING "Inductance (uH) : ########.###"; L * 1000000
250 PRINT USING "Cd(pF)          : ########.###"; (Cd) * 1E+12
260 PRINT "Resonance with this coil: "
270 PRINT "C (pF)", "F (MHz)"
280 FOR x = 0 TO 16
290 C = (2E-11) + (5E-12 * x)
300 F = 1 / (2 * 3.142 * SQR(L * C))
310 PRINT USING "#######.###"; C * 1E+12; F * .000001
320 NEXT x
330 INPUT "Do you want another calculation ? ", A$
340 IF A$ = "N" OR A$ = "n" THEN GOTO 350 ELSE GOTO 150
350 END
```

A typical printout from running program 1

```
CL tests with 2-terminal test oscillator

Tuning capacity (pF) ? 100
Frequency at minimum C(MHz) ? 5.83
Frequency at maximum C(MHz) ? 2.49
Inductance (µH) : 33.393
Resonance with this coil:
Cd (pF)         F (MHz)
20.000          6.158
25.000          5.508
30.000          5.028
35.000          4.655
40.000          4.354
45.000          4.105
50.000          3.894
55.000          3.713
60.000          3.555
65.000          3.416
70.000          3.291
75.000          3.180
80.000          3.079
85.000          2.987
90.000          2.903
95.000          2.825
100.000         2.754
```



Appendix 2

few cm of wire (to attenuate external signals) and operate the test oscillator alongside the receiver. Starting from a much higher frequency than you expect, search for a strong unmodulated carrier. When you find one identify it as the test oscillator either by switching on and off or by moving your hand near to the coil to cause the frequency to shift slightly. Having found the oscillator signal on your receiver, listen also on the harmonics (2f, 3f etc.) and subharmonics (f/2, f/3 etc.) of this frequency to find out if you really are listening to the fundamental and not to an harmonic or an image signal.

Measuring inductance

Once the oscillator is operating correctly, it is a simple matter to find the inductance of a coil. Put a convenient 1% capacitor (Ct) in parallel with the coil to be measured, connect this tuned circuit to the test terminals with the shortest possible leads, and measure the oscillating frequency. A reasonable estimate for the circuit stray capacity is 10pF plus the minimum value of the tuning capacitor. This must be added to the to the value of the fixed 1% capacitor to give the total capacity to be used to calculate the inductance. For example, with circuit strays of 25 pF and a fixed 1% capacitor of 100pF, the inductance is calculated using a value of 125pF in formula 3 of Appendix 1.

Greater accuracy

Whilst the above is good enough for most purposes, the accuracy can be improved by actually measuring the circuit strays. This is very easy to do as it entails only one extra measurement and a calculation using the procedure summarised in Appendix 2. Start by connecting a test coil to the oscillator, and with the tuning capacitor set to minimum, note the frequency (F1). Next, connect a 1% capacitor (Ct) across the coil, measure the new (lower) frequency (F2) and substitute values of F1, F2 and Ct in formula 1 of Appendix 2. This gives the total distributed capacity in the oscillator with the variable capacitor at its minimum setting.

By repeating this routine with different settings of the variable capacitor, the tuning scale may be calibrated in terms of capacity. However if you do want to do this, it is easier to use the procedure that is described later.

Computer program

Although the formulae given in the appendices can be solved easily enough on a pocket calculator, it is worthwhile using a computer if a lot of coils are going to be tested. Listing 1 is a program to find the inductance of a coil, and the circuit distributed capacity from frequency measurements using formula 1 of Appendix 2. Run the program and enter the values requested at the prompts: 1. Value of the added 1% tuning capacitor - (Ct). 2. Oscillating frequency without Ct - (F1). 3. Oscillating frequency with Ct added - (F2).

The result of running this program is a printout giving the inductance of the coil, the total distributed capacity, and a table of resonant frequencies for the coil with capacitors from 20 - 100pF in 5pF steps. If desired, these steps may be altered by changing the values in the loop between lines 280-320. In line 280 'X = 0 to 16' controls the number of steps while in line 290 '(2E-11)' is the 20pF starting point and '(5E-12)' gives the 5pF steps.

Measuring small capacitors

As well as being a useful indication of the tuning range of the coil, the data in the printout table may be used to calibrate the tuning scale of VC1 in terms of total circuit capacity. Do this by setting the tuning dial to obtain the frequencies corresponding to the capacity values in the printout: e.g. with VC1 set for oscillation at 5.028 MHz, circuit capacity = 30pF; at 3.894 MHz, capacity = 50pF and so on.

After this is done, it becomes a simple matter to measure small capacitors: 1. With a test coil connected to the oscillator terminals, set VC1 to a convenient capacity, say 50pF. 2. Measure and note down the frequency of oscillation. 3. Connect the unknown capacitor across the test coil. 4. Reset tuning to give the frequency in 2. and note the new capacity reading. 5. Unknown capacitor is 50pF minus the capacity value in 4.

Alternatively, capacitors can be measured by using formula 2 in Appendix 2 which is also presented as

Appendix 1. Standard resonant frequency formula

The formula for calculating the resonant frequency of a tuned circuit is;

$$F = \frac{1}{2\pi\sqrt{LC}}$$ Hz (L Henries, C Farads).....(1)

For practical use at HF this may be put in the form;

$$F = \frac{159.15}{\sqrt{LC}}$$ MHz (L µH, C pF) .....(2)

or, to calculate L when C and F are known;

$$L = \frac{25330}{F^2 C}$$ µH (F MHz, C pF) .....(3)

e.g. If F = 1MHz, C = 100pF, then L = 253.3µH
F = 2MHz, C = 50pF, then L = 126.6µH
F = 3MHz, C = 30pF, then L = 93.8µH

2-Terminal Test Oscillator: Program Listing 2

```
100 CLS : PRINT
110 'Ctest.bas  P C Cole March 1993
120 PRINT "Capacity measurement with 2terminal test oscillator."
130 PRINT
140 PRINT "Circuit capacity          Cd(pF) "; : INPUT Cd
150 Cd = Cd * 1E12
160 PRINT "Frequency with Cd         F1(MHz) "; : INPUT F1
170 F1 = F1 * 1000000
180 PRINT "Frequency with Ct added   F2(MHz) "; : INPUT F2
190 F2 = F2 * 1000000
200 Ct = Cd * ((F1 / F2) ^ 2  1)
210 L = (1 / (2 * 3.142 * F2 * SQR(Cd + Ct)) ^ 2)
220 PRINT
230 PRINT USING "Inductance          L(uH) = ########.###"; L * 1000000
240 PRINT
250 PRINT USING "Unknown capacitor   Ct(pF) = ########.###"; (Ct) *
1E+12
260 PRINT
270 INPUT "Do you want another calculation ?  ", A$
280 IF A$ = "N" OR A$ = "n" THEN GOTO 300 ELSE GOTO 130
290 PRINT
300 END
```

A typical printout from running program 2

```
Capacity measurement with 2-terminal test oscillator.

Circuit capacity              Cd(pF)   ? 22.3
Frequency with Cd             F1(MHz) ? 5.83
Frequency with Ct added       F2(MHz) ? 3.29

Inductance              L(µH)  = 33.411

Unknown capacitor       Ct(pF) = 47.725
```

Program Listing 2.

Use as a dip meter

Even though the GDO/dip meter is highly regarded by radio amateurs, it is hardly ever used in a professional workshop or laboratory. This is largely because it needs skilled handling and careful interpretation of results if the measurements made are to be relied on. Much of the difficulty arises because reliable oscillation over the wide frequency range expected of a dip meter needs a very active oscillator circuit, i.e. one with a large amount of positive feedback. Unfortunately the high level of feedback tends to compensate for the power sucked out from the dip oscillator by the circuit being measured. This masks the dip so much that, even with greatly increased coupling, only the tiniest flicker of the meter needle may be noticed.

The 2-terminal oscillator is no different in this respect. Indeed, over most of the operating range it oscillates so strongly that a discernable dip can be found only when the oscillator and the tuned circuit under test are so overcoupled that a double-humped tuning response results. This causes severe pulling of the oscillator tuning and makes it impossible to find the true dip frequency.

To overcome this problem, RV1 is used to reduce the loop gain of the circuit so that oscillations are only just maintained. For best results, you may need to experiment with the settings of VR1. But I find that, after using the setting-up procedure described earlier, there is a clear dip with loose coupling when the meter is set just below mid-scale by VR1.

Conclusion

Although the principal function of this test oscillator is to measure the inductance of small coils for use at HF, it does have a lot of other uses. I've described some of them here, and a little brainstorming should reveal others. But even if it doesn't, the instrument will still be invaluable around the shack. Build one, and you will wonder how you have ever managed without it.

Suggested Reading

Anyone interested in making measurements on coils and capacitors will find lots of information in older text books, such as Terman's Radio Engineering, Scroggie's Radio Laboratory Handbook, and The Radio Designer's Handbook by F. Langford Smith. Nowadays these may be difficult to find in a local library, but make friends with an old-timer and he may well have them on his bookshelf.

If you have any queries regarding this project please address them to the author; Peter Cole DA1PE, Comms Branch (Tels Division), HQ BAOR, BFPO 140, enclosing an SAE if a reply is required - Ed.

Parts list

Capacitors;

C1 50pF polystyrene
C2 0.22µF
C3 0.1µF
C4 0.47µF ceramic or
C5 0.22µF mylar film
C6 0.47µF
C7 0.47µF
C8 0.22µF
C9 10pF ceramic
C10 25µF 25VW electrolytic

VC1 10-75pF variable capacitor

Diodes;

D1, D2 Germanium diodes, 0A91 or similar

FETs;

TR1, TR2, TR3 N-channel FETs, BF244A or similar

Resistors *(all 0.25W carbon):*

R1 2M2
R2 1k5
R3 68R
R4 1M0
R5 470R
R6 470R
R7 1k0

VR1 100k miniature potentiometer wired so that full clockwise is minimum resistance.

VR2 10K preset carbon potentiometer.

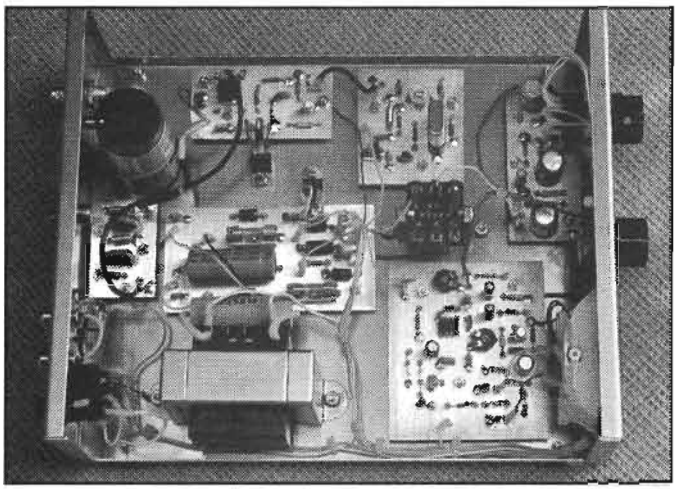
Other Items;

B1 9V PP3 battery
M1 250µA VU meter, e.g. ex-cassette recorder.

SKT1, SKT2 Phono sockets or similar
SW1 Miniature On/Off toggle switch
T1, T2 Terminal Posts or coil sockets as preferred.
Diecast box approx 9.5 x 12 x 5.5 cm
Tuning dial
Circuit board and pins

A Practical Alternative to the PCB

Ian Listen-Smith G4JQT describes a simple alternative to the printed circuit board for your home construction projects



A 160m AM transmitter using this construction method for each board

Over the years there have been many magazine articles describing numerous methods of making PCBs at home. Unfortunately none seem to be worth the effort, since most of us are only making one-off boards. A very neat job can of course be achieved this way, but the process was originally developed by the electronics industry to speed up mass production.

Various types of matrix boards are available for the home constructor, but these suffer from two disadvantages; they do not provide an earth plane for RF circuits, and an awkward component layout often has to be drafted in order to follow the copper strips.

Having tried the above methods, I now use a different approach for my home brew projects. I doubt that it is an original idea, but I have not heard or seen it described elsewhere.

Single sided plain copper board is used in this technique, with the copper side uppermost. The earthed component leads are soldered directly to this surface. Holes for the other leads are drilled and countersunk.

Method

If the circuit contains any ICs or other components with O.1in lead spacing, then O.1in matrix graph paper is required.

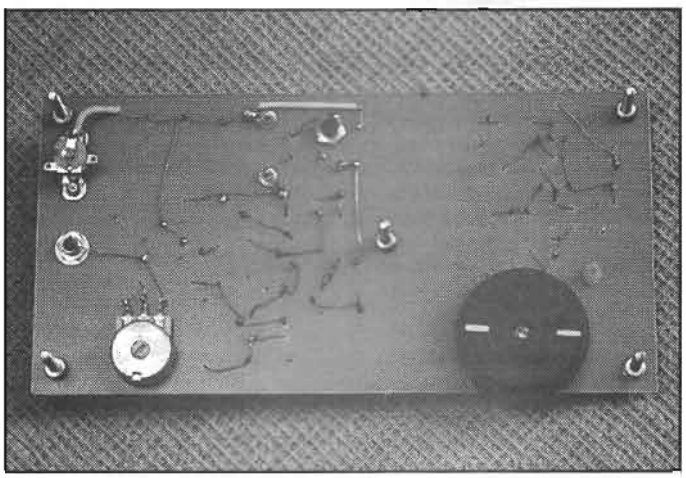
Draw the circuit on the paper as if a proper PCB were being laid out, but instead of outlining the tracks, just draw lines connecting together the required components. However, if tidiness is not important, this whole stage may be omitted.

Clearly identify those leads which are to be soldered to the top surface, from those which are to pass through it. When you are happy with the layout, place it over the copper side of the board and use an awl or centre punch to mark the holes which are to be drilled.

Remove the paper, drill the holes with a 1mm twist drill and use a Verocutter or 6mm twist drill to countersink them. This removes a ring of copper so that the non earthed leads may pass through without touching the copper earth plane. Gently rub the board over with some emery paper or wire wool to remove any tarnish and burrs. Carefully go over the countersunk holes again with the 6mm drill to remove any grit and copper which will have been rubbed into them.

Position the components and solder any earthed leads to the top surface. Using tinned wire, join up the circuit underneath following the lines from your diagram. Place insulated sleeving over any wires which may come close to touching.

The finished board will look the same as a PCB from above, it provide an earth plane, and yet avoids all the difficulties involved in the time consuming process of track layout design and etching. The technique can also be adapted for use with projects which already have a PCB layout by using it as a template for drilling, and replacing the track with tinned wire.



Underside of a typical board using this technique

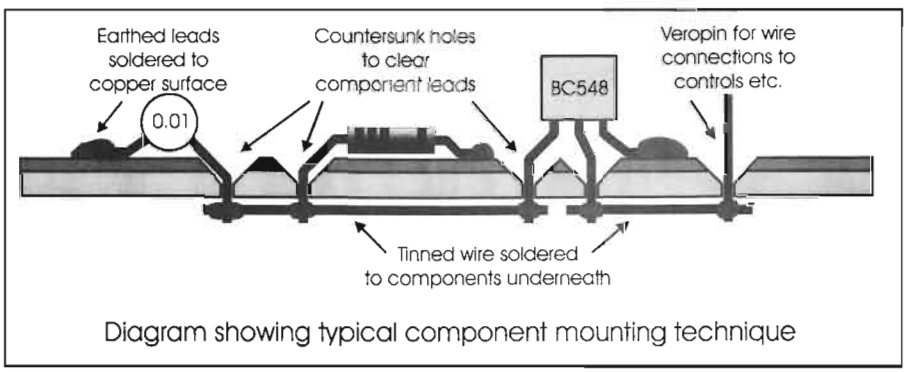


Diagram showing typical component mounting technique

The KW2000A Transceiver

Ben Nock G4BXD shows how to bring new life to a HF transceiver that's commonly found on the secondhand market

Along with the many interesting sets to come out of KW's Vanguard Works in Dartford, the Vespa, the Viceroy, the Vanguard, and the Atlanta for example, probably the best known is the KW 2000 series. The original 2000 was followed by the 2000A, the B then E, but this article deals with the 'A' version. Brighter and better, this set probably cut more amateur teeth than any other.

Produced in the mid 60's, the set is housed in the familiar KW light blue, 'G' line styling, perforated case, is around 350mm by 150mm by 330mm and weights in at 8kg. The power supply unit weights are11.4kg for the AC supply, or 3kg for the mobile supply.

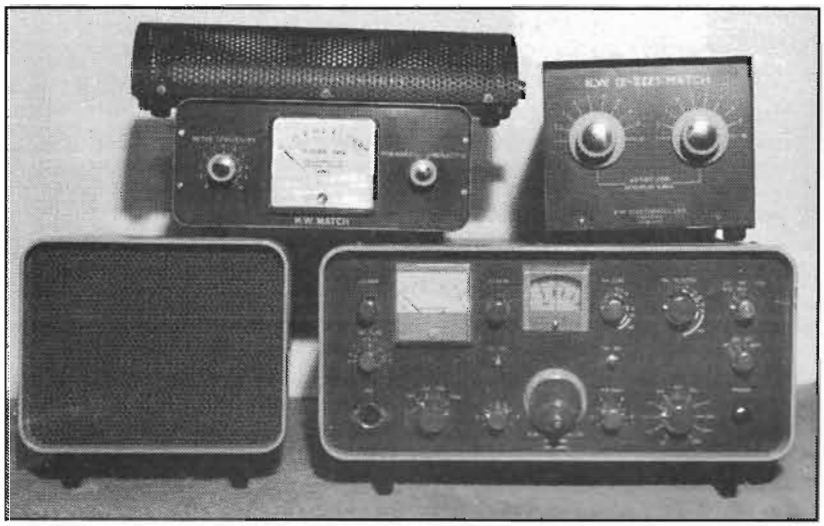
With 180W PEP SSB, the frequency coverage is restricted to the 'old' six bands, 160, 80, 40, 20, 15 and 10m, in 200kHz segments. This gives a total of 11 ranges but this I feel is not too much of a hardship to suffer. A lower output on 160m is achieved by automatically switching out one of the two PA valves (6146s) as this band is selected. SSB and CW modes only are available, no AM provision is provided for.

How does it work, the transmitter section

A high impedance microphone connects audio to the grid of the mic amp (V1), this is amplified and coupled to a cathode follower (V2a) via a front panel mounted mic gain control. The cathode follower feeds the balanced modulator (BM) with the amplified mic signal. The output of the BM is then mixed up to the different bands of operation using the VFO signal first and then a switched crystal oscillator.

As with the KW Vespa transmitter, there is an oddity around the mic plug. The 'cold' end of the mic amp cathode resistor and by-pass capacitor are connected to one of the mic plug pins, the grid to another and the PTT line to the third, a three pin DIN socket being utilised.

So, to activate the set on voice, the cathode pair need grounding along with the PTT line whilst the mic is fed to the grid, assuming the case of the DIN plug is considered to be ground potential. I have slightly rewired my set so as the ground is one pin, the grid another and the PTT line the third, I have soldered the cathode resistor/capacitor to deck in the set.



The KW2000A, with matching speaker/PSU, SWR bridge, 'E-ZEE' match and dummy load

Balanced Modulator

A pair of OA79 semiconductor diodes form the balanced modulator, fed with the mic signal and the output of the carrier oscillator (V16). The upper and lower sidebands are passed to the amplifier (V3), there through a 2.1kHz mechanical filter at 455kHz, the selection of upper or lower sideband being dependent upon the front panel FUNCTION switch selecting the required carrier oscillator crystal. The now SSB output is fed to the first mixer.

For CW operation a separate tone oscillator is used to inject into the mic amp circuit, controlled by the MIC GAIN control on the front plate, thus producing RF output.

The VFO

The triode pentode, (V11), operates as a Colpitts oscillator buffer at 2.5-2.7MHz. To maintain alignment between upper and lower sidebands the VFO is moved in frequency by the switching in of a one-turn shorting link, relay operated. IRT, ITT or both is selectable from the front panel.

Mixers

The 455kHz SSB and the VFO output are fed to the first mixer (V4) producing an SSB signal in the range 2.955-3.155MHz. A broadband coupler feeds the second mixer (V5) which, along with the output of the crystal oscillator (V10), produces an output in the required amateur band.

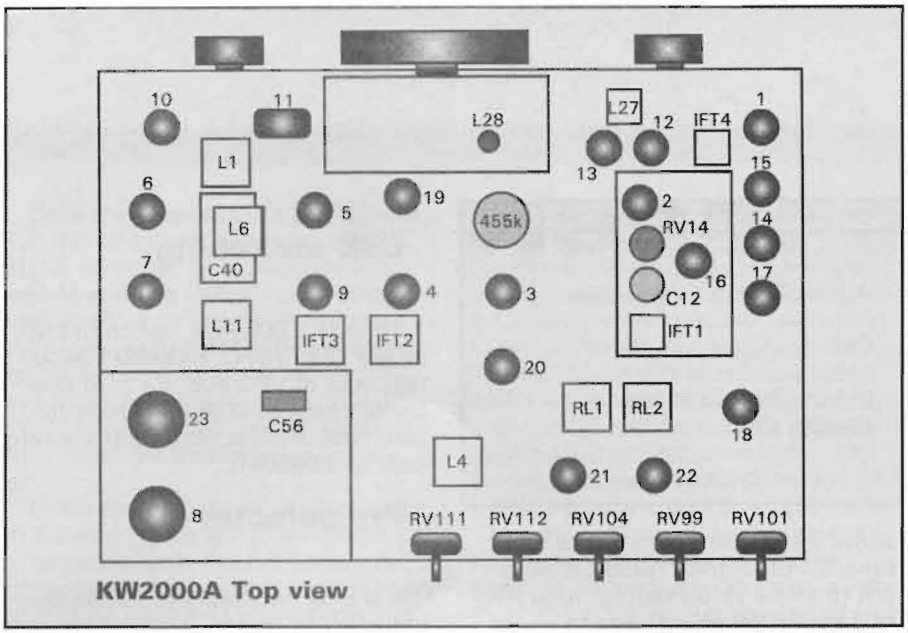
The crystal oscillator is always 3.155MHz higher than the lower edge of each band.

Driver - PA

A PRESELECTOR control gangs the output tuned circuits of V5 and the anode of the driver (V7). The output of the driver is capacity coupled to the PA stage, two 6146 valves, operating in linear class. A standard 'pi' network is used to provide PA tuning and aerial loading/tunning, separate front panel TUNE and LOADING controls are provided.

The workings of the receiver

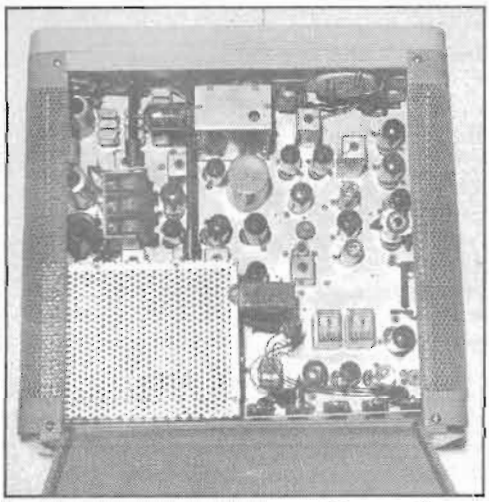
The RF amplifier (V6) uses the driver grid tuned circuits as its plate circuit, the amplified received signal then being passed to the first RX mixer,



KW2000A Top view

Table 1 - Alignment points

Band	C or L	VVM	MM
1.8	L25	2.0	-2.0
3.5	C73	1.5	-1.5
3.7	C73	1.5	-1.5
7.0	C74	2.0	-0.3
14.0	L22	2.0	-1.2
14.3	L22	2.0	-1.2
21.0	L21	1.3	-1.2
21.3	L21	1.3	-1.2
28.0	L20	0.8	-1.2
28.4	L20	0.8	-1.2
28.6	L20	0.8	-1.2



Internal view of the KW2000A, PA compartment lower left, VFO top centre, VOX circuitry lower right

(V9). This stage combines the amplified aerial signal with the crystal oscillator (V10) and passes its anode signal to the previously mentioned bandpass filter in the TX strip.

The second RX mixer, (V19), combines with the VFO signal to produce the 455kHz second IF. After passing through the mechanical filter the IF is amplified by two stages, V12 and 13, before being passed to the product and AVC detectors, V15b and 14 respectfully.

The audio output is provided by a triode pentode, V17, and transformer coupled to a low impedance speaker. V21 is used as VOX amp and actuator, V18 operates the S meter, and V22 is used as a 100kHz calibrator oscillator.

The Power Supply

The PSU transformer has four secondary windings producing two HT rails, a negative bias voltage, a heater voltage and a negative relay supply. A switchable 245/285V winding is rectified and doubled to give 580/750V DC HT for the PA. A separate 195V winding gives a rectified 245V for the remaining valves. A 90V winding is rectified to produce a 110V DC negative supply which is provided with a pot to adjust the standing current on the PA valve.

A low voltage winding supplies both heater volts AC and, via a single diode and filter, a 12V negative supply used to operate the relays in the set. The tapped primary can be set to operate from 105V AC to 240V AC.

Servicing and alignment

It must be noted that the valve heaters and dial lamps are wired in series parallel for 12V operation. Valves 3, 4, 5, 9, 12, 13, 14, 15, 17, 18, 19, 21,22 and LP1 are wired in parallel. Valves 1, 2, 6, 7, 8, 16, 23 and LP2 are also wired in parallel. These two strings are then wired in series. Valves 10 and 11 are wired separately in parallel and fed from a separate pin on the power plug (12). Therefore, when replacing the bulbs, they must have the same current rating as the old item.

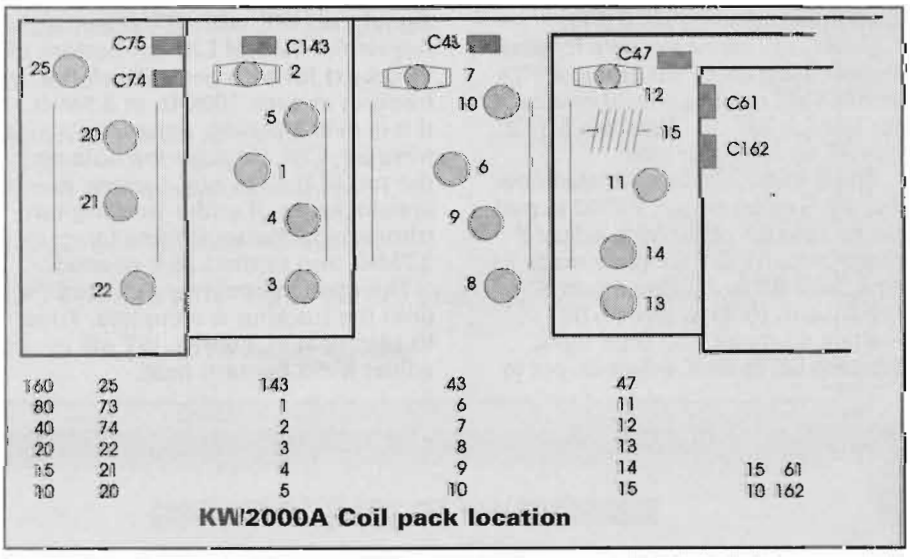
The chassis is easily removed from the case by removing the two rear feet. Two plugs in the front feet are removed to gain access to the screws, and the two front feet removed. The chassis then slides easily out of the front of the case.

Alignment of the set can be undertaken using a receiver of known calibration or a frequency counter, a dummy load with a power meter fitted, a high impedance RF voltmeter (VVM) would be handy, a "swamping" tool consisting of a 0.01µF 400VW cap in series with a 1k 0.5W resistor, and a non-metallic hexagon trimming tool. Any fixing compound on the coils/trimmers etc. can be dissolved using acetone.

The transmitter should be set up as follows: Carrier - Fully Counter-Clockwise (FCC), PA Tune - 80m, Pre-Sel - 80m lower edge, Control Switch - EXT MOX, IRT - off, Function - LSB, Mic Gain - FCC, VFO - 000, PA Load - Fully Clockwise, band - 80m, mic/key - out.

After a 10 minute warm up switch to TUNE with CARRIER FCC. Check the output of the carrier oscillator, test point A, a voltage of 1.5V RF should be present on both sidebands. Check the VFO output at test point B, a voltage of 0.4V RF should be obtained, if it's lower it suggests V11 is faulty.

Check the HF oscillator level, test point C, the junction of the 220pf and the 60pf, adjusting caps and inductors as shown in Table 1. The cores may need loosening as directed above. If an RF voltmeter is not available, a multimeter of at least 20kohm can be used, connected between GND and pin 1 V9, 10V range.



KW2000A Coil pack location

Pre-selector adjustments

Band	*Set pre-sel*	*Adjust RX*	*Adjust TX*	*Neutralise*
160	1900	C143 C43	C47	
40	7100	L2 L7	L12	
20	14200	L3 L8	L13/C162	C162
15	21400	L4 L9	L14/C61 C61	
10	28500	L5 L10	L15	C5

Pre-selector 3.5MHz band

Connect the VVM to the AVC line, test point D, a 'no signal' voltage of 0.6V should be present. Start by setting the preselector pointer at lower edge of the 80m segment and VFO to 3.5MHz. SG to 3.5, 50µV. Adjust L1 and L6 for a peak in reading. Note: L1 tuned to bottom tuning point. L1 has two cores in it, bottom core is L1, top core is trap L19.

Change SG frequency to 3.155MHz, 25mV, rock dial until signal heard on RX at 3.5, adjust L19 for minimum reading. Set SG to 3.6MHz 50µV, set RX to 3.6, peak PRE-SELECTOR (PS), then peak L1 and 6 for peak reading on VVM.

RX to 3.8MHz, SG to 3.8, peak PS, tune SG to 4.190MHz 50µV, rock SG dial until note heard, adjust L29 for minimum. Retune SG to 3.8, adjust L1 for peak. Set SG and RX to 3.6MHz and peak PS.

Wideband couplers, IFT2 & 3

Use the "swamping" circuit connected between pin 4 of IFT2 and ground, adjust bottom core of IFT2 for peak reading. Swamping circuit to pin 6 IFT2, adjust top core of IFT2 for peak reading.

Swamping circuit to pin 4 IFT3, adjust bottom core of IFT3 for peak. Swamping circuit to pin 6 IFT3, CARRIER up, adjust top core for peak. Repeat the above. Peak cores of IFT4 and 5, VVM reading should now be 4V for 50µV at 3.6MHz. ***Note:*** pin 6 IFT2 has HT on it, so take care!

The S meter can be calibrated now. Set the S meter lin pot, RV102 to mid travel, tune RX off 3.6MHz, adjust S meter zero, RV101, so meter reads zero, tune RX to 3.6MHz, adjust S meter sens, RV99 to give an S9 reading on meter with 50µV input. Increase SG to 5mV, adjust lin pot to show S9+40, decrease SG to 50µV, tune RX off signal, re-adjust zero pot to show zero reading, tune RX to 3.6MHz, re-adjust sens to show S9, set SG to 5mV, adjust lin pot to give S9+40, now repeat above until off tune shows zero, 50µV shows S9 and 5mV shows S9+40.

Disconnect SG, plug dummy load into TX, switch to INT MOX, and adjust PA standing current to 50mA. Turn to EXT MOX, switch to TUNE, and advance MIC gain until PA current starts to rise, adjust L11 for peak current, backing off MIC gain to keep current at about 75mA as L11 adjusted.

Setting the Carrier Balance

With dummy load and VVM connected across it, load the transmitter up to 120 mA PA current, RF voltmeter across dummy load should read 35V. Adjust RV14 and C12 for minimum reading, it should be possible to get as low as 0.2V on both sidebands.

Another way, is to listen to the signal on a separate receiver, and adjust for maximum dip in signal strength.

VFO Calibration

Check internal calibrator against known signal, adjust to zero beat using C158. Receiver tuned to 3.7MHz, check against calibrator signal, set IRT, with IRT at zero. Adjust the core of L28 (on bottom of VFO box) for zero beat. Check the tracking at each 100kHz, at 3.5MHz, if it is over-tracking, adjust the trimmer, C80, through the hole on the top of the vfo box, turning it anticlockwise. If under-tracking turn trimmer clockwise. Retune to 3.7MHz and retrim L28 if needed.

The above should be repeated until the tracking is complete. Tune to zero beat at 3.6MHz, IRT off, adjust RV53 for zero beat.

LSB switching

Tune to 3.600MHz, switch to LSB, adjust link in VFO, through hole in rear wall of VFO box, for zero beat. Switch back to USB and check for zero beat. Repeat until both are zero beat at 3.600MHz.

Pre-selector

It is only necessary to adjust the inductances of one segment for each band as the tracking is good enough. Tune for 50 mA PA current and see the accompanying table for adjustments for peak current.

On each band to be neutralised, tune for 130 mA PA current into dummy load, if maimum output occurs with PA TUNE cap LF of dip then increase trimmer, else if HF of dip then reduce trimmer. Adjust inductor in TX list for resonance, then repeat this until max output occurs at dip.

After all that

The above description does sound a bit formal and it reads harder that it is in practice, but should enable you to get the set on alignment and working satisfactory. Into a dummy load, with the PSU switched to highest voltage, I achieved 100W RF output on single tone (CW). The 8 pin socket on the rear apron is used for the CW key, pins 1 (Gnd) and 5. It also can be used to actuate the changeover relay in the matching KW 600 or 1000 linear amplifier, pins 2 and 3, if it is available. A footswitch to override the PTT can also be connected here, pins 1 (Gnd) and 6.

On the air

In use, the operation of the set is straight forward enough. After tuning the receiver to the frequency of operation required, the function switch is set to TUNE. Place PA TUNE and LOAD fully clockwise, a small amount of tone is inserted, resulting in around 100mA of PA current, and the preselector is rotated for a peak in the reading. Back off the tone (MIC gain) to keep the PA current below 120mA. A system of 'on, tweak, off', is recommended, to save straining the PA valves with heavy current for too long.

Once the preselector is tuned, with 120 mA of current indicated, the PA TUNE is rotated to dip the current, watching on an in-line power meter should show an indication. Increase the LOAD control anti-clockwise and re-dip as required to get as much RF output as possible. The PRESELECT, PA TUNE and LOAD are all adjusted in turn to get the maximum out of the set.

Check the tuning with a short burst at full tone, there is a slight difference in settings due to the full power. In either of the SSB modes, the MIC gain should be advanced to show an average PA current of 120 mA, peaking at 200 mA or so. If a compressor or clipper type mic is used, the meter will show a higher average current reading, care should be taken though not to over-strain the PA valves. Always seek reports over the air to ensure you're not overdriving the set, the audio quality will be a good giveaway to that.

The KW2000A transceiver, whilst not being an all-singing, all-dancing 'teamaker come bottle washer', can nevertheless still give a good account for itself. Considering the high price of the modern plastic, eastern delight, and that rigs such as the 2000 can be bought quite cheaply, then activation of the HF bands for a beginner or newcomer needn't cost you an arm and a leg, or even a second mortgage.

Old valve sets are a joy to operate, the PAs certainly stand rough punishment easily, and, if there is little loading on one's pocket, all the better. They are normally easier to service and align, but do take care of the possible high voltages present, a little thought before work is needed. I hope you find a good specimen, good hunting on the bands.

Queries regarding this feature should be addressed to the author, either direct or c/o the HRT Editor, enclosing an SAE if a reply is required.

A Circuit diagram of the KW2000A transceiver is available from the Editor, send an A4 or A5 sized SAE marked 'KW2000A circuit' plus the corner flash from this page, to the HRT address.

KW 2000A Valve line-up

V1	Mic Amp	12AX7
V2	Audio cathode follower	12AT7
V3	455 Kc Amp	EF183
V4	1st TX Mixer	12AT7
V5	2nd TX Mixer	12AT7
V7	Driver	6CH6
V8/23	Power Amp	6146
V16	Carrier Oscillator	12AT7
V20	Voltage stabiliser	OA2
V11	VFO	ECF82
V10	Crystal Oscillator	6AM6
V6	RF Amplifier	EF183
V9	1st RX Mixer	6BE6
V19	2nd RX Mixer	6BE6
V12/13	IF Amplifier	6BA6
V14	AVC Detector	6AL5
V15	Product detector/tone	12AX7
V22	Calibrator	6BA6
V21	Vox amp	12AT7
V17	AF Output	ECL82
V18	S meter amplifier	12AT7

Power connections to 15-way plug/socket

PIN	10/8	12	14	7/9	15	6	11	1/3/4/5	2
USE	AC ON/OFF	VFO HTR	750DC	GND	245DC	-65DC	BIAS -55/-65	12.6AC HTR	-13DC

Specifications: KW 2000A HF Transceiver

Frequency range (MHz):	1.8-2.0, 3.5-3.7, 3.7-3.9, 7.0-7.2, 14.0-14.2, 14.2-14.4, 21.0-21.2, 21.3-21.5, 28.0-28.2, 28.4-28.6, 28.6-28.8 MHz
Power rating:	180 Watt PEP 160-15, 100 Watt 10 Mtrs
Intermediate Freq:	455 kHz, 2.1/2.6 kHz at 6 dB, 6kHz at 60 dB
Modes of operation:	CW, USB, LSB.
Sensitivity:	Less than 1µV for 500 mW O/P, 1 µV for 17 dB s/n
Carrier Suppresion:	Better than 50 dB
Image rejection:	60 dB or better
Dial accuracy, Elect:	Within 400 Hz on all bands
Visual:	Within 200 Hz on all bands
Power requirements:	105-125V or 210-250V AC 50/60 Hz
Dimensions:	13-3/4" wide x 5-7/8" high x 12-1/2" deep
Weight:	Rig 18 lbs, psu ac 25 lbs, dc 6.5 lbs

From My Notebook

Geoff Arnold G3GSR continues his explanation of those often mysterious circuit symbols

As I mentioned last month, a tremendous variety of symbols have been used in drawing radio and electronic circuit diagrams over the years. Because of varied styles adopted by individual publishers of books and magazines, this continues to be so.

Circuit symbols always seem to me to fall into three groups. First, there are those whose meaning is immediately obvious from the electrical function of the component they represent - zig-zag resistors, capacitors and coils, for example. Then there are those which you can appreciate the logic of when they are explained to you. Finally, there are the symbols which, having been explained to you, cause you to wonder what sort of tortured minds dreamed them up!

This month I shall be considering three groups of components, switches, relays and connectors. I have grouped these together because the form of the circuit references they are given tends to be different to all other components.

Switches

I could easily fill an issue on the subject of switches - there are so many varieties, push-button, toggle, slide, rotary, etc. Luckily, the symbols traditionally used to represent them - that shown in Fig. 1a is the single-pole, normally-open switch - are fairly obvious in their meaning. Obvious, that is, until you come to the current British Standard.

Their problem was that the Standards Committee wanted to simplify the symbols for the most commonly used switch types (yes, it s down to those drafting machines again!), which means that a basic normally-open contact is now shown as in Fig. 1b. The problem comes when you have a normally closed contact, which traditionally would have been shown as in Fig. 1c. Because the circles depicting contacts and the thicker line for the contact arm were discarded, the Committee had to find some totally different format. They came up with Fig. 1d.

Basic changeover switches (break before make) are now drawn like Fig. 1e, with the make before break variety shown as in Fig. 1f.

There is still a switch with a contact circle, as shown in Fig. 1g. It' s officially described as 'Make contact without spring return (stay put)' . When I first saw this in the Standard, I wondered what on earth it meant, but eventually decided it must be something like an old fashioned knife-switch, where you push the contact blade home and pull it out again by means of an insulated handle on the end of the arm.

There are several other varieties in BS 3939, but once you've understood the above, the rest become fairly obvious, apart from those for larger contactors, which I don't propose to go into.

The way in which switches are referenced on circuit diagrams has varied quite a bit over the years. The modern way is to use the letter 'S' followed by a number. Multi-pole switches then have their poles identified by small letter, beginning with 'a' . Under such a system, the two parts of a double-pole on/off switch might be identified S1a and S1b. A similar system is used to identify the different sections of a multi-pole wafer switch. As an alternative to 'S', 'SW' is sometimes used, for reasons which I shall explain in a moment.

Often in large equipment, where there may be a number of multi-pole switches, the switches are identified by letter rather than number, so that instead of S1, S2 and so on, you will find SWA, SWB, etc. The individual poles are then identified by number, so that the wafers of a 2-pole switch might be identified SWA1 and SWA2. Finally, to avoid the need to have confusing masses of lines wending their way around the circuit diagram, individual terminals on each wafer can be identified by a number in brackets. A connection from the other end of the drawing could then be cut short, finishing in an arrowhead labelled, for example, SWA2(3), meaning it goes to tag 3 on wafer 2 of switch SWA.

If you use letters to identify switches, the eleventh switch in a large and complex piece of equipment will be identified by the letter 'K' . If you label switches just 'S' , then this switch would be called SK, which could be confused with sockets which are always identified as SK. Hence the use of the SW prefix for switch circuit references.

Regardless of the precise method used to identify the various parts of a multi-pole switch, all the parts should be drawn in mutually consistent positions - all poles of an on/off switch in the off position, or all poles of a rotary switch in the fully anti-clockwise position, for example.

Relays

In these days of solid-state switching, electromechanical relays are usually looked on as pretty old hat. However, they give good isolation between the controlling and controlled circuits, and have a lower on resistance than any solid-state device. Anyway, there are still plenty of them around in older equipment.

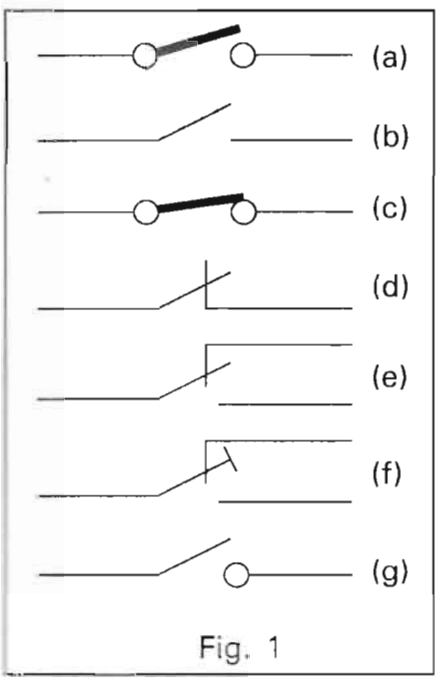


Fig. 1

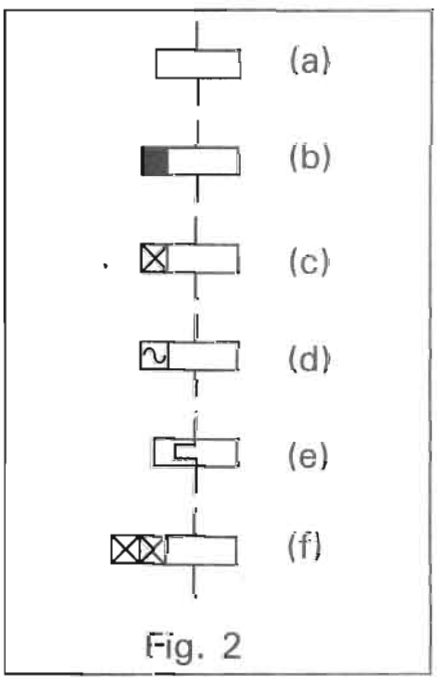


Fig. 2

Often, simple relays are drawn on a circuit looking just like the coil of any inductor, with the contact set or sets positioned immediately alongside. The meaning of such an arrangement is fairly obvious, but in a more complex diagram it would become quite unmanageable. The accepted symbol for a relay coil is a rectangle (this is one that s been around from before the days when the Standards Committee started to turn every possible component symbol into a rectangle!), but with its length at right angles to the circuit lines feeding it (Fig. 2a). There are special versions for slow-releasing relays (Fig. 2b) and slow-operating relays (Fig. 2c), for AC relays (Fig. 2d) and for thermal relays (Fig. 2e). A previously used symbol for a thermal relay is shown at Fig. 2f.

As far as the contacts are

Fig. 3

concerned, Fig. 3a shows the traditional representation of a single changeover contact set. By convention, circuits are drawn with all relay contact sets shown in the state they assume when at rest, in other words with no power applied to the equipment. At one time, the tiny shape representing the normally-open contact was drawn as an open triangle and that for the normally-closed contact was drawn filled in. The advent of the photocopier put paid to this useful convention! Whereas the old dye-line printing method of reproducing technical drawings would cope perfectly well with solid areas of black print, early photocopiers could not. They produced the optical equivalent of the mathematical or electronic function of differentiation - they showed just the outline of the solid black area.

Modern photocopiers can cope without problem, of course, but the convention has now long been lost in the mists of time. Instead, BS 3939 specifies that relay contacts should be shown in the same symbols as switches - see Fig. 1b, d, e and f.

For simple relays with just one set of contacts, it may be convenient to draw the contacts alongside the coil. Where bigger relays are used - the old war-horse Post Office 3000 type could have up to six changeover sets! - this would get totally out of hand. This is where a system known as detached presentation is used.

The same system can be used for any components having elements which are used in different parts of the circuit. This might be a relay consisting of a coil and several contacts, an IC containing several logic gates, or a multi-pole switch. In detached presentation, the various circuit elements are shown

detached from each other and placed on the diagram where their function dictates, without regard to their physical relationship. In this way, the length of lines and number of cross-overs on a circuit diagram can be drastically reduced.

Obviously the various circuit elements have to be related to each other and clearly identified as being physically part of the same component. For relays, a particular system has been devised which makes these relationships very clear. Unfortunately, that system is frequently ignored in practice.

The system is as follows. The relay coil is identified as RL followed a letter, RLA for example, then an oblique stroke and a figure indicating the total number of contact sets fitted. So if RLA had four sets of contacts, the coil would be labelled RLA/4. Sometimes this will be put in the form of a true fraction, with RLA as the numerator, a horizontal bar, and 4 as the denominator.

The contacts are then identified and labelled as RLA1, RLA2, RLA3 and RLA4. If a relay with four contact sets was fitted in a circuit where only three sets were required, the fourth set could be simply left out of the drawing. However, a poor fault-finding technician who was unfamiliar with the equipment could spend a long time looking for that fourth contact, thinking it might be the source of his problem. The correct method is to draw in any spare, unused contact set in a space at the edge of the drawing, and to label it with the appropriate reference - in our example that would be RLA4.

In the big, tightly packed drawings of yesteryear which used large numbers of relays, it was sometimes the practice to reduce clutter by omitting the prefix RL against relay coils and contacts, so that our example relay would be identified simply as A/4, and the contacts as A1, A2, A3 and A4. Using current BS 3939 symbols, this would no longer be an option, since switch contacts and relay contacts are indistinguishable from one another.

Connectors

The meanings of the symbols for plugs, sockets and jacks, whether in their traditional form or their slightly changed modern equivalents, are all reasonably obvious, with the possible exception of the coaxial plug and socket.

The traditional symbol for a single-pole plug and socket is shown in Fig. 4a, and its BS 3939 equivalent in Fig. 4b. Multi-pole versions are made up of a series of these symbols, linked by dashed lines.

For coaxial sockets, Fig. 4c shows he traditional symbol. My mind has gone a total blank on the symbol for the mating plug, and I have been unable to turn up a reference to one anywhere. No doubt I shall find it as soon as this issue has gone press! Under BS 3939, the plug and socket are as shown in Fig. 4d.

Screened cables, either single or multi-core, as used in audio systems for example, are dealt with as in Fig. 4e, with the screen made off to one pole of the connector on each side.

The symbols for telephone jacks and their mating jack-plugs have changed very little over the years. The current symbols are shown in Fig. 4f. Note that in the plug symbol, the longest pole represents the tip and the shortest the sleeve.

Next month, I plan to cover symbols used on circuit diagrams to represent the rest of the common electronic and radio components.

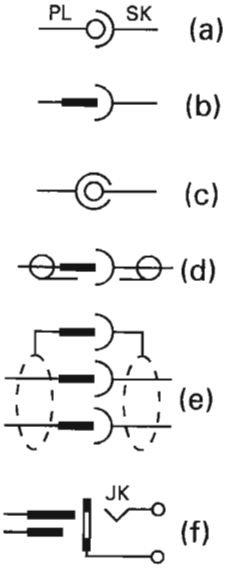


Fig. 4

QRP corner

Dick Pascoe G0BPS shows how QRP can be enjoyed on the move

This must be the time for a reminder about the annual pilgrimage. Our destination is a small district of Rochdale for the *QRP Convention* once again.

This will be the 21st Birthday celebration convention as the G-QRP club comes of age. Started in 1974 by Rev. George Dobbs G3RJV it has become the envy of other QRP clubs throughout the world. It may not be the biggest, but it has been called the best. It was a delight to hear from Doug Hendricks KI6DS, the mainstay of the new NorCal club, that he had aligned his club on ours, especially their magazine QRPp is a close cousin of Sprat.

The convention is at St. Aidans Church Hall, off Manchester Road, Rochdale, Lancs, on Saturday 14th October 1995. The event starts at 10.00am when the doors open to "Joe Public". There will be various component suppliers available to tempt you, plus a few dedicated QRP kit suppliers also looking to part you from a few sheckels.

The highlight of the day is not the range of homebrew equipment on display, nor the bring and buy. Not even the range of club bits, it is the hot pie and mushy peas with pickled red cabbage that everyone waits for! The main advantage of this event is that an area is set aside for visitors to sit and chat over a cup of tea or coffee. Discuss the latest project and tell of the rare DX worked with just a couple of microwatts.

Other useful things are availabe; Ian G3ROO will sit and give advice on home construction, alongside David GM4ZNX who will baffle you with science and then repeat it all at a level you will understand. Got an aerial problem? Chat to Gus, G8PG. He has the answers to most difficulties. All in all, a great day out for the family. The ham can go the show and the partner to the shops in the fine town centre.

For those who wish to stay over, there are hotels plus B and Bs about. You may get the idea that this event is highly commended to you! Suffice it to say that I have not missed a year since it all started.

Mobile QRP

As I have little time to operate from home, I enjoy mobile operating whilst I travel the country. To this end I bought and fitted the TS50. Much has been said about this little radio. It is intended for mobile use and, yes it does collapse when coupled to a main aerial system. I told a friend what I had bought and he immediately suggested that I should fit the better filter and an RF speech processor. As I was in Dayton at the time, I took the advice and fitted the two units. What a difference it made. I can without doubt highly recommend them to any serious TS50 user.

The TS50 can make a useful mobile QRP rig

The speech processor cannot easily be fitted without the filter and I strongly suggest that both are fitted. The filter replaces the stock Kenwood ceramic filter, and dramatically improves the SSB selectivity. The filter costs $85 and the processor $60 plus shipping (prices were correct at the time of writing). These are available from: International Radio and Computers Inc., 3804 South US#1, Fort Pierce FL 34982 USA. Tel 00 1 407 489 0956, Fax 00 1 407 464 6386. Needless to say I have no relationship with this company.

On the move

Coupled to my new 'Texas Bugcatcher' mentioned in my last column this radio really works well. This aerial is big! The loading coil is 45cm by 10cm with a 1.65m whip above, at 70 mph there is a lot of wind loading. To avoid problems I had to use some form of guying. As this aerial is mounted on the rear side of my Midi van there's about 45cm of metalwork beside the 1.07m base section.

Using my existing roof rack, I was planning to use some guy rope to prevent the movement. I then came across an idea in the book 'Hints and Kinks' from the ARRL. They suggest using 19mm plastic water pipe. By using a 'T' junction strongly glued in place around the vertical base section, bolting it to the roof rack in two places, I made this section a solid mount for the loading coil and the whip.

TS50 modifications

Back to the TS50, users will be aware there are three power settings on the rig, being factory preset at 100W, 50W and 10W. These can be changed down to our levels. To do this, open the case and look at the rear edge of the main PCB next to the huge heatsink. At the middle of the board edge is a multi-wire connector carrying seven leads. A small vertical PCB is attached to the main PCB. Next to these is a small white plastic preset pot. On the schematic this is labelled "VSF", it is a 50k pot and turning it anticlockwise will reduce all three power levels. Check with a power meter to set at the required level. Having set the high power level required the lower settings may now be done.

Just to the left of the piggyback IF board, centre and forward are two tiny surface mount presets. You will need a *very* small screwdriver to adjust them. Do it *very* carefully. They are VR16 (medium power) and VR15 (low power). Turn them anticlockwise to lower the setting. I set the mid level to 10W for SSB use and the low power setting at 5W for CW. Needless to say (again) if you are not happy about opening up your rig and doing this at your own risk, don't try it. Thanks to Smitty NA5K, Al, K3KMO and Duncan ON/G0UTY for this information.

Reading matter

I've occasionally been asked by folk about a book called "The history of QRP in the USA from 1924 until 1960". This book was by a well known US amateur by the name of Ade Weiss. I

had always thought it was out of print, but in the back of the latest issue of 'Hambrew' I saw an advert from Ade for this book Quoting a (USA) price of $12. This book appears to be one of the classics in the QRP field and should be obtained by those interested quickly. Ade's address is: Ade Weiss, 526 North Dakota St, Vermillon, SD 57069 USA. I would guess that he will not accept credit cards and that including air shipping $20 should suffice, but this is only a guess.

SSB QRP rigs

A phone call today asked about the range of dedicated QRP rigs available to the SSB enthusiast, specifically about the Index Labs 'QRP Plus'. A very nice radio, if you can get one. At the time of writing the UK importers are still quoting a wait of six months or more. This rig is just so popular that the manufacturers cannot keep up with demand.

The other Ten Tec radios such as the Argonaut 509 and the 515 both had SSB facilities, but are analogue readout only and although they are still a very sought after radio, are getting a bit elderly. The later Argosy radio's had a switch on the back to select either 5W or 50W out. These are much better, with a good digital display and quite nice to use too. The main problem is that they are rather rarely seen on the second hand market. The later Argonaut Two is similar but much updated, first seen at Dayton some four years ago. It has the famous Ten Tec "Jones Filter" which takes a little time to get to know.

All in all, there are a few dedicated QRP rigs available for the SSB enthusiast. It's a pity that most of the modern 'black boxes' will only deliver a minimum of 10W when the QRP awards state a maximum of that power level.

Aerial tests

Regular readers will be aware of my fascination with aerials of all types. I regularly try out different ones at my home and have recently tried some different ones for mobile use.

Dave G3RCQ has been a great help and given lots of advice. I have also acquired a program called *MOBILE* which gives lots of help for those wishing to make their own mobile aerials. The program, from AA6GL, is superb. It first prompts for the frequency required, then the length and diameter of the base section and the top whip. You are then asked what type of vehicle you wish to use. A selection of Compact, Standard, small Pick-up, large Pick-up, Van or fixed is available. You also have the choice of mount. The aerial may be roof, mid point or even bumper mounted. You will see the variations are endless.

Using my standard Hustler base mount with the Bugcatcher whip it came up with a rather interesting combination. Assuming a 1.22m base with a 1.52m whip fixed to a mid point on my 'Midi Van', the program gave coil dimensions of 15.2cm diameter, 25.4cm long with 81 turns of wire at 3 turns per cm (the US program however giving imperial, rather than metric, dimensions - Ed). The 'Q' of the coil was stated to be 510. Giving an efficiency of a massive 1.4% a feedpoint impedance of 16 Ohms and a bandwidth at the 1:2 SWR point of 8kHz. Change the mount to the roof position and the coil remains the same but with an efficiency of 1.6%, impedance of 14 Ohms and a bandwidth of just 7kHz. Much as I would have expected on such a short aerial for Top Band.

That's it this month, please let me have your QRP news, views and photos, via the editor, via packet to GB7RMS, Email to Dick@kanga.demon.co.uk or snail mail to me at Seaview House, Crete Road East, Folkestone, Kent CT18 7EG.

DATA CONNECTION

Chris Lorek G4HCL shows how to get going on 9600 baud with a kit modem, and takes a close look inside the PacTOR II controller

In my write-up on the BayCom PAR96 9600 baud packet modem in a recent issue, I gave details on where to get built-up units (from Siskin Electronics in Hythe), and I mentioned that PCBs and kits for these were available from the North West Packet Users Group (NWPUG). Unfortunately I didn't have any contact details for this source of kits at the time. However Phil G6IIM, who is the NWPUG/BayCom coordinator, kindly sent me a bundle of information which certainly rectifies this!

The PAR96 PCB, complete with GALs and EPROM, is available at £42.00, and the screen-printed and drilled case is available for £13. The group can also supply other BayCom product kits, such as the MkIII BayCom modem and the USCC modular 4 channel plug-in PC card. Contact Phil Jones G6IIM, 12 Coronation Drive, Bromborough, Wirral, Merseyside L62 3LF, Tel. 0151 334 2452 for more information.

The BayCom PAR96 9600 baud modem is available in kit form

Data rally next month

The 1995 BARTG rally will be held on Sunday 10th September, at the Sandown Exhibition Centre, Sandown Park Racecourse, Esher, Surrey, in a large spacious hall with plenty of free parking. This rally, organised by the British Amateur Teledata Group, is of general interest to all radio amateurs, most aspects are catered for as well as an emphasis on Data Communications.

The event is open between 10.30 and 17.00, with an admission charge of £2.00 for adults,£1.50 for OAPs, under 14's are free if accompanied by an adult. As usual there's on-site catering, hot and cold meals, snacks, beverages and a licensed bar available for visitors. The BARTG say there will be over 250 tables, and that many exhibitor and special interest groups will be attending. The venue is well signposted, and is just 10 minutes from Junction 10 of the M25. You can get further details from Pater Nicol G8VXY, 38 Mitten Avenue, Rubery, Rednal, Birmingham B45 0JB, Tel. 0121 680 5963.

Maxpak news

News on the Midlands packet radio scene comes from *Maxpak,* the Midlands AX25 Packet Group. Their latest *Digicom* newsletter (which has been published for no less than 9 years this September) tells us;

WV Nodes; After the initial teething troubles setting up WV11 to work on 9k6, the node is performing well. The problem was eventually traced to the variable capacitors which tune the rig to the operating frequency. These were replaced with 'professional' quality ceramic types which provided a complete cure. The group thank David G8SQH for his help in locating the problem.

AP Nodes; AP21 went off air for a while due to a power unit failure. Bob G8KHV made the necessary repairs and it is now back on line. Drawings of the brackets etc. have been made and have gone to the site owner for approval prior to the next stage of upgrade work at the site.

DY Nodes; DY71 was off the air for a short time due to a power failure at the site. Ed G4ZXS has sorted the problem and he believes things are back to normal at the site, with DY22 and DY71 both working 'flat out'.

Their bimonthly newsletter also carries plenty of other information of interest to packet users, and is a very useful way of keeping members in touch. Ed G4ZXS has recently also initiated a packet 'news bulletin' sent to members (thanks for the copies Ed).

You can get further info on Maxpak and membership of the group from Richard G1NZZ @ GB7MAX or Tel. 0973 262287 (1900-2300 weekdays and 1000-2200 weekends)

PTC-2 Communications Controller

Regular readers will have occasionally seen information on PacTOR activity, and a mention of the new PacTOR II. previously in this column. The PACTOR-2 controller was displayed in its basic form approximately a year ago at the Dayton Hamvention, by SCS, the original developers of PACTOR. They describe the mode as "A New Dimension in Data Transmission Technology", which sounds rather interesting. Here's an extract from the information that Roy, DJ0OW kindly sent me;

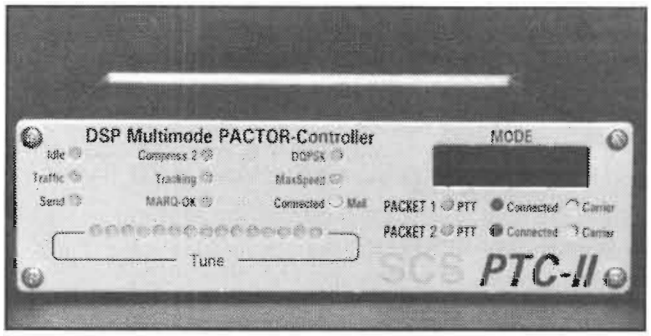
"As PACTOR-2 must incorporate extremely good transmission qualities for shortwave use, it uses a coding and modulation system much more complex than that currently used in PACTOR-1, AMTOR or RTTY. The pi/4-DQPSK modulation system for example, makes it mandatory to use a DSP (Digital Signal Processor) as the interface to the HF transceiver. The

use of a reliable, and in practice, easy to use modulation system, is an essential step on the way to optimum data transmission over the often difficult paths used on HF radio. It is however much too simple just to concentrate on the modulation system alone.

Dramatic improvements can be obtained through the correct preparation of the data before it gets as far as being transmitted by the modem. To be efficient, this preparation, also known as Channel Coding, imposes very high computing requirements on the system processor. It can be said that the final limit of transmission reliability, is dependant on the computing power used for the Channel Coding. The more power available, then the more efficient can be the coding. It is thus possible to approach ever closer to the theoretical limit (Shannon Channel Capacity). Instead of the often used, but relatively weak Block codes (Reed-Solomon, Golay etc), PACTOR-2 uses the extremely high performance folding or convolutional coding with a real Viterbi-Decoder on the receive side. This is the present "State of the art" in communications technology.

Many have the wish to be able to operate not only the with usual digital HF modes, but also to cover VHF and UHF Packet Radio with one unit. This forces the use of a RISC (Restricted Instruction Set) processor for fast processing of the HDLC Packet protocols. It is also desirable in Packet Radio to be able to operate simultaneously on two frequencies. For example on 23cm with 9600 Baud and on 70cm with the usual 1200 baud. Naturally, during this time, no PACTOR or AMTOR connect on HF should be lost or ignored. Therefore all operating modes must be available for use simultaneously and with the same priority.

As the majority of modern HF transceivers can be programmed via a serial interface, the wish has slowly formed to use this feature for remote control of the transceiver. Perhaps one will wish to use one's home based PTC-2 whilst on the move or from a remote location. Using Packet Radio, tell the HF transceiver which frequency to tune to. Then to make a connect in PACTOR-2 to a particular mailbox and read the mails. Last but not least, one would like a large, comfortable (user friendly) mailbox, capable of *simultaneous* access from all communications channels. Naturally, the usual small comforts such as Real-Time clock, battery back-up etc. as



The SCS PacTOR II DSP multimode controller

incorporated in the previous PacTOR-controllers should not be forgotten."

Results: SCS tell me the above information was prepared about 9 months ago. They currently add;

"Since then considerable experience has been gathered using this mode. The first 100 or so units are now in use. Results bear out the mathematics. They say; "PacTOR-II really works. Speeds exceeding 1200 bauds are achieved under good conditions, and the link is maintained, when the partner station is not audible to the ear. Even under these conditions, throughput is good enough for a normal QSO. The system is insensitive to QRM, and works reliably totally unattended. The auto-switching between AMTOR and PacTOR 1 and II works even with very weak signals, as does the automatic level finding so that stations not fitted with PacTOR-II are only worked using PacTOR 1. The automatic data compression system achieves a compression ratio approaching 2. The bandwidth remains constant at around 450Hz even at full speed, so narrow filters may be used. Stability and setting accuracy need to be no better than that of PacTOR-I, and slow drift is automatically compensated for. The listen mode is implemented internally, so no extra software or hardware is required. This too switches automatically between PacTOR-I, PacTOR-II and AMTOR depending on the station being received".

My thanks go to DJ0OW for the large amount of information, much of which I couldn't fit here due to space restraints. If readers would be interested in more info, or a 'full-blown' feature on PacTOR II, do get in touch with either myself or the Editor and we'll try to oblige.

'Hip Tips'

'Hip Tips' is the newly-launched newsletter of the Hampshire TCP/IP Users Group. It's edited by Ken Adams G7OAH, the next issue being due out in August this year (i.e. as this magazine appears on the shelves). Ken's done an excellent job of his first issue, which includes details on the GB7HIP BBS system and the people behind it, hints and tips on TCP/IP and how to get started, forthcoming packet events in the area and even a for sale/wanted section. You can get further details from Ken via GB7HIP, or Tel. 01705 615424.

DISview from G3NRW

Ian G3NRW tells me that Demon Internet users now have access to the new *DISview* on-line documentation package. Produced by Ian's company of Dowermain Ltd. in Luton, Ian says *DISview* provides detailed information on all the Demon NET software commands and control files, via a pop-up file viewer. This gives users instant help when connected on-line, just when they need it most. It contains around 90 files, including a handy command set reference guide, and a 'NOSintro to Demon conversion guide' which covers the differences between the packet radio implementations of NET (as described in *NOSintro*) and Demon's implementation. *DISview* is available at ftp.demon.co.uk: /pub/doc/disview/disvw518.zip, or if you'd like a copy on a 3.5in HD disk just request the 'DISview' disk from HRT's software offer service this month (either, or in addition, to this month's collection offer on disk) - the additional copied disk plus return UK p/p will cost you just the usual £1.00, i.e. £2.00 total if requesting this together with this month's 'software collection disk'.

CTRL-Z, End of message

Please do keep me in touch with what you're doing, and as always if you've any thoughts on data modes over ham radio that you feel would be of interest to others, do let me know. 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 reveals that you really can work EME with just a modest station

The dates for the ARRL International EME (Earth-Moon-Earth) competition have been set for the weekends of October 7-8 and November 4-5, 1995 (the complete rules will appear in the September 'QST').

I received some interesting news from Ray W2RS about EME. It seems the record for the smallest station to make a 144 MHz EME QSO is held by Arne Coro, CO2KK, who worked KB8RQ with 22W (measured) to two five-element yagis. Arne and Gary made use of mutual ground gain.

Arne is also active on 50MHz and produces the amateur radio programs for Radio Havana in Cuba.

EME report

Conrad G0RUZ writes; "Hi Geoff, first a little background. I became active on 432 EME in November with 4 x 8.5 wl DJ9BV with a crude coax feed and a rather poor power splitter. I worked 13 stations during the ARRL contest.

In December I converted the system to open wire which made a dramatic improvement. I had worked 25 initials by the end of December, 37 by the end of January, the appalling weather kept me quiet during February adding only 2 initials. In March I worked 4 more taking the total to 43.

The new aerial system of 6 x 11wl DJ9BV opt 70 yagis was installed (not without problems, the rear weight of the aerials give me elevation headaches at first) on Saturday 8th April. I was only active between 20:00 and 21:00 and worked K0RZ 449/459 for No.44 and K1FO 559/439, then disaster. The elevation screwjack clamp slipped due to the imbalance, and that was that.

I was up early on Sunday and finally sorted out that problem. At moonrise, JA9BOH was a great signal, also copied was VK5MC with 439 signals, they were working each other. I was reluctant to call them at this time as I had not yet assessed the TVI situation and didn't want to tempt providence with the new system. I worked ON4KNG 0/0, SM2CEW 559/549 (No.45), WA4NJP 449/0, DL3BWW 549/539, and N4GJV 559/559, a huge signal. I then decided to call CQ and was amazed to be called by G4ALH O/O (No. 46), I5CTE O/O, DL4XX O/O, and HB9SV 559/559 (No.48).

There was a station with a '3' in the call who called me on random, but I just could not pull a call out due to QRM at this time. CWNR was I2COR and also heard was EA3DXU. I had a sked at 00:00 on the 10th with PY5ZBU O/O (No.49) and WAC! Thanks Don! I had 6 previous skeds with Don and only heard him weakly twice, but his signals were 439 this time. This illustrates what a huge difference a 2.5dB aerial gain improvement makes on the EME path. Nil on sked with AL7JM at 00:30, I think we have a polarity problem, we need Faraday to work!!

Also on the 10th, email set up skeds with: 1400 JR9NWC nil, 1430 JH4JLV O/O (No.50). 12th; 00:00 W0RAP O/O (No.51), DL8OBU 439/429r, OE3JPC (2 x 19 ele Tonna)T/- EA3DXU (2 yagi) 439/O (No.52). 15th; K5JL 449/559, I5TDJ 439/449 (No.53),N9AB O-569/M (one way propagation?) for No. 54.

So I am delighted with the aerials which are available from Eagle and perform exactly as predicted by DJ9BV. I worked 10 new stations and can hear echoes with as little as 50W in the shack! My current equipment is 6 x 11 lambda DJ9BV OPT70 (27.5 dBi), FT990DC, LT70S transverter,

DJ9BV preamp 0.4dB noise figure, and a 3CX800 PA.

I would now like to try with some smaller stations, i.e. 2 yagi etc. Skeds are always welcome, especially by email. Packet radio skeds can also be sent to

G0RUZ @ GB7WRG.#19.GBR.EU.

I am particularly keen to have skeds outside of sked weekends, Conrad G0RUZ."

Beacon news

This month sees part 2 of the 50MHz beacon listing, part 1 appeared in the July issue of HRT. Beacon news from Stephan LA0BY reads: 'The new beacon JW7SIX is active from JQ88AD since April 7th. It runs 10 W RF into a 4-element yagi on the frequency 50.047MHz. Until the end of May, the aerial will be beaming towards Europe (azimuth bearing 190 degrees). Thereafter it will be turned around and aiming towards VE8/KL7 (azimuth bearing 340 degrees) for the

50MHz Beacon List (part 2)

FREQ	CALL	LOCATOR	POWER	ANTENNA
50.061	KH6HME	BK29	20	DIPOLE
50.062	PY2AA	GG66	25	G PLANE
50.062	GB3NGI	IO65	25	DIPOLE @ 240M
50.063	W3VD	FM19	10	SQUALO
50.064	WD7Z	DM75	75	SQ/O
50.064	KH6HI/B	BL01	60	TURNSTILE
50.064	GB3LER	IP90	45	DIPOLE
50.065	W0IJR	DM79	20	2 RING HALO
50.0655	GB3IOJ	IN89	10	VERTICAL
50.066	WA1OJB	FN54	10	J POLE
50.066	VK6RPH	OF78		QRT AT PRESENT
50.067	KD4LP	EM86	75	G/PLANE
50.067	OH9SIX	KP36	35	TURNSTILE
50.069	K6FV	CM87	100	
50.07	N4LTA	EM94	10	1/2 HALO
50.07	EA3VHF	JN01	0.25	VERTICAL
50.070	W2CAP/b	FN41	15	V/DIPOLE
50.070	ZS1SES			NEW BCN
50.070	SK3SIX	JP71	10	X/DIPOLES
50.071	W0VD	EM27	10	G/PLANE
50.072	KS2T	FM29	10	G/PLANE
50.073	WB4WTC	FM06	10	2LO
50.073	ES6SIX	KO37	10	G/PLANE
50.073	VE1MQ	FN65	2	D/POLE
50.075	JY6ZZ	KM71	8	5/8 VERTICAL
50.075	NL7XM/2	FN20	10	
50.075	PY2AMI	GG67	5	G PLANE
50.075	EA8SIX	IL29	10	???
50.075	K7IHZ	DM43	20	SQO
50.076	PY2AMI	GG67	10	G/P
50.077	N0LL	EM09	21	HALO
50.0775	VK4BRG	QG48	3	TURNSTILE
50.078	PT7BCN/	HI06	5	G PLANE
50.078	OD5SIX	KM74	8	1/4 VERTICAL
50.079	TI2NA	EJ79	20	DIPOLE
50.08	WB4OOJ	EL87	10	VERTICAL
50.08	SK6SIX	JO57	10	GROUND PLANE
50.08	ZS1SIX	JF96JG	10	HALO
50.082	HC8SIX	EI59	4	VERTICAL
50.084	3D2FJ	????	20	2 EL NNE
50.086	VP2MO	FK86	10	6 EL YAGI
50.0865	LU1MA	FF57	8	G/PLANE
50.087	VK4RTL	QH30	10	PROPOSED
50.0873	YU1SIX	KN05	15	DIPOLE
50.089	VE2TWO	FO13	18	DIPOLE
50.092	HC2FG/b	FI07	8	VERTICAL
50.095	PT5XX	GG54	50	
50.098	LU2MFO	FF97	4	BEAM
50.1	LU2FMO	FF96	4	3 EL YAGI
50.2	VK0IX	OC53	50	3 EL YAGI
50.315	FX4SIX	IN06	10	X/DIPOLES @ 160M
50.48	JH8ZND/B	QN02	10	DISCONE
50.49	JG1ZGW	PM95	1	DIPOLE
50.499	5B4CY	KM64	15	1/4 GP
50.521	SZ2DF	KM25	1000	4 * 16E QTF330
51.022	ZL2UHF	RF73	25	VERTICAL
51.029	ZL2MHB	RF80	10	1/2 VERTICAL
52.10	VK6RTT	OG89		
52.326	VK2RHV	QF57	10	VERTICAL D/POLE
52.33	VK3RGL	QF22		
52.347	VK4ABP	QG26	10	1/4 VERTICAL
52.35	VK6RTU	PF09		
52.37	VK7RST	QE37		
52.37	VK7RST	QE37		
52.41	VK1RCC	QF44		
52.418	VK0MA	QD95		
52.42	VK2RSY	QF56	25	TURNSTILE
52.423	VK2RGB	QF59	5	OMNI
52.435	VK3RMV	QF12		
52.445	VK4RIK	QH23	15	D/POLE
52.445	VK4RBM	QG48		
52.45	VK5VF	PF??	10	TURNSTILE
52.46	VK6RPH	OF78		
52.465	VK6RTW	OF85		
52.47	VK7RNT	QE38		
52.51	ZL2MHF	RE78	4	D/POLE

summer Sporadic E season.

The equipment is operated by LA0BY. The transmitter was supplied by Arvo, ES1CW, and the aerial was donated by Siggi, DF9WB. Many thanks!

Listening for beacons is only half the fun, and some efforts are also made to stimulate QSO activity. The local club station JW5E, being situated in JQ73SG, will be equipped with a rotatable 5-element-beam and a 28/50MHz transverter. In case one should monitor JW7SIX, the following amateurs may be called by telephone:
JW5NM Mathias Bjerrang Tel. +47 790 21152 (Op at JW5E).
JW8GV Ola Johan Oestvig Tel.+47 790 21583 (Op at JW5E).
JW0BY Stefan Heck Tel. +47 776 35144 (mainland number).

All three amateurs can be on-air from the club station within 10 minutes. JW0BY will also have the possibility to operate from the beacon location. Calls between 2300-0600 UTC should be avoided. JW0BY will not be permanently in JW and therefore only the mainland phone number is given (please do *not* phone any other numbers for JW0BY, as those are exclusively for QRL purpose). In urgent cases the information may be routed through the other amateurs, the mainland number.

Reception reports are very welcome and can be send to Stefan Heck, LA0BY, Floyvegen 25, N-9020 Tromsdalen, Norway (email: stefan@eiscat.no). It would be useful if the reports would include information on QTF, possible signal distortion, other signals copied at same time, etc.

The beacon operating parameters will be reconsidered for the next year, depending on the experience obtained in the 1995 season. Already now it is planned to relocate the JW7SIX beacon to a better location in the autumn and replace the yagi aerial by one with an omnidirectional pattern.

The first report of the new 6m beacon JW7SIX on 50.047MHz was telephoned to Neil G0JHC. Hakken, SM3EQY (JP73) heard it for about 5 minutes at 1940z, the signal peaking 429 on Sunday 16th April.

V31SMC on 50.035MHz and built in Jersey is now operational, and was heard in Eastern US on 2 May. It's nice to see our work paying off!

DX news reports

Frank PA3BFM reports good aurora on April 7th, his comments were: "I'm in the middle of a very good aurora here in JO22OC. On 6 metres I worked OK1DDO in JO60 and heard S59A from JN76. Many G, GM, GW, OZ, SM, LA, DL, ON, PA stations were heard/worked. It's rare to hear stations this far south on aurora. Between 1630 and 1700 UTC all signals were extremely strong, I could hear all beacons north of me including the ones in OH and ES (Estonia). The tone quality tended towards clearand normal sound. At around 1700 signals weakened but aurora was still strong on 48,250 TV and the 49,750 TV".

Herb, W3IWU reports the following; "Nice AU here in FN20FC on the 7th April between approximately 1800 and 2200z. Stations heard from VE1, 2, 3, W1, 2, 3, 4 (Virginia only), 8, 9. Between 1930 and 2000, signals at 48.242, .249, .248, .250 were heard. Since these signals were just moving the S meter and were typically hissy, one could not say for sure that they were video signals originating from EU. I have not had the opportunity to check with VE9AA and VE1PZ (who were active) for confirmation".

Neil G0JHC reports the first significant 50MHz 'ES' opening on Tuesday 25th April. The band opened at around 0930z from the UK to Italy. Areas heard/worked were I4/5/6/8/IT9, and 9H5DM was also in there. When Neil returned back from work at 1230z the band was still open, but signals were fading badly.

On April 28th, Kent WA6TBO (DM02) posted an urgent message on the Internet which read "receiving stations on FM broadcast band in Idaho and Nebraska right now". Kent stated that the stations copied were at 90MHz, not bad for April!

April 30th saw another good opening on 50MHz, on Sunday afternoon YU, DL, OM, SP, OK, and Italy were all worked or heard from my location, however the 'Jewel in the Crown' was hearing the 5B4 beacon at S5, at a distance of 3350km.

Neil G0JHC received a call from Jorge EA2LU on 28th April, stating he had just received permission to once again begin transmitting on the 6m band. All other letters of authorization had also been received over the past week. He implied all those who previously had permits and re-applied were successful, along with a number of new calls, which

would bring the total permit list up to about 120-130 (his guess).

Martin G3USF reports the following; Norway is reported to have announced plans to close its Band I TV transmitters. No information as to dates, but it's not thought to be imminent. It's also reported that, by next year, Hungary, Poland and the Czech Republic will have converted all their transmissions from SECAM to PAL, which suggests an intention to remain in Band I for some time.

Eric 5T5JC passed on some information via 28MHz to me. Eric will leave Mauritania this month (August) and will sell his 50MHz radio to 5T5BN in Nouakchott (a new square!).

24GHz UK record

A short report from Sam Jewel G4DDK; Following on from G3LQR's recent contact with PA0EHG/P on 24GHz for a first contact between the two countries on this band. I was able to successfully work ON6UG/P in Belgium on the evening of 4 May 1995, for what I believe to be the first contact between G and ON on this band. The calculated distance is 210km and may be a UK record distance for the band, just exceeding G3LQR's 205km with PA0EHG/P.

I operated from home in JO02. Freddy was located at Ronsa in JO10. 10GHz was used for talk-balk, where the signal from Freddie's (ON6UG) portable 1W station reached S9+40dB! Even on open waveguide and with the transverter laid on the ground, Freddie's signals were S9.

The 24GHz systems consist (at G4DDK) of a DB6NT based transverter with G4DDK/G3WDG local oscillator chain, a power HEMT output amplifier giving 125mW at the aerial, low noise amplifier using a Mitsubishi MGF4915 HEMT, and a system noise figure of about 5dB. The aerial is a 25cm Procomm dish with Procomm feed. The transverter is mounted at masthead and uses a 2m IF. At ON6UG/P the system consists of a DB6NT transverter, 90mW output and a 48cm Procomm dish and feed. This system is tripod mounted. Signal levels started at 419/519 and peaked at 51/52 on SSB. I believe the propagation mechanism was super refraction with extension over ground by approximately 50km to Ronsa from the Belgian coast. There will be further tests with ON6UG/P being located on the Belgian coast.

Should we say "A Jewel in the crown"?

That's all for this month, news and views to: Geoff Brown, GJ4ICD, TV Shop, Belmont Road, St. Helier, Jersey. Fax/phone 01534 877067 or via the Internet at: equinox@business.co.uk

Don't forget my WWW pages at: http://www.business.co.uk/~equinox

Satellite Rendevous

Richard Limebear G3RWL brings the latest AMSAT-UK news collation, including some tips on contacting the Mir space station on packet radio

It took a few weeks, but the Mir crew finally had time to work on their Packet Personal Mail System. The crew thought the problem was with the laptop running the TNC, but the problem turned out to be some incorrectly set TNC parameters, e.g. TXDELAY was set for zero delay (it should have been 300 millisec). The PMS was left working, but remember the mail buffer is only 22k. Also, remember, only one station can connect to MIR's PMS at a time, *all* others *must* wait.

The current crew on Mir appear to be getting the hang of the 2m transceiver and the packet Personal Mail System. Norman Thagard for example has been answering packet messages as fast as time allows. Many amateur radio stations have learned the correct procedure for connecting to the Mir PMS. But unfortunately, there are many others who do not understand the procedure for connection to Mir. The PMS on Mir can only connect to one station at a time, and it only takes one station operating badly to ruin a whole pass for everyone.

Some tips

The keyboard port (R0MIR) is not used often. Unless there is a crew member actively typing on this port, you should *not* connect to the keyboard port. Don't be fooled by the R0MIR<CQ <UI>: message coming from this port. Anything you send to this port is not saved and just causes interference to people using the Mail port (R0MIR-1). Stations attempting to connect to Mir should make sure the TNC parameter MCON is turned *ON*. Look for the packet message: R0MIR-1<CQ <UI>: before you call Mir! If you do not know how to read a packet string, then maybe you should not try until you study a little more. If you see a string with an Index number: R0MIR-1<xx1xxx >I0 or I1,I2,...I7<: then immediately abort any attempt to connect the PMS, and wait until you see the <UI> packet.

QSL Information

Norman said he is logging all voice contacts, and will bring the log back to earth next month (as this is being written). Most packet contacts are not logged, because there are three people using this PMS. Packet messages are read and deleted, but are not logged. It may not be possible to get a QSL card for a packet contact with Norman. For those who made contact with Norman, QSL address is: Norman E. Thagard, Mail Code CB, Johnson Space Center, Houston, Texas 77058

The packet system was reportedly shut down in early May while various reconfigurations were carried out - it should be back by now.

With the planned Mir/shuttle linkup, the authorities recently found out that Russia and the USA do not have a full time 'Third Party' agreement. There was a temporary agreement when STS-60 was in space, but that one expired.

Digital Satellites

WO-18 had a crash and is in MBL. The cause of the crash is currently unknown. Weber State University Ground Controllers will be uploading newer operations code (with a few new features) soon to resume activity. The spacecraft transmitter has been turned on and pre-crash telemetry does not show any problems. The Ground Controllers will post any diagnostic findings.

New Fuji for 1996

JJ1WTK has announced that there will be a new Fuji class spacecraft launched early next year; the planned date has been tentatively set for February 1996. It appears that this new JAS-2 will have the same frequencies as FO-20 currently uses. However, there will be a 9600 baud capability FSK (G3RUH type) uplink available on 145.870MHz but it will not use the current PACSAT protocol that is currently used on AO-16 and the UoSats today. The BBS will work just like it currently does on FO-20.

Fly your callsign on board Phase 3D!

As a part of Amsat-UK's fundfinding for P3D, it is now possible for your callsign to be included on a plate attached to the spacecraft. People with deep bank balances should contact the Amsat-UK Office (see below); people with even deeper bank balances will also get a smart plaque for their office wall!

AMSAT-UK Keplers are also put out on packet fortnightly, sent to KEPLER @ GBR. The latest satellite Keplers as supplied by AMSAT-UK are 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. They're also available by post by sending an SAE together with the corner flash from this page to the HRT Editor, stating whether you want all amateur satellites (one A4 page) or all satellites (10-15 A4 pages).

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Amsat-UK

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