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HAM RADIO TODAY

VOLUME THREE NO. 5 MAY 1985

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ABC

REGULAR COLUMNS

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FEATURES

REVIEWS

We would like to apologise to readers for the recent increase in cover price of this magazine. This situation was regrettably forced upon us at short notice due to increases in the cost of production and raw materials.

LETTERS

POOR SHOW

Sir, Having listened to several special event stations over the past twelve months, might I be so brave as to suggest that in future, all GB operators use *morse code only!*

This would cut out the crap as well as being much more interesting to the proverbial 'man-in-the-street', by now quite blase watching his own kids yackking into the mikes of their CB rigs. So, let's roll out the keys this summer, and give 'em all a blast of dots and dashes. . .

Douglas Byrne, G3KPO

2m ON THE CHEAP

Sir, Just a couple of quick points to add to '2m on the cheap' by Richard Wander, G4RPS (*HRT* March '85).

I've used the Spectrum Communications RC2-10 and TC10-2 for about 18 months now with a standard FM CB set. The crystal I use is 39.19958 MHz (tripled to approx. 117.59875MHz) which allows S8 to S22 on the following CB channels:

1 = S8 , 145.2
6 = S10, 145.25
11 = S12, 145.3
16 = S14, 145.35
21 = S16, 145.4
26 = S18, 145.45
31 = S20, 145.5
36 = S22, 145.55

The only fault has been on the converter receive IF stage, a coil became open circuit, otherwise no problems. However, I feel it would be nice if the output from the transmit section was 2 or 2½W rather than ½W, particularly as the 'powers that be' won't allow beams at this QTH!

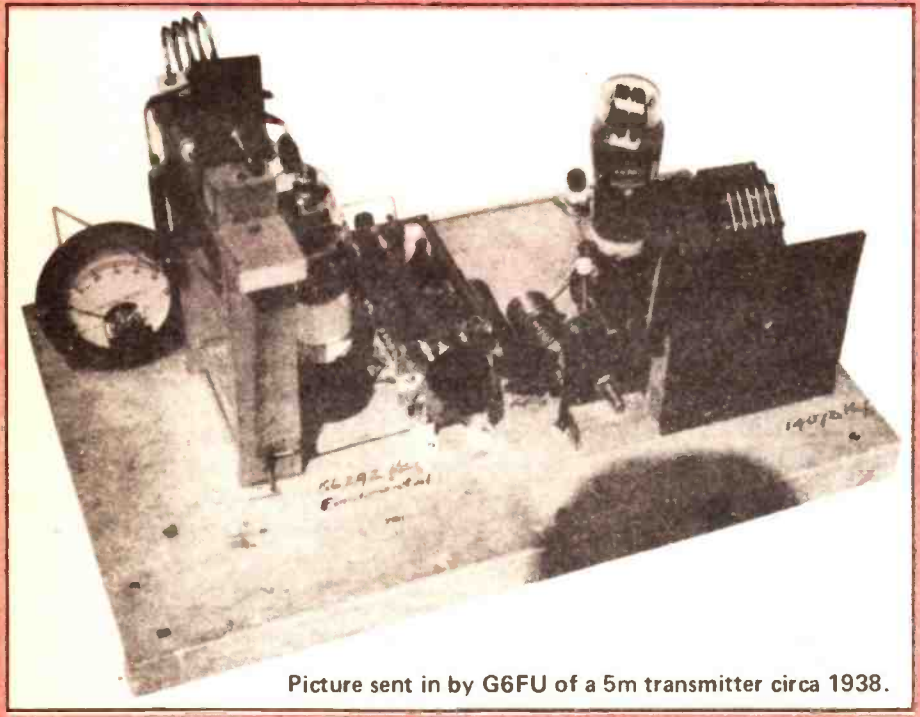
Finally, I personally disliked the compression type capacitors in the Tx kit, and replaced these with foil trimmer types, which will not loosen when the equipment is used in a mobile/portable environment.

Basil Spencer, G4YNM

A 5m ORIGINAL

Sir, I have just been loaned a copy of *HRT* December '84, it being the first time I have seen *Ham Radio Today* and was very interested in 'Radio Yesterday — the old 5m band'. Before the war, in 1938, my 5m transmitter was crystal controlled, employing a 6A6 crystal oscillator with a crystal on 14.073MHz, driving an RK34 in push-pull on 56.072MHz.

J H Cant, G6FU



Picture sent in by G6FU of a 5m transmitter circa 1938.

G6FU kindly provided us with a photograph of a 5m transmitter circa 1938 (shown nearby), currently lodging in the Wireless Museum on the Isle of Wight, which, incidentally, is well worth a visit.

CB AGAINST RACISM

Sir, Recent mass media reports of racist attacks against Asian families in Britain prompt me to write about another sinister aspect of racism in this country.

All over London, anonymous racists promote their hatred of foreigners, blacks and Asians over the Citizens Band frequencies — making it almost impossible for any operator with a 'foreign' accent to utilise this mode of communications. As soon as an Asian voice for instance appears on any of the 40 legal channels, he/she is immediately abused and invited, among other things, to *"go back where you come from, you. . . b*****d!"* (presumed race or nationality often added to the insult).

Racism on the 27 MHz Band is surely depriving ethnic minorities of their democratic right to use CB in Britain, and such illegal discrimination cannot be tolerated or ignored by any one involved professionally or as a 'hobby' with this medium.

It is the responsibility of the specialist press, CB Clubs, CB monitoring and pressure groups and of individual anti-fascist CB operators to alert the Home Office about this situation and *demand* that an end is put to this intolerable state of affairs, which transcend in seriousness the habitual CB pollution imposed upon us by an assorted array of anti-social wallies.

CB was originally intended to bring people together. What we have today is a very depressing racist joke instead.

Flying Kite, London NW

Unfortunately, the problem of racism on the air is not confined to CB. Recently, whilst monitoring a 2m repeater located in London, the editor heard a racist joke being told and racist language being used. This was coming from a G4 station, who had been licenced for at least several years and was not, by the sound of his

voice, a young man. Not a word was uttered against this individual by any of the stations in contact with him.

FILTERED OUT

Sir, I wonder if there is anybody in the amateur radio field who is capable of writing articles on harmonic traps for HF, bandpass filters (VHF, UHF), high and lowpass filters, and mains filters that consist of 75-85% constructional details with the rest devoted to introduction, tuning and testing *without reams and reams of mathematical formula*, all of which is in super abundance in the technical books one is able to purchase.

The reason I ask is that after purchasing five or six different books, I've now got masses and masses of formulae (not two the same for any device) and designs that vary in size from 9" x 6" to as large as my transmitter.

There are many people who through pressure of work or who's technical knowledge and ability was stretched to the limit in passing the RAE could make these filters and traps, if only the *sadists* would keep the formulae to a minimum.

J D Bolton, G4XPP

Please note this letter has been shortened. We will do our best to provide something of this kind in the near future.

STOLEN GOODS

Sir, The following Amateur Radio equipment was stolen on the night of 13/14 February from Roy Bailey, G6WLE, of The Malt House, Great Shefford, Newbury, Berks:

Yaesu FT708R Serial No. 041387 with speaker mic, ni-cad battery and ¼ wave whip. This transceiver has been modified by removing the resistor to the Ear socket, giving an improved audio level to an external speaker. The power output has been upgraded to 1½ watts.

70cm Linear Amplifier, home made from a Wood & Douglas 70LIN10 kit. It comprises an aluminium die cast box, approx 4¾" x 3¾" x 1½", with a black heatsink of almost the same length fixed to the underside. At one end there are two BNC square base sockets, bolted through only two of the four holes, and a 3 pin, in-line power socket between them. This socket is of the unique configuration fitted to Alinco linears. At the other end are two LEDs, one green and one red, and an on/off switch.

OSCAR 2m/70cm dual band antenna. This is mounted on an old mag mount that originally held a cheaper antenna. The socket is a Revco right-angled type, and the 12 feet or so of co-axial cable is terminated in a BNC plug. The outside of the antenna and the mount are somewhat rust stained.

Duplexer. Home-made, in an aluminium die-cast box, approx 1½" square and 1" thick, with a BNC socket at one end and two leads, approximately 35cm long, at the other. These leads leave the box through rubber grommets and are terminated in BNC plugs.

Yaesu PA3 car power/charger. Standard item, with cigar socket plug on one lead and a double power and charger plug on the other.

If you are offered any of these items, or you have knowledge of any attempt to sell them, please contact your local police station and/or myself at *048839 441*. There is a reward of £25 for information leading to the recovery of all of the above equipment. For single items, the reward will be in proportion to the value.

Roy Bailey, G6WLE

Please address correspondence to:
Ham Radio Today,
1, Golden Square,
LONDON W1R 3AB.

RADIO TODAY

'Wet String' to the Rescue

In last month's HRT, Bill Sparks, G8FBX, described the theory behind using a piece of 'wet string' (slang for a random length of wire) as an antenna. We recently heard from the Cambridge Repeater Group of someone who actually used a piece of wetted string as a conductor in an emergency (!) G8XMS narrates a watery tale . . .

"We used to live near the Solent and have an 11' sailing dinghy. One hot weekend we were creek-crawling near Lymington with the dinghy stripped of all sailing gear and being propelled by a trusty Seagull outboard. However, Seagulls occasionally suffer from whiskered up plugs (deposits on the contacts), like any two-stroke, so a spark plug spanner was an essential tool.

"Just to take the shine off a glorious day, the outboard faltered and stopped. Out came the plug spanner and I applied myself with enthusiasm to the hot engine. Too much enthusiasm! As I removed the cap from the plug, the lead parted company at its mid point where the in-line suppressor was — and I dropped it overboard.

"Not dismayed I removed the plug, cleaned and put it back, but the 9" gap between the now shortened lead and the plug made starting impossible. Too lazy to row to the nearest landing stage, I looked for some alternative. One of the children in the dinghy had a toy boat with him on a piece of string — *wet string* .

"A length of this was requisitioned and fixed between a whisker of the ignition lead and the spark plug. The motor fired immediately and ran smoothly. It stopped again, because the string had charred where it was wound round the plug connection and had fallen off. This was refixed — and rewetted — and our journey back to the slipway continued in a very satifactory way. All that was needed was a handful of sea water to be splashed over the spark plug and string every few minutes

"This is really all quite logical and understandable, but it did look a bit silly to stagger ashore carrying an outboard with a 9" length of string attached!"

New Goodies For HF And VHF/UHF From RWC

Ray Withers Communications have recently announced **an add-on PCB for the Yaesu FT757GX** to improve the smoothness of the VFO tuning by eliminating VCO 'glitch' (those irritating little frequency hops that synthesised rigs to make when being tuned) and increasing the tuning 'speed', from 5kHz to 50kHz per dial revolution, which will be selectable on the '757 500kHz step switch. Designed by G3SBI, G8FBX and G4KZH, the modification has been made as to enable installation by the end user.

The unit comprises of a small PCB designed to fit onto the existing microprocessor (Q67) and has two ICs, some small components and needs only eight connections, three of which are connected to three of the micro pins direct. The other five wires connect to existing terminals on the main PCB, and also the display board. The modification is intended to be installed by "experienced constructors" and will also be available from selected dealers who will be able to offer a fitting service.

Each board will be supplied complete and tested and no kits of parts will be available.

UK price is £29.50 for the built and tested PCB with complete fitting instructions and £39.50 plus carriage for a unit factory fitted and tested. User warranty "will not be affected on units supplied by RWC" but if you fit the unit yourself we suspect this will invalidate the guarantee. *Check the position with the dealer you bought your FT757 from before going ahead with purchasing the modifications if your equipment is still under guarantee,* even if the modification is going to be fitted by one of the 'selected dealers'.

Also newly available from RWC is the intriguing and very versatile **ARM multi P6 antenna.** This antenna is apparently capable of being used on 2m and 70cm in both horizontal and vertical polarisation modes, both mobile and portable, and can give either omni-directional and directional facilities. No relative gain figures have been announced

as yet. The antenna is priced at £29.50, postage excluded.

Details of both the above products are available from Ray Withers Communications on 021 421 8201.

Repeater News

The Tyne-Wear Repeater Group has sent us news of **GB3TW** (R5) and **GB3NT** (RBO). GB3TW has had a complete rebuild by G4DWM and G8YWK and seems to be giving excellent service. GB3NT employs the same logic design as GB3TW and since its commissioning in October appears to have worked very well. At present the Group is hoping to move GB3NT to a new site that will give better coverage than the present location.

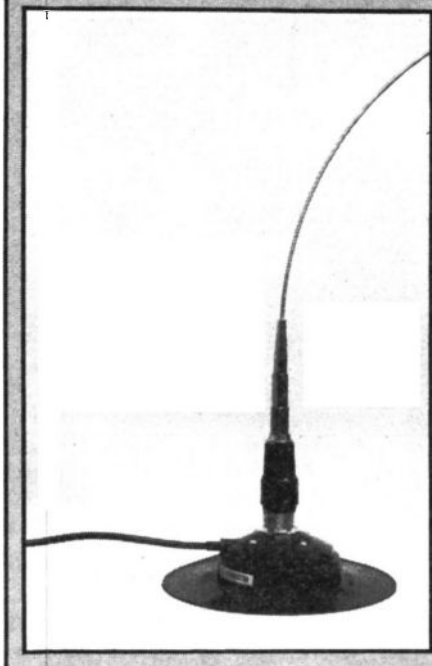
The UK FM Group (Western) put **GB3MT**, its thirteenth amateur radio repeater station on the air on Tuesday 5th February. In contrast to its other repeaters in the North West, this one is an RTTY and data unit.

The repeater operates in the 432 MHz band, channel RB12, from Winter Hill near Bolton. Aerial polarisation is 45 degrees slant, to allow use by horizontally and vertically polarised stations. Operation is at present on 50 Baud Murray code but ASCII operation probably at 1200 Baud will hopefully be implemented shortly.

If the RSGB approve, the UKFMG(W) hope to attach a 'mailbox' to GB3MT to allow radio amateurs to leave messages for one another, for collection later. This is similar to the 'bulletin boards' available on the telephone network.

The unit has been built and funded by the UKFMG(W), information on the group is obtainable from the Membership Secretary, 26 Brooklands Drive, Goostrey, Crewe, Cheshire CW4 8JB.

A Mighty Mount



How many times have you heard the tale of the man who has a 7/8th aerial for 2m on a magnetic mount which parts company with the car when driving at anything more than 30 mph?

Well, a new magnetic mount has come to the market, which is claimed to be *three* times stronger than the conventional magnetic mount. This means that for a normal mounting and up to the speed limit, the aerial should stay put. It is even claimed that the aerial base would probably break before the adhesion between car and base went!

The unit comes with some 50 ohm cable and a PL259 plug and will be selling in local emporiums for around £15.00. For further details ring Waters and Stanton Electronics on Southend (0702) 206835.

'Stand-alone' AMTOR system for the BBC 'B'

The G3WHO stand-alone AMTOR system is now available for the BBC micro model B. The package consists of the necessary software and hardware to run AMTOR with an ordinary terminal unit between the BBC B and your rig.

The program is contained in an 8K Eprom and plugs into one of the sideways ROM sockets inside the computer. The program is called by *AMTOR and comes ready-programmed with your callsign and selcall. Features are similar to those of the G3WHO RTTY program but some operate in a slightly different manner. Features include:

- FEC, ARQ and LISTEN modes.
- Unattended MAILBOX mode.
- Split-screen + 1K type ahead.
- Received text buffer for QSO review.
- 6 × 254 character memories + scratchpad memories.
- Auto callsign capture.
- Real time clock.
- CW ident.
- 2 dot tuning display.
- Works with printers.
- OS commands available from menu.

The hardware package is being provided by G3LIV and consists of a 1kHz clock plus PTT delay circuitry. The external clock is necessary because of the inaccuracy of the BBC computer's internal clock. Many programs that are available for other computers which do not use external timing run into problems with loss of phase during QSOs, which can be irritating. The clock/PTT unit comes in 2 forms:

1. A ready-built boxed unit with switch and LED indicators with an IDC connector to 'piggy back' into the existing ribbon cable between the computer and terminal unit.
2. A ready-built and aligned unit on a board for building into existing terminal units or putting in your own box.

A solid state PTT switch is provided on the board and also an adjustable PTT delay to cope with the differing change-over requirements of transceivers. Please note that a separate Terminal Unit is required. Any TU capable of operating at 100 baud should work. Suitable

units can be supplied by Johnny Melvin (G3LIV), 2 Salters Court, Gosforth, Newcastle, Tyne and Wear. (0632 843028).

The E-PROM plus boxed unit is £70.00 and the E-PROM plus PCB is available for £55.00. The software and hardware will be sent out separately from G3WHO and G3LIV respectively. Orders though, may be submitted to either. *Ken Michaelson, G3RDG, will be reviewing the system in a forthcoming issue of HRT.*

At a recent meeting of the Edgeware DARS, John Bluff, G3SJE, was presented with a trophy by Eric, G3GC, to commemorate his service to amateur radio via his slow morse transmissions for the last 18 years. The trophy comprised "an omni-directional radiator atop a 50 KV insulator". Rumours that the insulator was salvaged from an old 'SJE PA are completely unfounded. (photo G3MNO)

Rally Round Up

N Wakefield RC have organised an Amateur Radio and Computing Fair to be held on the 8th April at the Bretton Hall College, near Wakefield. The doors open at 11am (10.30 to disabled visitors) and admission is free.

The stands will cater for radio, electronics and computers and there will also be a RSGB bookstall, handicraft traders and films. There's a talk-in on S22 and GB3WU (RB15). Ring G4RGH for further details on 0532 536633.

The following weekend is the big one! The **RSGB National Convention** at the NEC, Birmingham. The RSGB have gone for a larger hall (hall 3) this year. As usual a big attraction is the considerable lecture program, but the show's worth coming to just to see us on stand A23. **We shall be offering some very special deals to visitors to our stand. . .**

On Sunday 28th April **Southend DRS** are holding a mobile rally at the Rocheway Centre, Rochford in Essex. Stands will cater for the black box brigade, components, bring and buy and much more. Refreshments will be available along with a rest room and parking for the disabled on site. The usual talk-in on S22. Details from Bryn on 0702 617749 or Brian 03745 50494.

After hosting during the past two years the two largest amateur radio shows ever staged north of the Border, the West of Scotland Amateur Radio Society is this year organising The **Glasgow Amateur Radio Exhibition**, which it plans to make an annual event each Spring. Already, trade exhibitors have apparently booked more space than was taken up at last year's record-breaking show.

Saturday, 11th May, is the date and Cardonald College is the venue: "It has proved to be an ideal setting from everyone's point of view," says Tom Hughes, GM3EDZ, who is chairman of the organising committee.

"The college is close to the M8, which avoids congested city traffic and provides easy access from all over Scotland and the south, and it has extensive car parks, halls, lecture theatres and catering facilities".

This year's exhibition will feature trade stands, a large information and bookstall from the RSGB and exhibits on special-interest aspects of the hobby such as amateur TV, data and satellite communication.

There will also be a large bring-and-buy sale and in the course of the day — the exhibition will be open from 11 am till 5 pm — a series of lectures on topical developments in amateur radio. Further details from Ian McGarvie, GM4JDU, on 050 581 2708.

Action for ATVers

The British Amateur Television Club (BATC) will be holding their annual rally and exhibition on Sunday 5th May at the Post House Hotel, Crick near Rugby (just off the M1, junction 18). Admission is *free* and all the usual traders will be attending.

There is a full program scheduled starting on Saturday night with an informal get-together in the hotel bar. On Sunday, the doors open at 10am. There will be a wide range of demonstrations, a bring and buy sale and lectures on 'Colour SSTV', 'Interfacing with the ZX Spectrum' and 'ATV Techniques' with Andy Emmerson, G8PTH, well known for his ATV writings in the radio press.

For further details about the program, and BATC in general, contact Norrie (GM4BVU) on 0698 423121.

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Photograph by PAUL BUCKNALL

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ICOM

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IC-120	1296MHz FM Mobile 1 watt	470.00

2 METRE AERIALS

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Add-on FM using a CB set

If you have a receiver or SSB/CW transceiver and wish to add an FM facility, this can be cheaply accomplished by using some of the circuitry from a legal CB set. Hugh Allison, G3XSE, outlines the process.

This article has an unusual beginning, in fact it has two unusual beginnings. The first is that it started out as a long term project that I actually got round to, and the second is that I had an absolutely brilliant idea almost at the start of the project, rather than at the end, which makes a change.

The Initial Plan

I wished to convert my HF 'SSB/CW only' rig to also transmit and receive FM. Although well-read readers of various learned tomes will know that I am the undisputed and modest king of CB set to 10 meter conversions, I desired to convert the main HF rig to FM 'cos I had become fed up with having to use high current 12 volt supplies and nasty CB-type linears. I also rather fancied getting away from channelised operation on 10, necessary with the converted CB sets, mainly due to the appearance of several rather attractive FM DX stations 'off channel'. In the end, another bonus of my conversion came to light, viz the VHF/UHF transverters in the shack could now be used on FM as well as SSB. So, all in all, the FM conversion has turned out quite beneficial!

Before I go any further, the disclaimer. This article is *not* a step-by-step, blow-by-blow description of how to convert an SSB rig to work on FM. This is purely an ideas article, intended to stimulate the brains of the average amateur who knows what he is doing, and can find his way around an HF transceiver or receiver. If you don't know what you are doing, please turn the page and forget my magnificent article. *The voltages inside the average HF transceiver can kill. If the rig is solid state, severe damage to equipment could result if the 'modification' goes wrong.*

Please also note that suppliers warrantees will be infringed if you go running around inside new rigs, so think *very* carefully before you attempt these modifications.

I have deliberately not mentioned any specific rigs, either HF or CB ones, for two reasons. The first is that I have actually modified four different HF rigs with four different CB sets so this article cannot be one of the 'take the red wire off CB4 and connect to. . .' variety, anyway, and secondly, if you are competent enough to do this modification, you ought to be competent enough to work your way round the relevant circuit diagrams and think it out yourself. **Neither the magazine or the author accept any liability for any damage, you have been warned.**

The Brilliant Idea

Those of you who are really alert may already have worked out the whole crux of the plan already, but for those of you who have not been looking for clues, let me explain.

The original plan involved converting the receive side of the HF rig only to FM. As luck would have it, the HF rig in question had the first 'fixed' IF available, at low level, on the back panel. Note that, although some rigs have this output marked 'IF out', some are marked 'Panoramic Adaptor out'. The rig in question may not have this point available to the outside world, in which case it's soldering iron out time. However, I digress.

With a low level 9 MHz IF signal available from the rig, I was thinking of putting this into an all-in-one FM chip, probably a Motorola MC 3357. Being a tight fisted soul, I remembered I had a duff CB set

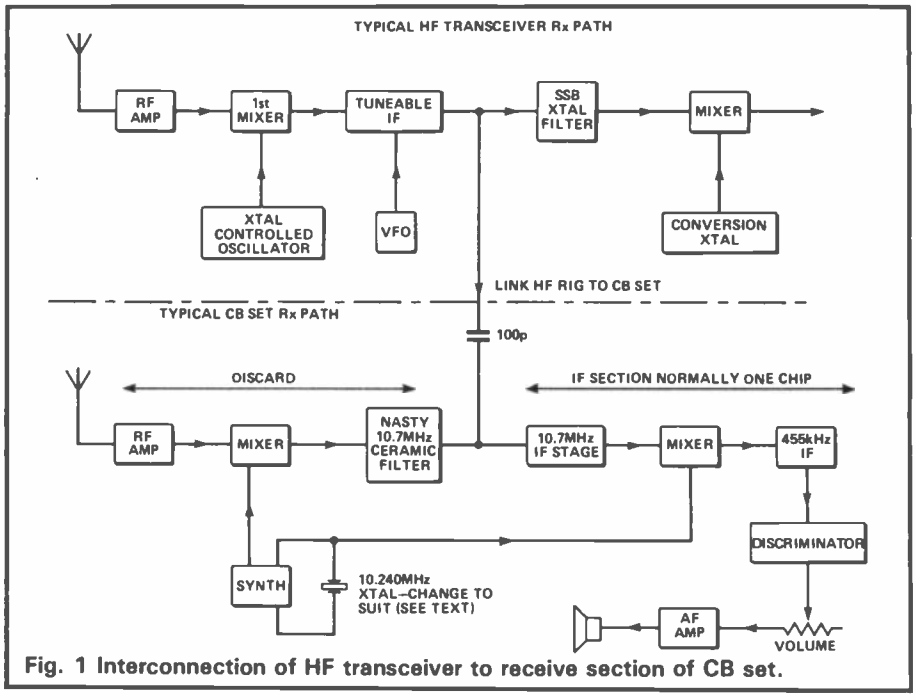


Fig. 1 Interconnection of HF transceiver to receive section of CB set.

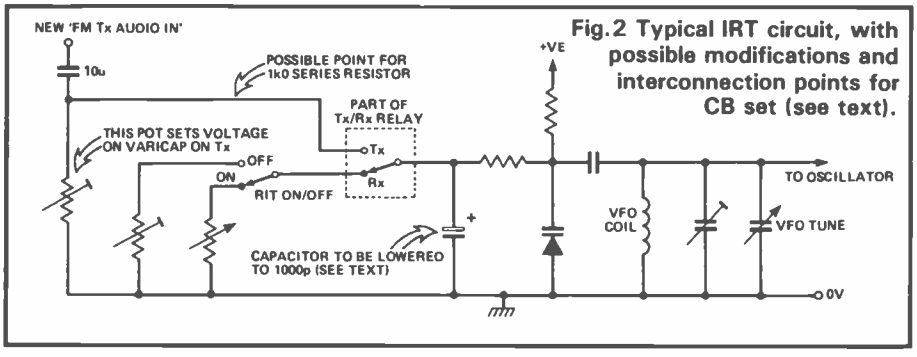


Fig.2 Typical IRT circuit, with possible modifications and interconnection points for CB set (see text).

that would probably yield a second hand example of this chip, and as I reached for the soldering iron, WHAM, a flash of inspiration. Why not take the IF output from the HF rig into the IF of the CB set as *it stood?* Brilliant, huh?

Well, not quite. If the HF rig in question has an IF of 10.695 MHz, you're in. Most HF rigs unfortunately don't; the IF is 'twix 3 and 9 MHz. The defeatists amongst you may care to buy (Oh, how I hate that word) a new mixer crystal for the CB set. This (obviously) needs to be the frequency you have left after subtracting the frequency of the first IF of your HF rig from that of the second IF of your CB set, normally 455 kHz.

Before you do anything rash, like spend money, think. If your HF rig has a 455 kHz second IF, a crystal will almost certainly be oscillating away at the required frequency within the rig. This is unlikely, however, to be available on a socket on the back of the rig. If you want to drill holes etc, go ahead. You might decide that another socket on the back of the HF rig is of no use to you and can connect this frequency to the redundant socket, it's all up to you. There may even be an unused accessory socket on the rig.

One advantage of buying the relevant crystal will be that a lead can be made up to go 'twix the CB set (maybe using the redundant aerial socket on the CB set) and the IF output on the HF rig. When you connect 12V to the CB set, you've got HF FM receive, with only one other connection.

Although the system described above will work well, an improvement in sensitivity and cross modulation performance will be found by inserting a bandpass filter (roofing filter) twixt the HF rig mixer and the CB IF unit.

Converting The CB Set

A fully working CB set could of course be the basis of the conversion. One that has IF, audio and Tx audio sections working but has other faults is also acceptable. First locate the 10.240MHz crystal, and remove this. Fit in its place the new mixer crystal, as described above, or arrange for it to be fed from the oscillator within the HF rig. If you

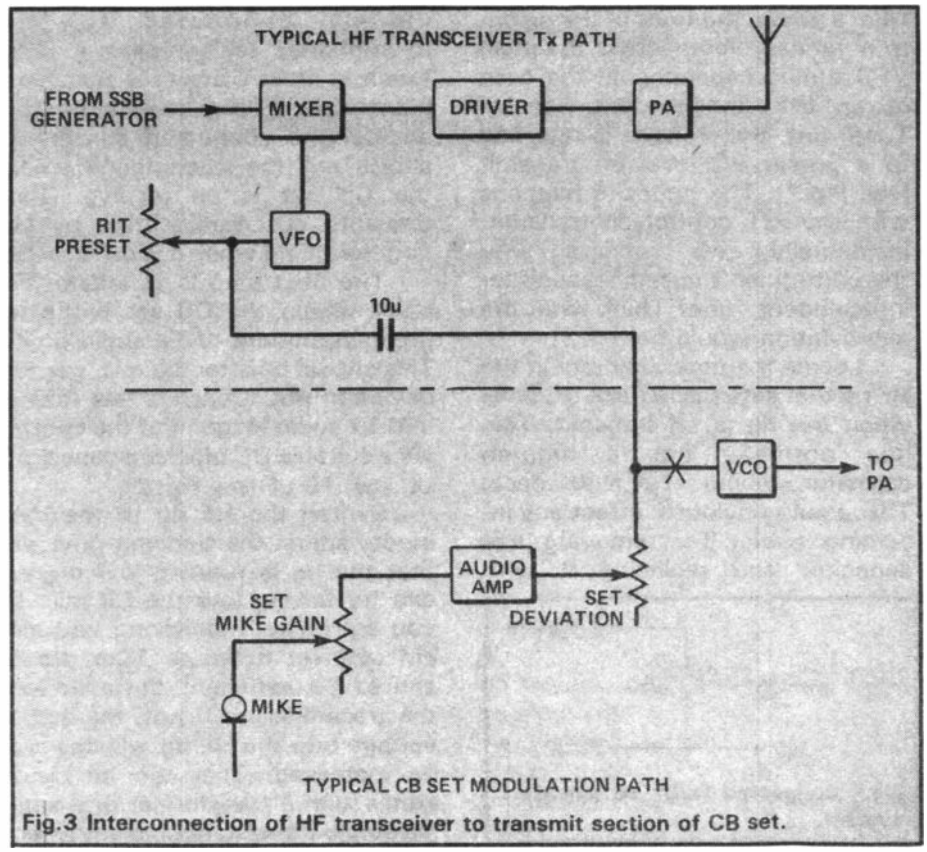


Fig.3 Interconnection of HF transceiver to transmit section of CB set.

are using this approach, you will have to decide which end of the crystal is the 'hot' end and feed as appropriate. Note that some CB sets use part of the synthesiser chip to oscillate the mixer crystal, while others use part of the IF chip to do this. If your CB set has a totally 'duff' synthesiser chip and you are unlucky enough to have this doing the oscillating, consider using the unused part of the IF chip.

All you now have to do to get FM reception is to feed in the IF signal from the HF rig. The connection point is very easy to find. Locate the nasty 10.7 MHz ceramic filter in the CB set and throw it away. Ascertain which end of it used to go into the IF chip and take this point, via a 100 pf capacitor, to the aerial socket on the CB set, having first disconnected the old aerial connection. See Fig. 1. Connect up 12V to the CB set and tune the HF rig as normal and if there are FM signals present on 10m, you'll hear them. Bet you're itching to transmit FM now, aren't you? Well, I've solved this one for you too . . .

Transmitting FM

Some HF rigs have an IRT and/or an XIT control. This control feeds a small variable DC voltage from a pot on the front of the rig onto a varicap diode across the main VFO tuning capacitor. In the case of an IRT (Independent Receive Tune) pot, this voltage is returned to a preset DC level on transmit (see Fig.2). The opposite happens with the XIT control on transmit. Incidentally, ever wondered why the control isn't called Transmitter Independent Tune? Think what the abbreviation would be!

Locate the potentiometer in the HF rig that sets the RIT line DC level when the rig is on transmit. This line normally has a biggish capacitor, about 1uF, to deck. This would obviously affect any incoming audio. Try removing this capacitor and replacing it with

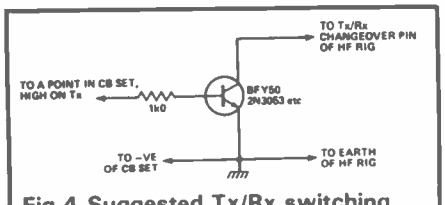


Fig.4 Suggested Tx/Rx switching system.

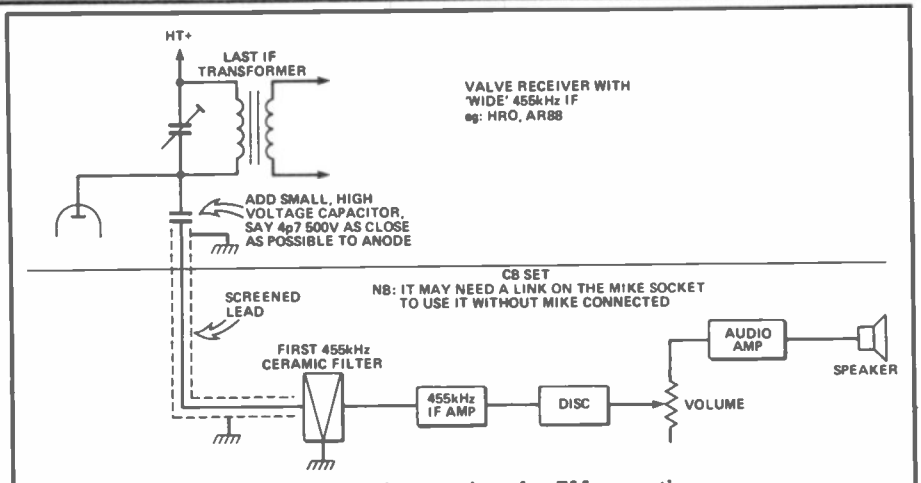


Fig.5 Connecting CB set to a valve receiver for FM reception.

1000 pF. If all is well, ie no instability on Tx (on all bands), you are in luck. If not, try fitting a 1K resistor between the pot and varicap, and decoupling it on the diode end with a 1000 pF capacitor. This point now becomes the 'FM Tx audio in' line for your HF rig. Where do you get this audio from? The CB set of course!

'Stealing' Tx Audio From The CB Set

Most CB sets generate FM by wobbling the VCO frequency a bit with a varicap diode. This diode is driven from a small audio amp within the CB set, which is obviously connected to the microphone. Incidentally, a nice touch in most CB sets is that they have the Tx/Rx switch in the microphone connected so that it shorts out the microphone when the CB set is on receive. This prevents our modification upsetting the HF rig when it is on receive.

The next step is to locate the point within the CB set with the greatest amount of Tx audio on it. This should be after the mic. gain or deviation pot. Connect this to the 'FM Tx audio in' point of the HF rig, via a suitable DC blocking capacitor of, say, 10 uF (see Fig. 2).

Switch the HF rig to the CW mode, adjust the transmit drive so that the rig is running low power and try talking into the CB mic. If you are lucky, monitoring with an FM receiver tuned to 10m, there should be sufficient deviation on the transmission. If not, the audio voltage into the HF rig will have to be increased. This can be done either with a transformer or a simple single transistor audio amplifier. The 'set deviation' control in the CB set will of course still set the deviation.

Switching The HF Rig

Most HF rigs have a Tx/Rx changeover relay, controlled by the microphone PTT switch. It may well be possible to run a lead from the CB set such that it will control the HF rig. If this is not possible, all is not lost. CB sets often have a line that goes 'high' on transmit. If you take this point, via a 1 k resistor, up the base of a suitable transistor (such as a 2N3053) and then run the collector to the HF rig's mic. socket, control should be obtained (see Fig.4). I would seriously suggest that the HF rig be controlled via its mic. socket so that, to operate FM, it is necessary to unplug the HF rig mic. This prevents the normal mic. interfering with the audio from the CB set.

A nice touch is to wire the HF rig mic. socket such that it uses 3 pins of the normal 4 pin socket. The 'unused' pin thus created can be used to feed in the FM Tx audio from the CB set.

PA Dissipation

If your HF rig is fitted with AM, don't exceed the recommended AM dissipation on FM. If your rig only has an SSB power rating, don't exceed 1/3 of that. That is because SSB has a low duty cycle, FM has 100% duty cycle. Go above these levels at the peril of replacing your expensive PA devices! Power out is controlled by the CW power or drive control on the HF rig, depending upon the manufacturer of the equipment.

In Conclusion

I was discussing the above ideas with a bunch of local amateurs over a pint or two (or three, or four). About a month later, I met up with one of them who had followed the idea up, and he was not happy. His complaint was that the audio when receiving FM was muffled. As he told me what he had done, I quickly realised his mistake. He had not used the first IF of his HF rig but the second. His reasoning was that this was at 455 kHz, and at a high level. If he put this into the demodulator in the CB set, it would save him mixing in it. Unfortunately he didn't realise that the signal has, by the second IF *been through the SSB filter*. FM of ± 5 kHz sounds very strange after going through a 2.7 kHz filter!

Several other amateurs have used the above idea on receivers. If you can switch in a fairly wide filter (say ± 5 kHz) and the receiver has a 455 kHz IF (be it first or second) then there is no need to mix in the CB set, just pipe a fairly high level 455 kHz from the receiver. Due to the excellent limiting characteristics of most demodulator chips the actual level into the CB set is not too critical.

Finally, it was a real treat to see a small CB set attached to an HRO by an enthusiastic SWL (see the photo nearby). He had been using a 2 meter converter ahead of the HRO and 'slope detecting' FM. The SWL was really pleased with the improved performance on FM, but the HRO, 40 years senior to the CB set now attached *to* it, somehow looked decidedly upset!

The old and the new. Pre-WW2 HRO receiver modified for FM reception with a 'York' CB set.

Cinderella did go to the Ball . . .

QRP is one of the fastest growing areas in amateur radio today. Here, Rev. George Dobbs, G3RJV, one of the founders of the G-QRP Club describes its roots and what makes 'QRP' so enjoyable . . .

Such is the perversity of human nature that we always seem to want those things which are just outside of our grasp. In my trade we call it covetousness. We all suffer from it, although in our hobby, it's more likely to be an item of oriental communication equipment than our neighbour's asses or handmaiden (*what about a eunuch? — Ed. Asst).*

I clearly remember being subject to this commonest of human failings some twelve years ago. For some time, my interest in amateur radio had been on the wane. I had not heated up a soldering iron or used a transmitter in anger for some time. I moved house and didn't even bother to set up a shack. An astute local amateur spotted the demise and alert to a good quick bargain, came to see me to see if I wanted to sell any of my equipment. I sold him the lot. Sure enough, shortly after the big sell-up, the powers of human perversity drove me to wishing that I could do some amateur radio operating. A burning desire to operate; no amateur radio equipment; very little spare money, I had built up that simple recipe for an unhappy radio amateur — perhaps you know it?

Oddly enough, it was the income taxman who came to my rescue! In the endless seesaw of personal taxation, for once the balance was tipped my way and I received an unexpected modest cheque from the Inland Revenue. About that time, Heathkit introduced the first of their low power CW transceiver kits, the HW7, which sold for a little over £30. This seemed a meagre price for a complete transceiver, albeit in kit form, so I consigned most of the windfall to the purchase of an HW7 QRP transceiver.

The HW7 was a direct conversion transceiver for CW operation on the 7, 14 and 21 MHz bands with an average of about 2 watts on transmit. It was small, simple and I had very little faith in its ability. Then I began to use it on the bands. I was amazed! Not only did the simple direct conversion receiver work far better than I had thought possible, but I was making routine QSOs with a power level I had previously considered to be too low for any useful purposes. In fact, on 14MHz, with a simple dipole, my results seemed much the same as those I had achieved with the 70 watt transmitter I had so readily sold.

I suppose, like many radio amateurs, I had forgotten what power really means. The common assumption is use more power and get further — "buy a burner, buddy". Look at the chart in Fig.1 which compares power, in watts, with 'S' point units. The chart assumes that 1 'S' unit is a 6 dB change and the figures are worked out from a dB/power chart of the

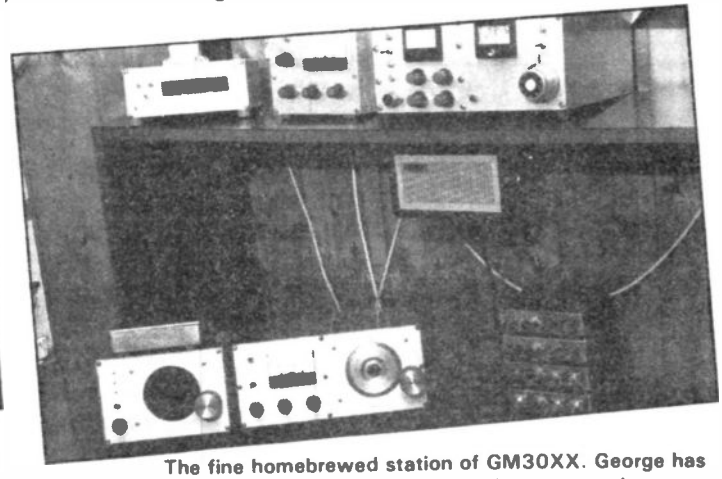
Fig.1

WATTS / S unit CHART

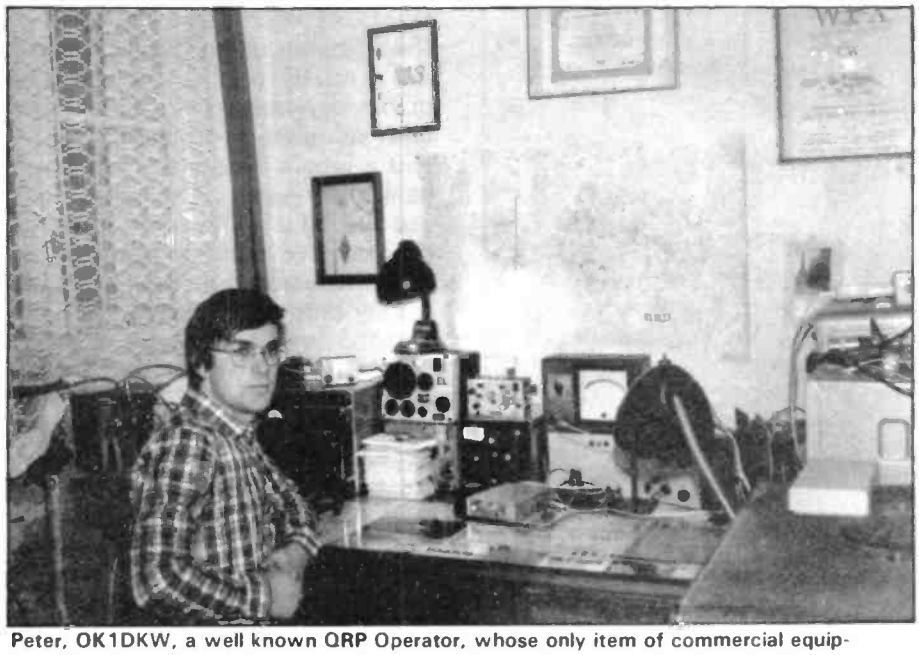
(1 S unit = 6dB change)

S9	1000 watts
S8	250 watts
S7	62.5 watts
S6	15.5 watts
S5	4 watts
S4	1 watt
S3	250 milliwatts

Moser, PY2TU. To the left may be seen the Yaesu FT7 and Argonaut 515, popular commercial QRP transceivers, whilst to the right are several homebrewed QRP rigs.



The fine homebrewed station of GM30XX. George has made contacts with 190 countries, never using more than 1W to simple wire antennas.



Peter, OK1DKW, a well known QRP Operator, whose only item of commercial equipment is a rebuilt AR88 receiver.

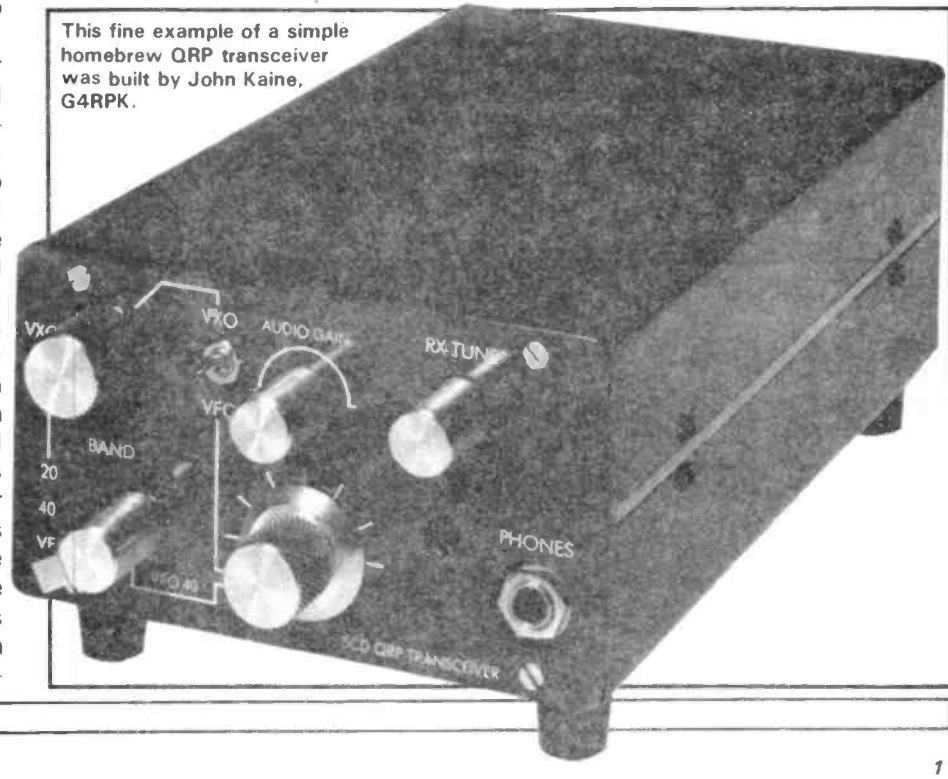
sort found in the amateur radio handbooks. The starting point is to take a large amateur signal being received at S9 and see by what amount the station has to reduce power to drop 1 'S' point unit. For the sake of convenience, the chart begins with a 1000 watt signal that is being received at exactly S9. The second column shows the power reductions required to drop a single S point unit. The results are surprising; even a power as low as 4 watts can be received at S5. Although there is nothing mathematically surprising about it, because 6dB is a fourfold power change. So, in theory one has to increase power four times to gain just one S point.

So that accounted for it; power was not as important as I had previously thought. My experiences with the HW7 and the theoretical re-think had opened up a whole new world. The use of low power transmitters equated to the use of relatively inexpensive solid state devices and simple circuits — which could produce viable results on the HF bands. Spurred on by these successes, I built my own simple direct conversion transceiver for the 3.5MHz band and found several other operators there with homemade low power equipment. We exchanged letters and circuit ideas and after a little while, I wrote to the Short Wave Magazine, inviting other amateurs interested in low power operation with home built equipment to contact me with the view of forming a club. About 30 people replied and over the New Year holiday of 1974/5, I produced a crude newsletter called SPRAT (Small Powered Amateur Radio Transmission) and the G-QRP Club was born.

For many years, the club went happily on its own way as a small group of people with a seemingly odd specialist interest. It took two years to raise the membership to over 100, but by 1979 there were over 600 members. For a long time the G QRP Club was something of a 'Cinderella' group; we bothered nobody and not many people bothered us. However the beginning of the 1980s saw a sudden interest in the club and low power operation; in particular, home construction of amateur radio equipment seemed to take off. Since 1981, the club has grown from under 1000 and over 3000 with members in over 60 countries. In fact at the first RSGB National Convention at Birmingham, the club enrolled more members in one day than it had in its first three years! It would be pointless to speculate on the reasons for the increase in interest in this facet of our hobby; some put it down to a dissatisfaction with amateur radio being simply an appliance users hobby; others to the challenges afforded by working with low power levels and using home made equipment. Whatever the reasons, QRP operation has never been more popular in the hobby.

What is QRP?

QRP is now loosely used to describe all forms of low power on the amateur bands. It comes from the International Q Code, where QRP means "reduce power". For the purposes of awards and definition, the G QRP Club designates a transmitter power of 5 watts DC input or 3 watts of RF output as being QRP. The World QRP Federation (WQF) defines QRP as being 5 watts of RF output power on CW or 10 watts on SSB. The WQF was founded by Gus Taylor, G8PG, the Communications Manager of the



This fine example of a simple homebrew QRP transceiver was built by John Kaine, G4RPK.

Chris, G4BUE, has made DXCC using under 1W and has worked 200 countries using only 5W.

G-QRP Club as a means of bringing together the various QRP groups throughout the world. The federation incorporates groups from many countries including Italy, West Germany, Canary Islands, South Africa, South America, USA, Japan, Australia, Holland, Belgium and Yugoslavia.

The actual power levels are relatively unimportant; in fact many QRP operators use powers considerably less than those mentioned above. What is more important is the ethos of the QRP movement and its approach to the hobby. The use of low power does wonders to enhance operating skill — it is difficult to be a bully with a couple of watts. A low power station demands not only operating skill but economical use of whatever power is available. Many radio amateurs just buy a transceiver and a commercial antenna and link the two with a suitable bit of coaxial cable, but the matching and optimum transfer of power from equipment to antenna is endemic to QRP operation.

The majority of QRP operators also enjoy using home made equipment on the bands. In fact, SPRAT, the journal of the G QRP Club has always been made up of two-thirds circuits and practical ideas, QRP is that kind of hobby. QRP is an inexpensive version of our hobby. Many QRPers do not like spending money (!) and even more of them cannot afford to spend a lot on their hobby. These criteria breed a delightful type of hobbyist who has little concern for the financial value of his radio equipment; is fascinated by the other fellow's station however simple or crude it may be; is not concerned about the resale worth of his station; enjoys real satisfaction from making contacts. . . I could fill the rest of the magazine.

Where Is It Used?

Although it is true to say that most QRP operation takes place on the HF bands using CW equipment, this is not the entire picture. A good many operators use SSB, some with complete home built stations, and a whole variety of modes and bands are used. A small number use QRP for RTTY and SSTV. A considerable number use QRP on the VHF bands but this is a completely different ballgame, (what a dreadful expression) as antenna gain plays more of a role than it ever could on the HF bands. There are international QRP calling frequencies on the HF bands which are listed in Fig.2. Have a listen around these frequencies for QRP stations, why not try reducing power and call them or even call "CQ QRP".

QRP equipment is often physically smaller and many radio amateurs use it for portable operation. QRP stations have been operated on mountain tops, in fields, from tents on campsites, from caravans, from hotel rooms, in fact anywhere where a keen radio amateur finds himself and wants to enjoy making a QSO. Portable operation can be a good way to combine a hobby with a holiday. I have worked 25 countries on 14MHz in 5 nights of casual operation using 2 watts of homebuilt transceiver power to a dipole strung between a tree and a holiday cottage in Wales. Several amateurs I know have a small QRP rig tucked away somewhere at their place of work and do a little operating during their lunch break, sometimes to "invisible" thin wire antenna strung between two office blocks! Simple, inexpensive, small radio

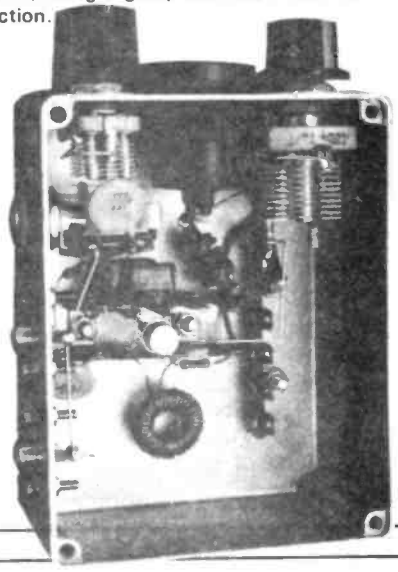
Fig.2 INTERNATIONAL QRP CALLING FREQUENCIES

BAND	CW kHz	SSB kHz
3.5MHz	3560	3690
7.0MHz	7030	7090
14MHz	14060	14285
21MHz	21060	21385
28MHz	28060	28885

plus 10.106MHz in Europe

USA stations also use 7.040MHz

An 80m QRP transmitter built by Colin, G3VTT, using tagstrip and direct lead construction.



Jack, F9YZ, the first QRPer to win the G-QRP club's coveted Silver Tern award for working a range of stations from the Arctic to the Antarctic with under 5W.

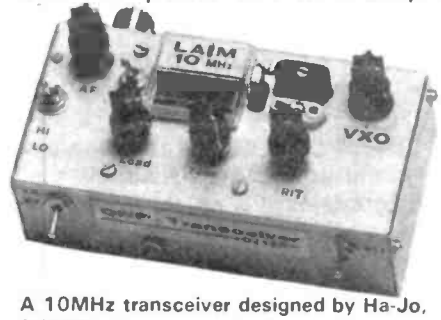
The compact all homemade QRP station of Claudio, IV3ESX, in Italy.

stations open up all sorts of possibilities.

QRP operators also like to work each other. A common view is that they may simply be hitching a ride on the sophistication of QRO commercial stations to gain QSOs. In fact nothing pleases a QRP operator more than working another QRP station, there is great satisfaction in two way QRP QSOs. The list in **Fig.3** shows some of the times and places where QRP operators can be found.

What Results Can Be Achieved?

The simple answer is almost everything that can be done by the average radio amateur with conventional power levels. There are QRP DX chasers. There are many awards for achievements in low power operation. There is a very fine piece of sideboard adornment available for DXCC with 5 watts or less and others for 1 watt or less. George Burt, GM30XX, was the first amateur in Europe, the second in the world, to achieve DXCC (100 countries) with under 1 watt. Chris Page, G4BUE, has DXCC with under 1 watt and double DXCC (200 countries) with under 5 watts. The list of DX achievements with QRP is considerable. Most of these have been attained not only with low power but with simple antennas. The QRP approach rarely seems to include the use of a commercial beam and tower — cunning combinations of bits of wire seem to be the QRP operator's chief firing weapon.



A 10MHz transceiver designed by Ha-Jo, DJ1ZB.

Where and When to find the QRP Stations

Each Sunday:

1100-1230 GMT
3560/7030 kHz CW
1400-1530 GMT

Each Day:

1900 UK clocktime
3690±QRM SSB
Daily QRP SSB Net

Wednesdays:

2000 local time
3560 kHz CW
UK and Europe

G QRP Club activity periods are held several times each year — details in the club journal SPRAT.

But as with most of us in the hobby, the majority of QRP operators are not high flyers; they simply want to enjoy radio communication from their homes . . . that's what the hobby is about. They find that the slight disadvantage of lower power is more than compensated by the enormously increased satisfaction of making contacts with low power level; even more so when the equipment is home built. Amateur radio is a hobby and hobbies are all about having fun — or is that heretical these days?

Can I Join?

The G QRP Club welcomes anyone as a member. There are no conditions, no vows to only use low power, pledges to build equipment — just pay the money and membership is yours. The club have a quarterly journal, SPRAT, which contains a lot of buildable circuitry and technical ideas along with news and announcements of interest to the QRP operator. The club also issues a series of "data sheets" which are circuits, either out of print or unpublishable in SPRAT because of copyright problems. The club also issues a successful Morse Training series of cassettes for the beginner and for speed improvement, sponsors and issues a range of awards, has an internal QSL bureau and sells items of club interest which sometimes include special offers on components. Some of the best circuit ideas from the first 7 years of SPRAT were collected into one volume as the G-QRP Club Circuit Handbook. This book is published by and is available from the RSGB.

Anyone wishing to enquire about the club and receive a sample of SPRAT with a membership form, can either write to: Fred Garrett, G4HOM, 47 Tileshead Close, Druids Heath, Birmingham B14 5LT or George Dobbs, G3RJV, St. Aidan's Vicarage, 498 Manchester Road, Rochdale, Lancs OL11 3HE with a large SAE. We Have enjoyed our first ten years, why not join us for the second ten?

Improved CW with an FT290

I believe that most newly qualified G4's probably transmit their first CW signals on 2 metres and perhaps, like myself, have a Yaesu '290R. As any '290R owner knows, before you can key the rig you must first (physically) switch to transmit, and this can be done either by closing the microphone PTT switch or by using a foot switch, for which there is provision on the side of the rig. This is not itself a problem, but it can be one more inconvenient thing to think about, particularly when making the first tentative contacts. Anyone who has tried to hold the microphone PTT shut with their left hand and operate the morse key with their right, particularly if the key tends to wander, will know the feeling. The problem is however further compounded if the operator wears headphones, and most CW operators do.

The difficulty is that when the volume control is set for a comfortable listening level, on receive, the level of the sidetone is almost deafening on transmit. The reason for this is that on transmit, the output from the sidetone oscillator is fed directly to the audio output stage and then to the extension speaker socket (see block diagram on page 24 of the '290R Instruction Manual and also main circuit diagram). This means in practice that you have to remember to push your headphones up on your head — away from your ears — before transmitting. For an experienced operator this is inconvenient but easily accomplished, but when one is new to CW it can be very trying, not to say account for abandoned

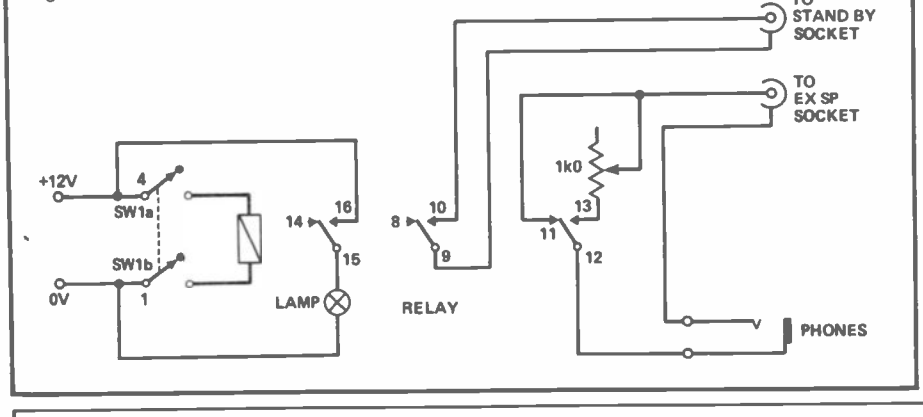
If you are one of the many owners of an FT290R and would like to simply improve the operation on CW, take the advice of John Kaine, G4RPK.

contacts! I still remember the horror of my first real CW contact, when I encountered all the above difficulties, and am indebted to the station I worked, who seemed at least to understand what I was facing.

Eventually I solved the problem by constructing a very simple circuit, containing a relay, a variable resistor and a switch, that allowed me to simply switch to transmit and attenuate the sidetone output to the headphones. (**Fig.1**) Reference to the instruction manual diagram will show all that is required is a variable resistor, to act as a volume control, between the power amplifier output and the extension speaker socket. What I actually did was to combine this with a simple switch for 'switch to transmit', a large indicator lamp, to prevent confusion between transmit and receive, and a relay that switched the attenuating pot into circuit on transmit.

To build the circuit is no more than an evenings work and it can be constructed on 'Vero' board or even perforated board and mounted in any small box. I built my version onto the lid side of an 80mm x 145mm box. The circuitry worked first time and I am still using it two years later. An even simpler version is shown in **Fig.2** based on a 3 PDT (3 pole double throw) switch, and requires a battery to power the 'on air' indicator. The possible variations are infinite, and most Amateurs could probably build some kind of version entirely from bits in the junk box. Not a sophisticated device I know, but it did make operation much less of a strain. All the newly qualified operators with FT290's I have spoken to have admitted to experiencing the same difficulties that I did. With the opening up of a 2m CW facility for 'B' class licensees (*Radio Today, HRT February '85*) perhaps quite a few of these devices will be built.

Fig.1 Circuit of additional TR switching and sidetone attenuator



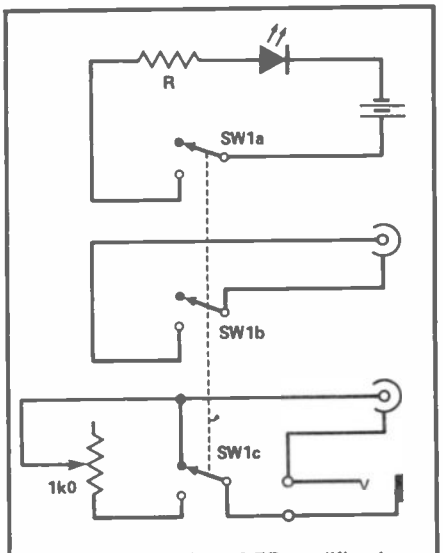


Fig.2 Simple version of TR modifications

Looking at BBC 'Outside Broadcasts'

Outside Broadcasts are arguably the most intriguing area of professional broadcasting. This month, Mick Rump, G8VIC, looks at local radio 'OBs' and goes on the road with Radio One.

The BBC has the largest amount of varied and interesting outside broadcast (OB) vehicles in this country. The consistent high technical standard of their TV and radio broadcasts from different locations is due in some measure to what are widely regarded as the best equipped vehicles in Europe.

As you may imagine, it takes a vast amount of equipment for a TV 'OB', a little less for radio. This equipment, cameras, camera trolleys, microphones and mile after mile of cable of various descriptions, is all brought to the OB site in technical support vehicles. All this equipment is eventually linked up to the nerve centre of the OB which is a specially converted (or purpose built in most cases) vehicle, the control room. This can vary from a compact mobile studio for radio interviewing to a giant eight camera capacity mobile, used for large venues when a TV broadcast is required.

It is the 'control rooms' that this article will look at. I live near Brighton, a popular conference resort as well as a town with a traditionally active cultural scene; both of which attract the BBC to the area many times a year, also giving me the chance to study the many different types of OB vehicle used. I can only write about the vehicles I have seen in and around Brighton and apologise for not including every vehicle in the fleet(!) That being said, this and the following article will give you a fairly good idea of how they go about an OB, from a simple 'radio car' to TV coverage of a large conference. I shall start off with the simpler forms of OB and work my way up. . .

Top. Radio Sussex radio car in action. Bottom. The Dodge powered Radio One Roadshow lorry.

The Smallest OB

The local radio car plays an important part in the day-to-day running of a BBC local radio station. The particular one I have taken for examination belongs to BBC Radio Sussex and vehicles of this type can be regularly seen around the county involved in making many

different types of radio programme. The cars for local radio stations all perform the same functions; although the equipment may be housed in different vehicles, the equipment is standard.

Radio Sussex use their car only for radio communication, say, from a remote point in the county to the studios in Brighton. The crew consists of a reporter and an engineer/driver. The car is parked as close to the desired venue as possible, which may vary from a road accident to a reception at a theatre, and the engineer elevates the thirty foot telescopic 'Hilomast' automatically from the car. The reporter is then sent to the desired position, armed with a microphone and a pair of headphones. The headphones are used for monitoring, whether it be on-air (ie a live transmission) or off-air (ie a recording), either of which can be done.

The microphone is fed into a two channel mixer in the car. The output of this mixer goes direct to a 25 watt UHF transmitter and then, finally, into a ¼ wave ground plane aerial mounted at the top of the mast. The second channel of the mixer can either be used for a second microphone or, more commonly, a radio microphone. A receiver for the radio microphone may be plugged into the input of the mixer and a half wave aerial for reception is mounted on the car roof. The BBC seem to favour the old 'Band 1' VHF frequencies for their radio microphones, as opposed to those used by most manufacturers for theatres and general use.

An Important Link

Another important piece of equipment installed in the car is a two-way Storno VHF radio telephone, which links the car with the presenter in the studio. This is used for off-air engineering information and cues. The aerial for the radio telephone is a ½ wave, mounted on the roof of the car.

An essential piece of equipment of the radio car's inventory is an off-air check receiver. In practice, this tends to be a normal car radio which monitors the home station's output, which of course may include both studio material and that coming from the radio car. The engineer in the car thus forms an important additional check on the transmission, simultaneously checking the car's output for such as an intermittent noisy UHF link.

BBC Radio Sussex radio car with aerial mast raised and on-the-air.

So far we have left our intrepid reporter in the middle of a venue happily chatting to their interviewee, to be re-transmitted via the radio car, from the main studio. But how does he know when to start, stop or what is happening back at the studio? Well, facilities are available in the two channel mixer to sent the output of the mixer down the line to the reporter's headphones, so at least they can hear what they are saying. Also included is a simple intercom, so the engineer can talk to the reporter and vice-versa. If it is required, the output of the off-air receiver can be sent down the line so the reporter can hear the station output. The final option available is the output of the radio telephone is sent down the line so that the reporter can take off-air cues from the presenter in the studio. In practice, a combination of the latter two options of off-air receiver and radio telephone receiver are used.

The car carries no other ancillary equipment apart from microphone extension cables, as it is designed to have a fast set up and a fast dismantle time so that the car can be on the air within minutes of arriving at a venue. Any unnecessary equipment for the engineer and reporter to fall over/erect would obviously slow things down.

One interesting point I discovered was that both in East and West Sussex, the coastal strip is separated from inland areas by a ridge of hills known as the South Downs. These hills do not run in a straight line but bend and weave through the country. As you can imagine from this, VHF communication from the mid-Sussex region to the studios in Brighton is not good, so the studio radio car receiving aerial is actually placed on the top of the downs just outside Brighton! Unfortunately, this does not cure all the problems. Some of the villages are tucked in coves created by these green covered chalk lumps and the original aerial had 'blind spots', so *two* more were situated on high ground. Now with three aerials, 99% of the county can be covered. The presenter in the studio is able to switch between any of these three aerials for the best reception from the radio car.

Radio One Roadshow

The Radio One Roadshow brings pleasure and entertainment to many people when it tours around the coastline of Britain each summer. The show stops for one day in selected towns and makes an hour and a half 'live' radio broadcast from the chosen site. What follows will show you what a fairly typical roadshow day is like and what equipment the BBC uses for the broadcast.

The convoy of vehicles will already have travelled to the next town the previous day, and parked overnight in the local council yard for security. By 07.30am the main roadshow trailer will have arrived at the site and parked, making sure that there are telephone lines and electricity nearby (the latter may be supplied in an emergency from a convenient lamp post!). This trailer will be the centre of activity for the broadcast.

The specially constructed trailer is equipped with air suspension on the single rear axle. Once the trailer is positioned, the air is released, making the trailer sit solidly on the back axle. After checking to make sure everything is level, the stage can now be erected . . . all at the push of a button.

The roof canopy and stage all hinge outwards and are operated by in-built hydraulic rams, so, at the push of a button, the roof goes

up and the stage comes down. Some sweat has to be broken however as the final stage extension is manually 'hinged' into place.

About 8.30am all the aforesaid operations will be completed and people soon start to gather at the front of the trailer. All the equipment required is stored centrally on the trailer and now the road crew start putting together the roadshow complete. By 10.00 everything has been connected together, checked *and* double checked and when engineers and producers are satisfied, the roadshow starts.

The Presenter for the day then comes on stage to entertain the large crowd that has already gathered and warm them up ready for the broadcast at 11.00. All too soon, the finishing time of 12.30 arrives and the roadshow goes off the air. The Presenter is then hurried off the stage to sign autographs for the crowds!

Everything is now quickly taken apart and packed away ready for the journey to the next venue and roadshow the following day. Once everything is clear and each piece of equipment accounted for, the convoy moves off about mid-afternoon.

As I said earlier, the trailer forms the centre of attraction for the broadcast and is divided into three main areas. The stage in the centre with the hospitality (hic!) area at the back and engineering section at the front.

6s1/6 mixer with Dk2/20 matrix unit located above, as used in the 'Roadshow' lorry.

The Presenter has a simple mixer and two turntables (known as 'grams' in the BBC), three cartridge machines (known as 'carts') and a microphone attached to the desk. There are also two 'floating' microphones for interviews and the like, and two rifle mikes, so called because of their ability to be focussed on noises some distance away, mounted on the canopy for the crowd.

All this is then wired into the engineering area to the main mixing desk where the engineer has overall control. The desk is split into two main sections . . . a 'mono' desk (6SL6) for the microphone inputs and a stereo desk for the music inputs. The main difference between the two is that the mike desk has a series of potentiometers, known as 'pan pots', so that you can 'pan' the microphone anywhere within the stereo image.

The mixer is then fed into a Dk2/20 which produces three main outputs, a mono, a stereo 'pair' and a feed for the PA amplifiers for the site. As the roadshow is transmitted in mono on the medium wave, the mono output is connected to one of the telephone lines and the second line is used for engineering communications. These lines are routed through the British Telecom network to Broadcasting House in London, ready for re-transmission over the network. During the time of the broadcast, somebody sits in a studio in London, ready with music to play just in case the Telecom line becomes disconnected. The engineering line is normally used one way from the London studio to the outside broadcast vehicle.

At the touch of a button and with only a small amount of manual assistance (right) the lorry side is converted into a stage, powered by hydraulic rams.

Additional equipment used for a normal roadshow includes a pair of engineering two-way radios and a radio microphone, used for interviews in the crowd.

The Roadshow trailer is designed to be used in a host of different situations, the main equipment being fitted at the start of a tour and additional pieces fitted as and when required, perhaps for use with another mobile studio or in conjunction with a TV broadcast.

Next month, Mick will be taking a look at television 'OBs'.

Meet the MICRON!

In response to numerous requests from readers and with the rapidly expanding interest in low power operation, Frank Ogden, G4JST, and Tony Bailey, G3WPO, have designed a very tasty six band direct conversion CW transceiver. Features include fully variable power from 0 - 8/10W, silent TR switching, automatic gain control and a sensitivity of better than 0.5uV. Let's face it, you've just **got** *to meet the Micron!*

Tony and I have been designing radios for at least a couple of years now. During that time we have received many requests for an incredible variety of home construction projects — these have ranged from all band, all mode transceivers (which we have done), to high power FM Broadcast Transmitters (which we haven't done). Perhaps the most often repeated request has been for a simple — everyone prefaces their suggestion with the word 'simple' — CW only multiband transceiver.

It has taken us quite a long time to get to grips with this one for a very good reason. There is no such thing as a simple multiband transceiver, even if it is just for CW operation. Multiband operation poses real problems for the designer, far more, for instance, than the offering of SSB in addition to CW in a single band set. The VFO, preselector and output filters all require simultaneous switching. Even worse, the major circuits are sensitive to interference from each other.

Overcoming Interference

Our solution has been to use a single circuit board, incorporating a direct mounting PCB wafer switch with all the major wiring as printed tracks. This alone takes the traditional headache out of wafer switch wiring; there are nearly 40 connections which are made to the switch. We have obtained the necessary isolation between circuits by a combination of careful layout and the use of DC switching for critical areas such as the phase locked VFO system, with minimal additional screening.

We next examined the design options for a CW-only transceiver. The major decision concerned filtering arrangements — a good quality 500Hz or narrower CW crystal filter would cost more than £25. Although the PLL VFO system we wanted to use could adapt to a full superhet design, which this type of filter demands, we felt that the crystal filter approach and the additional circuitry needed would put the end cost of the project up to an unacceptable level. This leaves the only feasible alternative to a superhet with crystal filtering as the direct conversion receiver.

There have always been quite a few objections to the basic DC receiver, although Heathkit have very successfully sold a fairly unrefined version in their HW7 and 8 for many years. Among the objections are poor selectivity and lack of any AGC system, together with susceptibility to broadcast

station breakthrough (by direct demodulation). On the face of it, the foregoing doesn't make the set a lot to write home about. What it does however, is its big plus — simplicity! Also, the strong signal performance (dynamic range) is excellent, and the purity of the received signal is high, as witness our DSB80 and DSB2 designs, which have appeared in this magazine.

Direct Conversion + Full AGC!

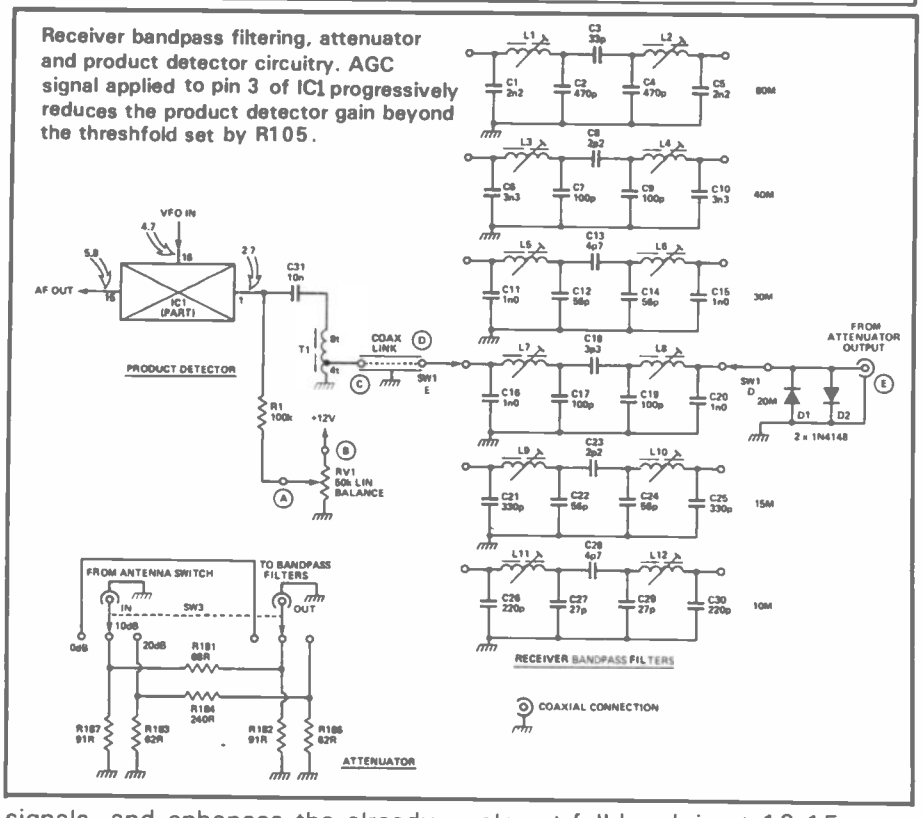
Our experience with these single band transceivers led us to see if anything could be done about these aforesaid problems. After an awful lot of experiments, we now have the first direct conversion design ever made to feature full AGC, thus removing one of the major objections. Selectivity is far improved over a basic DC set, and we have also virtually overcome the broadcast problem.

The most obvious of the improvements is the adoption of an audio derived AGC system which acts directly on the AF chain following the demodulator, and with delayed action, on the RF 'front end'. The AGC also provides 'S meter' drive in the same way as a conventional Superhet.

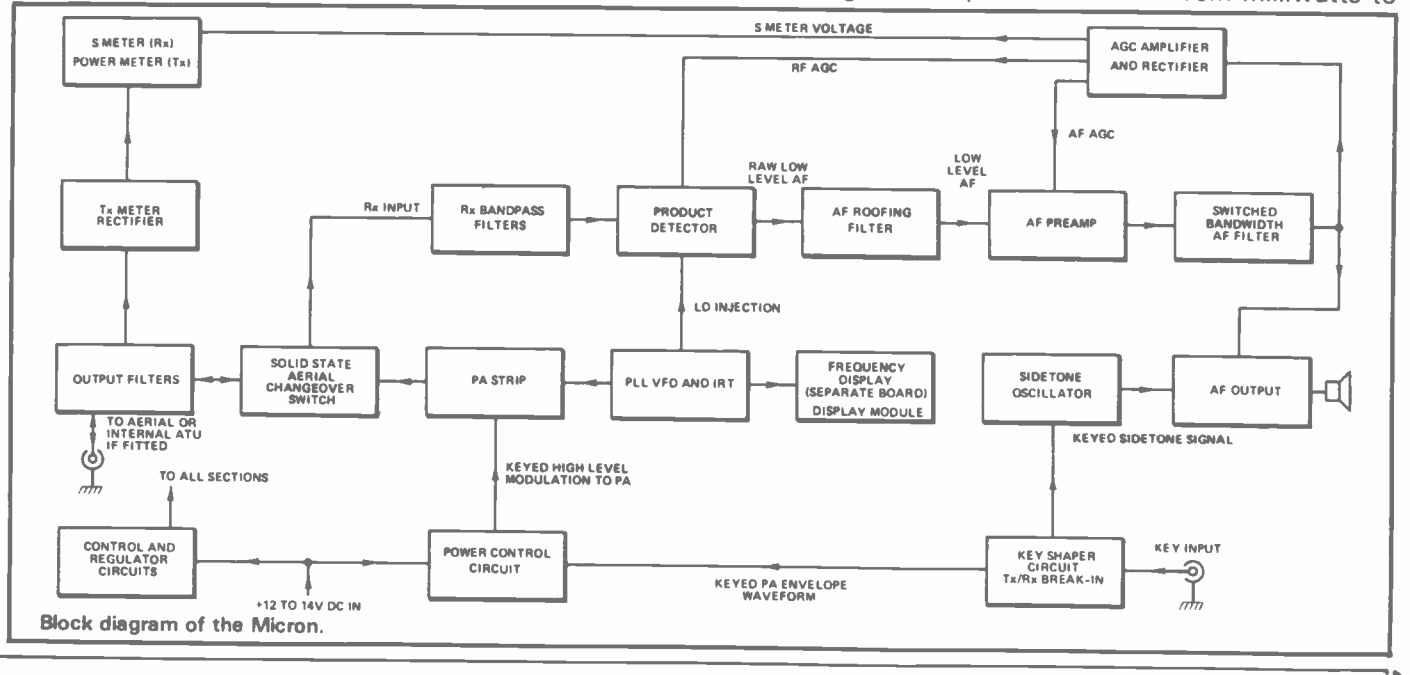
An active IC double balanced mixer provides the design with ample sensitivity; the *Micron* will resolve signals down to 0.5uV or better. The provision of an external electrical balance control allows effective rejection of broadcast signals, and enhances the already excellent strong signal performance, even after dark on 40m.

The selectivity has been addressed with an eight-pole fully passive filtering system. The back-end poles of the system are front panel switched for three separate CW bandwidths. Most of the simple CW rigs already on the market suffer from the 'noisy relay' syndrome when switching from receive to transmit — we have removed all relays and gone to solid state aerial changeover, the receiver switching fast enough for almost full break-in at 12-15wpm, and fast semi break-in above this.

The transmit side of the *Micron* has been substantially simplified by restriction to CW operation and a power capability not exceeding 10W. Knowing that many operators value variable power output for QRP working, the 'class C' driver and output stages are DC collector modulated for a precise, optimally shaped (no key clicks) keying envelope at any power level up to maximum. The 'key-down' power is infinitely variable by front panel control — from milliwatts to

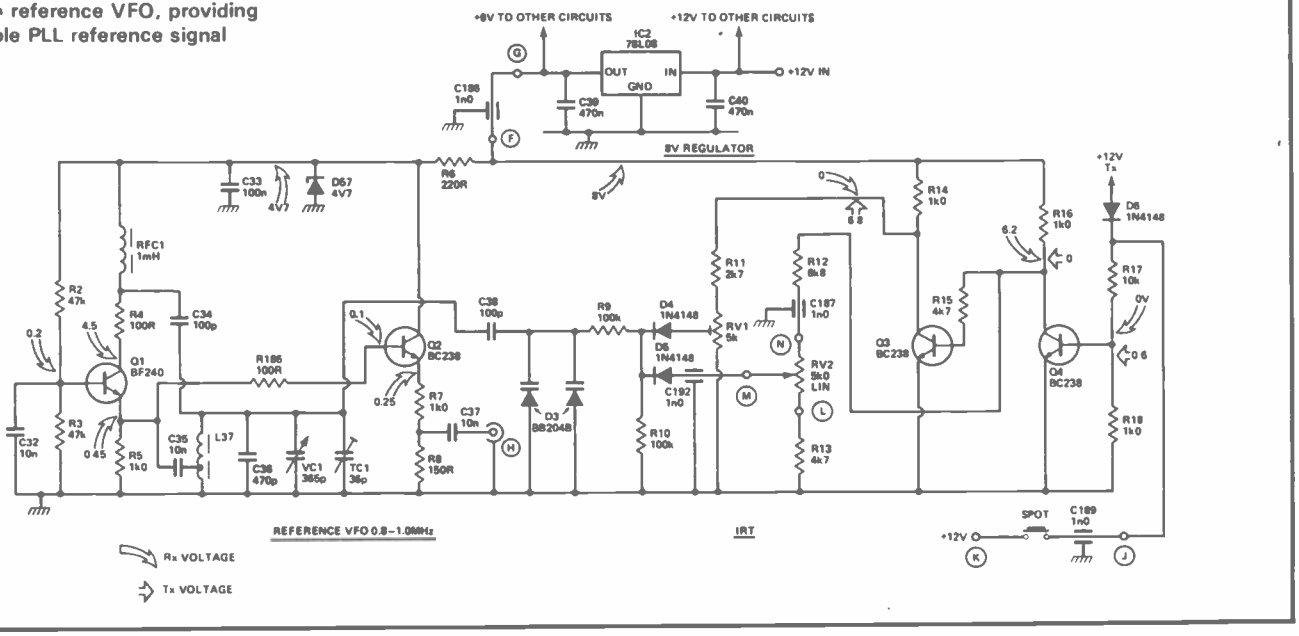


Receiver bandpass filtering, attenuator and product detector circuitry. AGC signal applied to pin 3 of IC1 progressively reduces the product detector gain beyond the threshfold set by R105.



Block diagram of the Micron.

Micron reference VFO, providing tuneable PLL reference signal



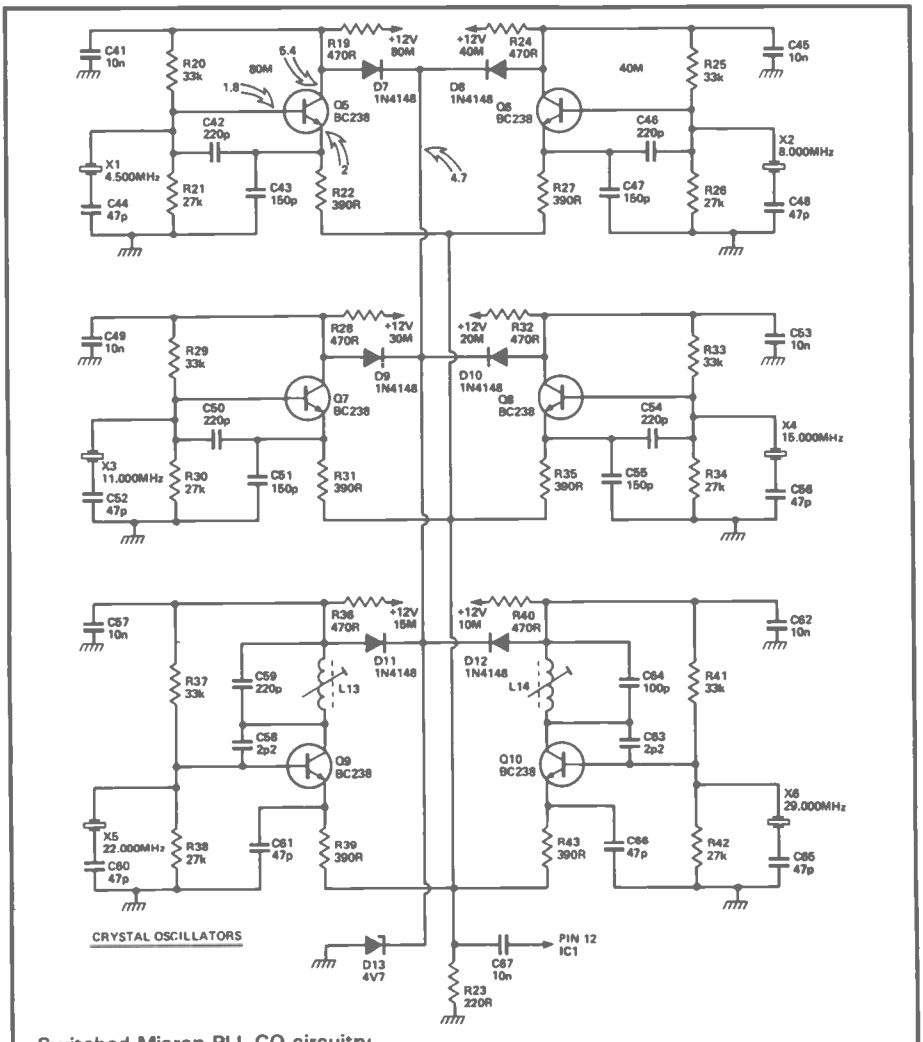
full power, with full keying shape retained. And of course, you will want to hear what you are sending, so sidetone is incorporated into the design.

To get over the problem of having to always tune to one side of a station with a Tx offset when working CW with a direct conversion transceiver, we have included a 'spot' function. Used in conjunction with the IRT control, this allows you to net (ie zero beat) onto the station being worked, then tuning wherever you like on receive (with the IRT) thus *without affecting the transmit frequency.*

Most modern gear is full of memories and other not-strictly-necessary refinements which we have carefully avoided in order to keep the cost of the *Micron* down. There is one refinement which is quite useful and is really becoming a standard now, and that is a digital display. This facility has been included in the *Micron* as an optional extra.

Finally, we took a long look at the complete CW Transceiver package. An undoubted advantage of the old valve sets which the solid state equivalents never had, was the Pi tuning network on the PA output. Valve gear could always be tuned for maximum smoke into almost any aerial system without recourse to an external ATU. This enabled almost any old bit of wire to be loaded up and an effective signal radiated.

This can't be done directly with the *Micron* PA stage, or any other solid state final for that matter. So, we have allowed enough space in the custom cabinet that comes with the Micron for an internal ATU. The set, fitted with these components will load up almost anything for unhampered portable operation. To set up a station using the *Micron* all you need is the unit itself, a key, a battery, and a length of wire for the aerial — just the thing to brighten a wet holiday!



Switched Micron PLL CO circuitry.

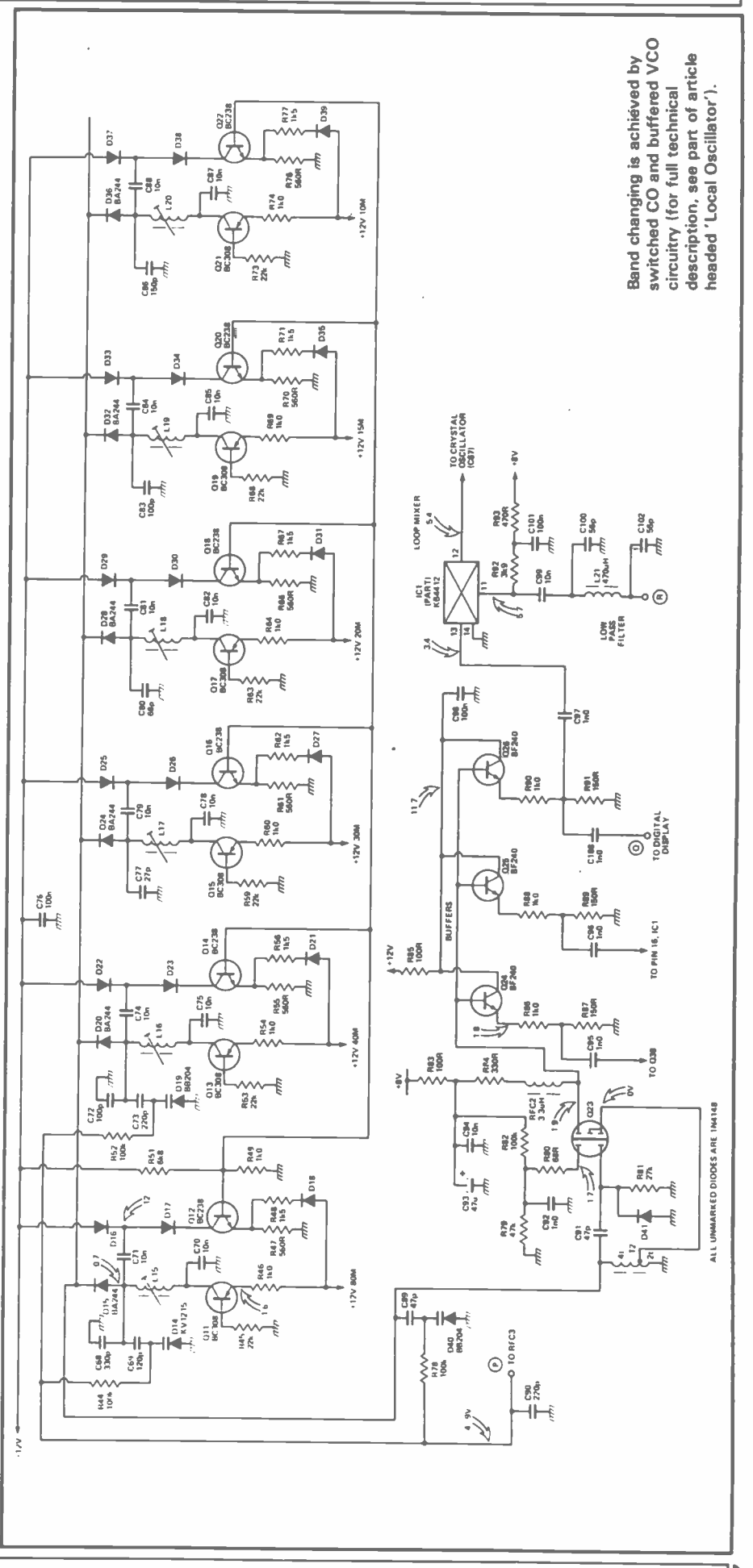
Circuit Details

Description of the *Micron* circuitry logically starts with the input to the receiver section. Incoming signals, routed initially from the transmit low pass filters (L25-36) and the solid state aerial switch (Q50 and D51) pass through the switched preselector filter bank (L1 to L12 etc). These filters have been designed with slug-tuned transformers to offer a passband of just over 200kHz (except on 7MHz where 100kHz is used). The flanks of the response fall off very rapidly beyond the individual 200kHz band segments, effectively attenuating out-of-band interference and with a corresponding general improvement in overall receiver performance.

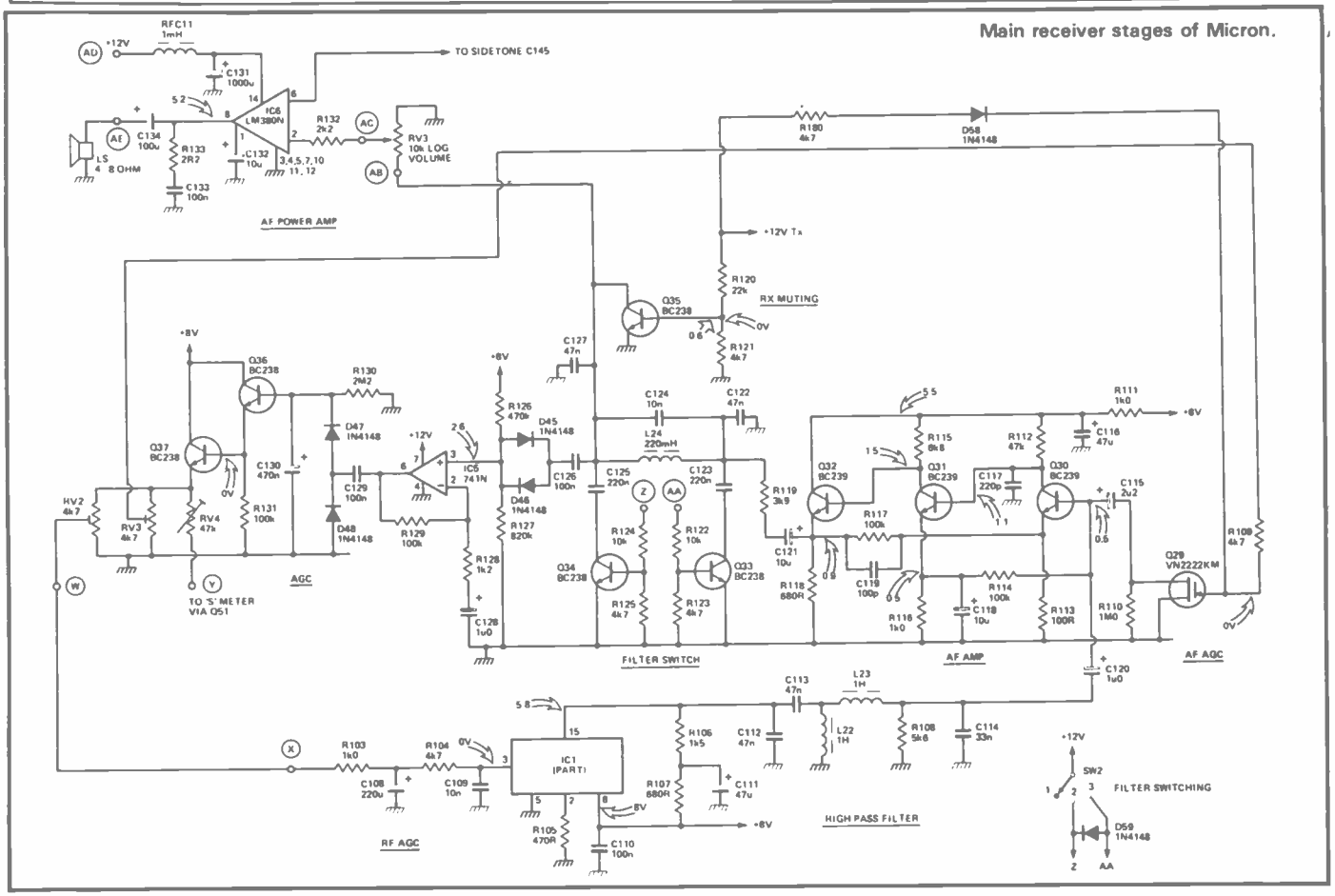
Transformer T1 steps up the input impedance from the nominal 50 ohms of the filter bank to the 500 ohms effective input impedance of the double balanced mixer, IC1 at pin 1. The signal mixes with the local oscillator injection (pin 16) to produce a direct AF output at pin 15. The local oscillator signal typically differs from the input signal by the VFO off-set — tuning 700Hz higher or lower of the nominal carrier frequency will produce a demodulated tone at this frequency.

Active (as opposed to diode ring) DBMs have their own noise contribution, although they exhibit useful gain (around 14dB in this design). Because the output is at audio rather than the more usual 455kHz or 10.7MHz IF, the 1/f noise which predominates in audio amplifier design is of major significance. The receive audio roofing filter (L22, 23) has a response which falls off very rapidly below 600Hz, reducing substantially the 1/f noise content, and almost as rapidly above 2kHz, reducing the possibility of amplifier overload from strong carriers in the region of 6kHz or more from the unwanted signal. Together, the dual filter characteristics improve both signal-to-noise ratio on weak signals and strong adjacent signal handling.

It should be noted that the passive inductors for the roofing filter are sensitive to induced hum and audio currents from the speaker and power supply circuitry. Wiring the board in accordance



Main receiver stages of Micron.

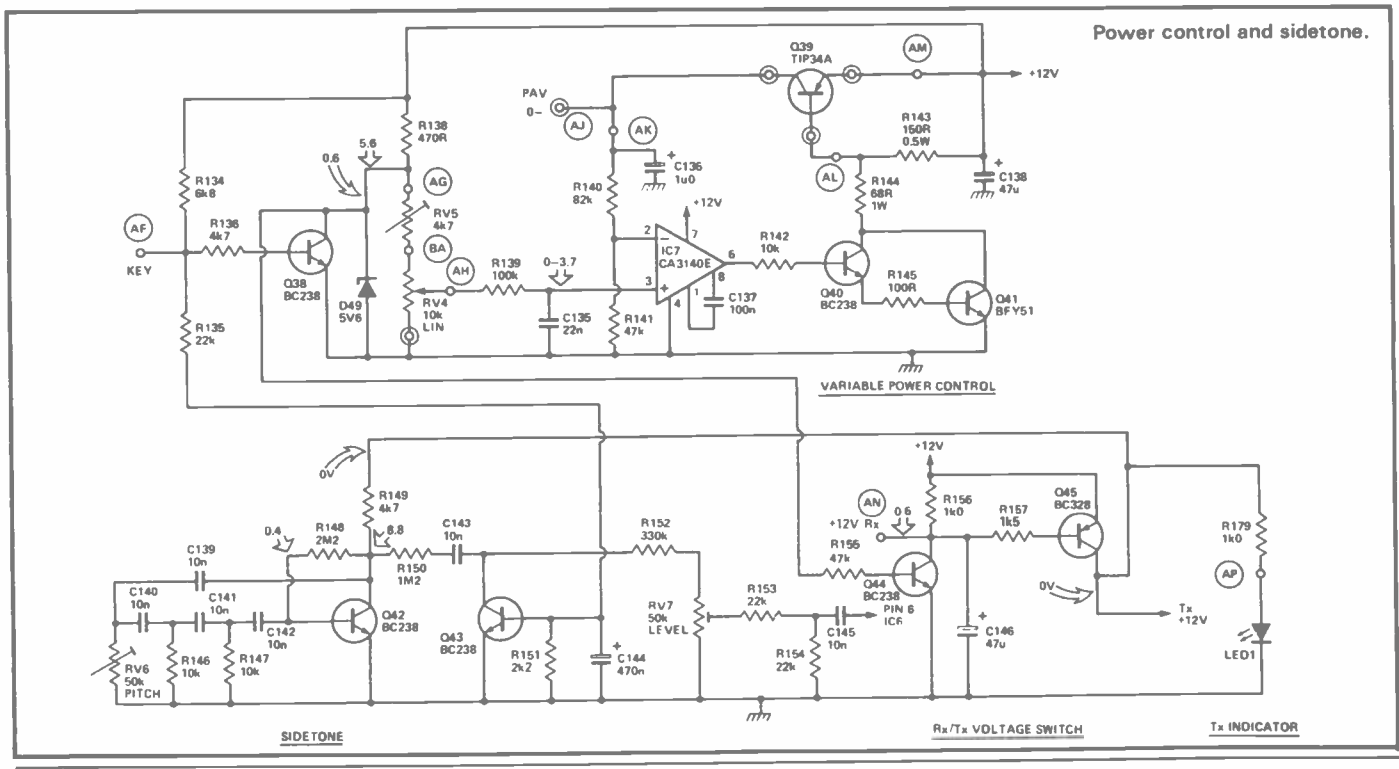


with the accompanying instructions will ensure unconditional stability — *please follow these closely!*

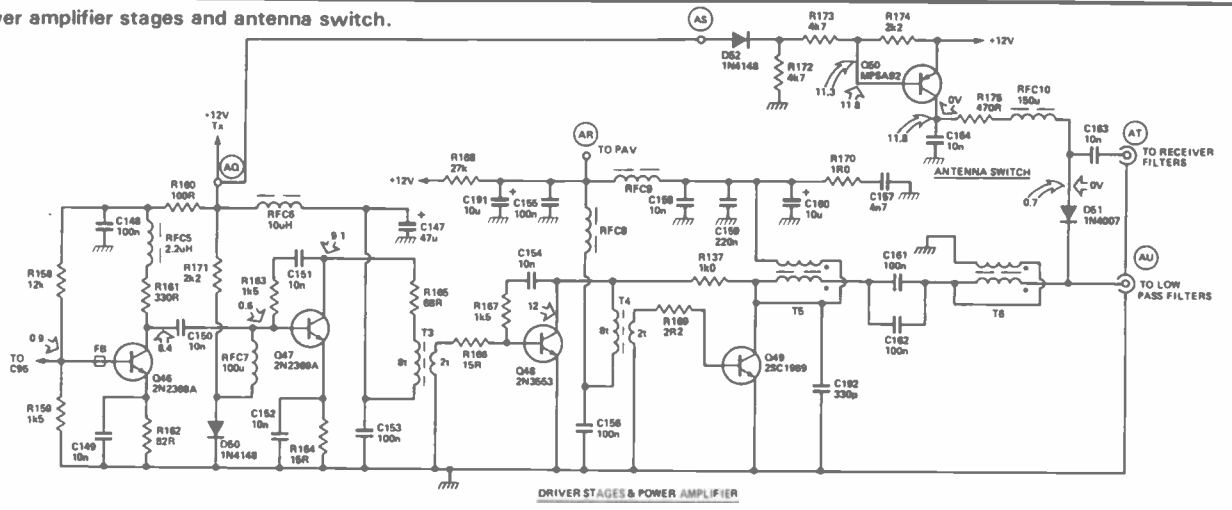
The AGC Secret

A delayed AGC control signal — the input level has to rise to a certain point before it acts; this optimises low level signal-to-noise ratio — is applied to pin 3 of IC1. This progressively reduces the product detector gain beyond the threshold level set by R105. Another portion of the AGC voltage is also used to activate the low resistance MOSFET, Q29. This shunts off the audio from the product detector with rising signals. The two circuits together provide an effective AGC system. Note that

Power control and sidetone.



Power amplifier stages and antenna switch.



the secret of getting AGC to work with direct conversion is to avoid any form of sudden DC voltage shifts, as you would generate with a normal AGC system. The RF AGC is slugged with C108 to give an extremely long time constant, and the AF AGC control voltage is isolated from the circuit by C115. Without these components AGC would not be possible. The actual generation of the AGC voltage is covered later on.

Q30 to 32 comprise a 3 stage low noise audio amplifier. The voltage gain is around 600 at maximum gain producing an output in the region of tens of millivolts from microvolt level signals at the aerial socket of the set. C119 provides HF roll-off for out-of-band signals.

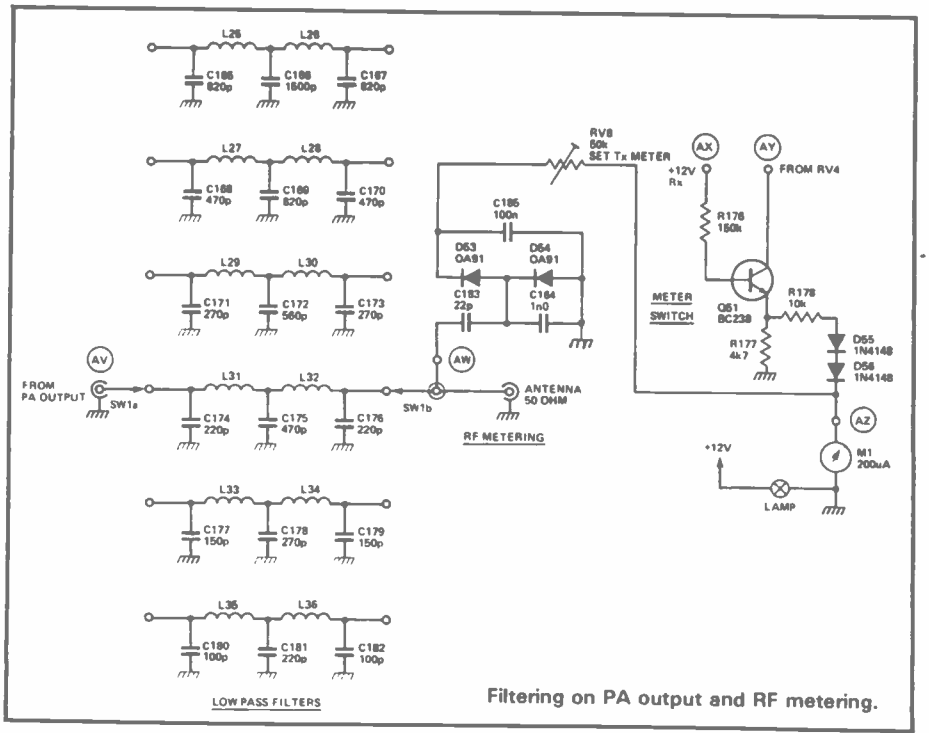
Selectable AF bandwidth is effected by the DC switching of filter poles into the filter inductor, L24. Taken together with the action of the roofing filter at the front end of the AF strip, the result is pleasing CW for all occasions, actually comparable in sound to a bank of switched crystal filters. Q35 shunts off AF from the strip during transmit. AF power amplifier IC6, active in both receive and transmit, delivers recorded audio during receive, and sidetone during transmit.

IC5 is the AGC amplifier delivering high level audio to the rectifier doubler D47,48,C129 and 130. Note that C130 controls the principal AGC time constant. Q36, 37 comprise a Darlington follower to the presets VR3 to 5. Diodes D45, 46 hold off the AF signals to the AGC amplifier until the recovered audio from the preamplifier reaches the 500mV peak-to-peak level — this results in a very positive AGC action. Preset VR5 allows meter calibration to suit the user.

Local Oscillator

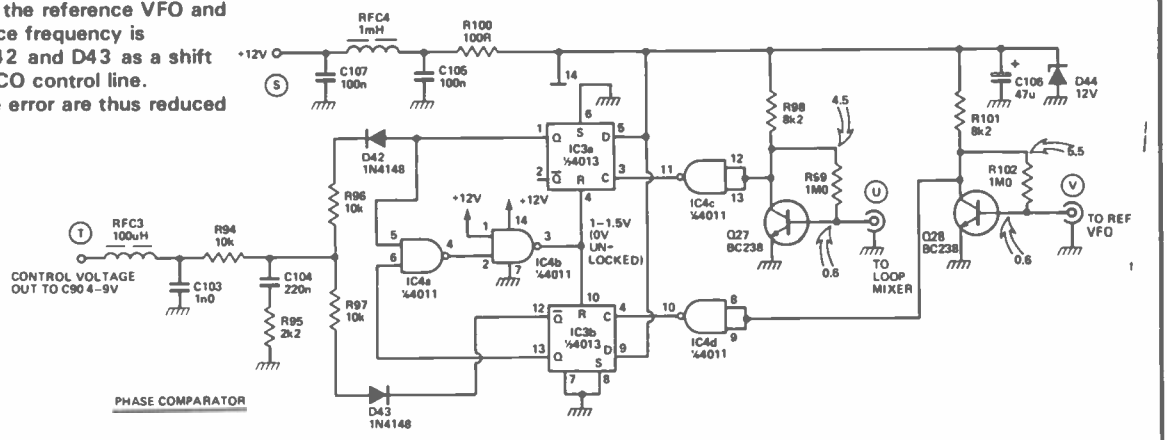
The *Micron* local oscillator system is an adaption of our classic 'Minisynth' design (HRT April '84) optimised for multiband operation. This produces highly stable (100Hz drift per hour) low noise carrier RF on each of the six bands covered. The heart of the system is a dual gate MOSFET VCO (voltage controlled oscillator) Q23 with individually switched inductors, one for each band (L15 to 20). Each inductor is switched into circuit by PIN diodes D15, 20, 24, 28, 32, 36. The PNP transistors (Q11, and the odd numbered transistors up to Q21) source current through the selected diode/coil combination, while the NPN transistors (Q12 and the even numbered transistors up to Q22) damp the five remaining coils not in use through their respective double diode switches.

VCO tuning is carried out by varicap D40, with extra varicap action provided by D14 and 19 on the lowest ranges. The various values of inductance and padding capacitance have been selected so that each VCO combination covers almost exactly 200kHz on each band, over a control voltage range of 4 to 9V. The precise confinement of the frequency swing is in fact very important. Firstly, it minimises the sideband noise con-



Filtering on PA output and RF metering.

Phase error between the reference VFO and the CO/VFO difference frequency is translated by IC3, D42 and D43 as a shift on the DC voltage VCO control line. Frequency and phase error are thus reduced to zero.



tribution of the VCO varicaps. Secondly, it enables a single PLL loop constant to be used without sideband noise degradation from band to band. The detail put into the VCO design has certainly paid off — spectral sidebands are certainly better than −80dB close in and there are no detectable spikes within the 2f frequency limit. Audibly, the received signal is as clean as it looks on the analyser.

Q24 to 26 buffer the VCO; Q26 feeds its signal to the loop mixer, the other half of IC1. This mixer, like the product detector, is double balanced. The other port is fed with the output of the appropriate crystal oscillator, (Q5 to 10). Each oscillator is DC switched according to the band. Note that the two highest bands operate in the *overtone* mode, the remaining four at the crystal fundamental.

The output from the DBM contains both the sum and difference between the VCO and the crystal oscillator — when locked this difference will be between 800kHz and 1MHz. A lowpass filter, L21, C100/102 filters off the difference signal, which is subsequently amplified by Q27 and applied to the edge triggered phase detector, IC3. It is compared both in frequency and phase with a signal derived from the VFO (covering 0.8MHz to 1.0MHz). Phase error between the reference VFO and the crystal oscillator/VFO difference frequency is translated by IC3, D42, D43 as a shift on the DC voltage VCO control line. This acts in such a way as to reduce frequency and phase error to zero. The major PLL constant is determined by C104 and R95. For a full explanation of this type of circuit see the original 'Minisynth' article in HRT April '84.

The tunable PLL reference signal is provided by the circuitry surrounding Q1 and 2. The combination of inductance (L37), tuning capacitance and padding capacitance results in a fixed coverage over a 200kHz span as outlined above, virtually linear in tracking through choice of the tuning capacitor, VC1, law. IRT signals derived from the keying circuits shift the basic VFO frequency via varicap D3. On receiver, the VFO frequency can be varied by VR2, over a +/− 3kHz range. On transmit, the IRT control voltage is mixed, set by preset VR1, such that the control voltage is the same as it would be on receive with the IRT control at mid-setting. This means that the transmit frequency *never* has any offset — pressing the 'SPOT' button has the same effect of removing any offset, thus allowing 'netting' to take place (ie zero beating an incoming signal with the main tuning control).

The loop settling time is *so* fast that this IRT shift can actually be performed at the highest of keying speeds (in excess of 50 wpm). The reference VCO is also fully temperature compensated through careful choice of capacitor types.

Since the *Micron* is a direct conversion set, frequency readout can be obtained directly from the local oscillator signal in both receive and transmit modes. The frequency display module takes its drive from one of the VCO buffers (there are three). Q1 provides input signal conditioning to drive the divide by 10 IC (74LS90) — the PCIM177 display used requires a signal below 4MHz to operate. Thus a direct display of frequency to 1kHz can be obtained on all bands.

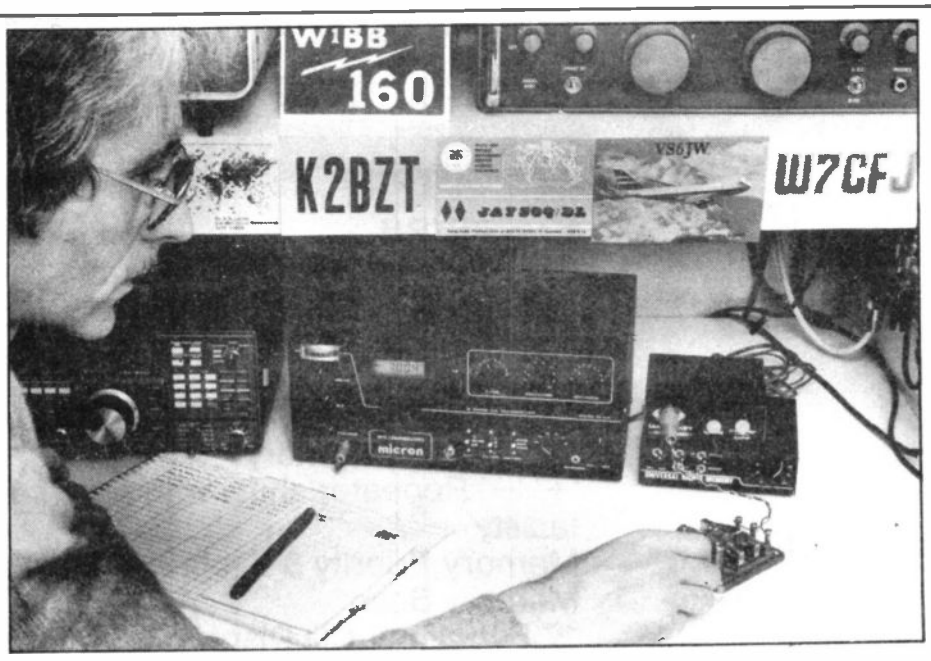
PA Strip

Like the display unit, the PA strip takes its drive from a VCO buffer at around the 150mV level. The first two stages of the strip, Q46/47 take their supply from a keyed (+12V on transmit) rail derived from Q45. The driver transistor, Q48, and the output transistor, Q49, are permanently connected to the power modulator, Q39, which provides a modulation envelope determined by IC7, Q40 and 41. Some time constants are built into this section of the circuit to remove 'thumps' and 'clicks' when going from transmit to receive and back, the receiver being muted on transmit by applying the keyed +12V rail to Q35, and the AF AGC circuit, Q29. The keyed transmit rail also operates the phase oscillator sidetone circuit, Q42/43, with output applied to pin 6 of the LM380 audio amplifier (which is still active on transmit, although its normal input on pin 2 is muted).

Neither the driver or the PA transistor conducts during receive, although R168 maintains a positive voltage on the collectors to aid operation of the solid state changeover switch. Bifilar transformers T5 and T6 provide DC feed and step up the impedance from the three ohms or so at the collector of Q49 to the 50 ohms of the output filter/aerial changeover.

Solid State Switch

The solid state aerial switch operates in this manner. During receive, Q49 is effectively an open circuit (providing there are some volts on the collector). The



resistor chain associated with Q50 ensures that this transistor, a high voltage PNP device, saturates, sourcing current into the PIN diode D51 (actually a 1N4007, which happens to have PIN diode characteristics) connecting the receiver input to the output filters through C163. In transmit, Q50 turns off allowing D51 to cease conduction — self-rectification of the transmit RF ensures that D51 becomes reverse biased. This blocks the RF path to the receiver, with cross connected diodes D1 and D2 ahead of the preselector shunting off any RF leakage through D51, although they appear as an open circuit on receive.

There are six output filters, one for each band, with each five pole section switched by the PCB wafer switch. Their function is to remove unwanted harmonics above the output frequency, and since they are in circuit on receive (so that the solid state switch operates correctly), they also help remove unwanted signals above the operating frequency. The narrow band receive preselector filters are also switched by the PCB mounted switch directly.

Next month sees the start of the construction details for the *Micron*.

Kits

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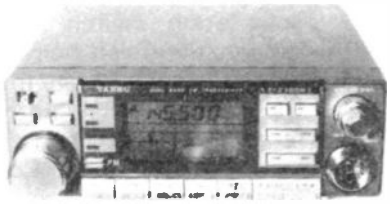

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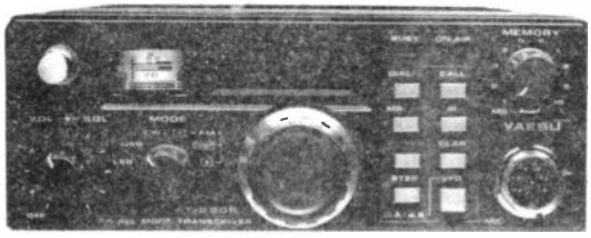

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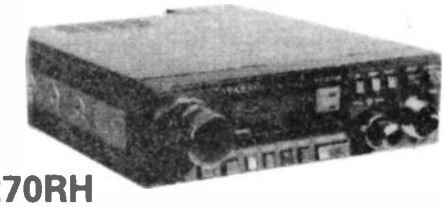

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AUTHORISED YAESU

REVIEW: Yaesu FRG8800

The FRG8800 is the latest in the line of solid state general coverage receivers from Yaesu, which commenced with the still sought after FRG-7. Tony Bailey, G3WPO, took time off from designing radio projects to do some SWL-ing.

Interested in SSB DX chasing? Or in Broadcast DX? Or listening to maritime transmissions? Or VHF 2m DX? Or the aircraft bands? Or just general listening around on HF or VHF? If you meet any of the above criteria (which isn't difficult) then the latest in the line of Yaesu communications receivers may be for you. A mid-priced receiver, it boasts an impressive number of features and facilities which should keep any SWL happy; or even the transmitting station who wants a second general coverage receiver.

Like most modern state-of-the-art designs, it uses a fully digitally synthesised VFO system, incorporating 12 memories — with back-up facility and niceties like storing the mode together with the frequency. Also, the Yaesu CAT system can be fitted to this receiver enabling personal computer control of the VFO frequency and memory functions — with some mind boggling possibilities for automatic monitoring!

The review sample came with both the CAT system and VHF converter accessories. Unfortunately, the writer's computer proved incapable of driving the CAT system as no assembler was available and the BASIC proved too slow (either that or I couldn't understand the rather Japanese instructions for driving the system). The other problem was that of noise. The computer generated S9 + 20 sproggies about every 200Hz from 1-30MHz and into VHF, so practical results would not have been good. This is an important point to bear in mind if you intend using the CAT system with a computer — you won't get far if you cannot get rid of the rubbish generated by most computers. So it is worthwhile checking first (borrow a similar model from someone else if you can) before spending money. I have heard good reports of the BBC computer being used with the system, so it is possible.

Circuit

Another unfortunate thing was that no circuit or block diagram was available at the time of the review. The description of the circuit is, therefore limited to a few observations from looking inside. This will mean concentrating on the practical aspects.

About the only information given in the manual about the circuit is that it uses a FET RF amplifier and double balanced diode ring mixer.

From observation, the synthesiser runs in 20Hz steps in 'slow tuning' mode, rising to 500Hz in 'fast tune' mode. One of the most obvious things you will notice is that when you tune round the band (especially on AM) there are a series of very muted thumps occurring rapidly all the time which I found a bit disconcerting (they are only present while actually tuning though). These are due to the way the synthesiser works.

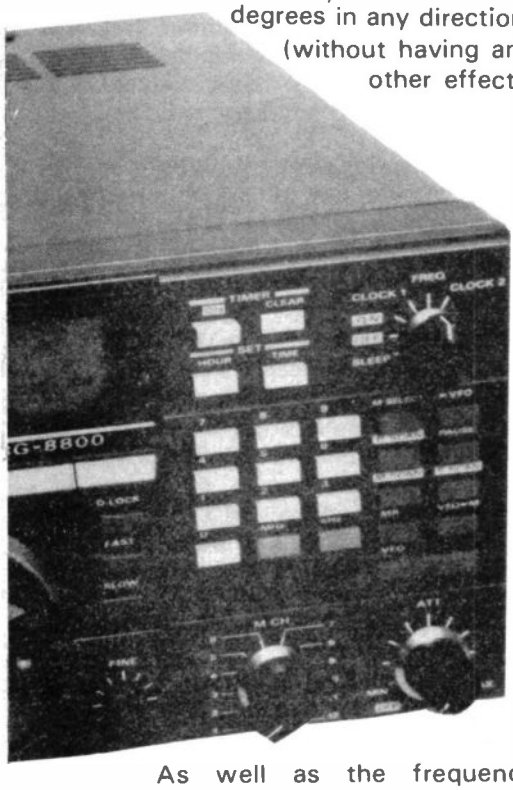
The signal selectivity is carried out at 455kHz. There are 3 filters used covering AM, FM, CW and SSB, all are ceramic. The AM narrow band and SSB filters are the same unit — Yaesu have chosen to use a Murata ladder filter for this narrowest mode and this does

show up when you look at the selectivity (see later). Two more ladder filters cover AM wide and FM narrow (an option is available for FM wide if required, but this appears to be an off-board unit).

Display

The most obvious front panel innovation is the LCD multi-function display. It is very large compared with previous offerings (130 x 24mm overall) and besides the normal frequency display, sports a digital 'S' meter arrangement in bar graph form; (also marked up with a SINPO scale) memory channel number, the mode in use, and a squelch 'BUSY' legend. Some of the adverts refer to this display as 'Multicolour': whether green or black counts as multicolour (on this basis the normal black/grey would be multicolour) I don't know, but someone obviously thinks it does!

The intensity of the display is adjustable (normal or dim) via a front panel button — useful at night when the normal display is a bit bright. One very good feature of this particular LCD readout is that the viewing angle is very large — you can read it from at least 45 degrees in any direction. (without having any other effect).



As well as the frequency display (full frequency to 100Hz), there are two clocks incorporated in the '8800 and either can be displayed instead of the frequency Both are 24 hour, so you can have say GMT, local time or even any other worldwide local time. The '8800 even dares to try to emulate a digital alarm clock — there is a 'Snooze' facility! More useful is the programmable alarm which can be set for both 'on' and 'off' times — good for recording while out via the front panel record jack or with the CAT system for more adventurous ideas.

Tuning and Memories

As mentioned earlier, the front panel tuning knob can be used to change frequency in either fast or slow modes — in 'slow', the tuning rate is 6kHz per revolution, and in 'fast' about 110kHz/rev. This is more than adequate for most applications, unless you want to go from one band extreme to the other. As the '8800 is continuously tuning, you need another means of fast retuning. The usual keyboard, which comes with modern digital offerings, is the answer.

This pad has a total of 21 keys, 10 white ones for the usual 0-9 calculator keys (it doesn't have a calculator though . . .). Two more are dedicated to 'kHz' (blue) and 'MHz' (orange). To enter the frequency punch in the MHz first, then press 'MHz', then punch in kHz and press 'kHz'. Being a clever machine, it accepts all correct entries with a short beep and fortunately you can adjust the intensity of the sound on the back panel. Incorrect entries (like too many MHz) get a longer beep and the frequency doesn't change.

The usual memory facility available for transfering the VFO frequency to any one of the selected (by rotary switch) memory frequencies, simply by pressing the 'VFO to M' button. This action also stores the mode and if in AM or CW, the narrow/wide filter option. Pressing 'VFO' then puts you back into the control of the VFO. When you require a memory channel you just press 'MR' and select the channel required.

One very nice feature is a button which will transfer the recalled memory frequency *back* into the VFO again. Many memories lock you to the selected frequency and if you want to tune round it, or just retune a little, you have to reselect the frequency again back in VFO mode. With the '8800 no such problems.

Scanning

There are two basic scan modes available — either by band (between two frequencies), or by memory channel. In the former, you put the two limits between which you wish to scan into any two adjacent memory channels — pressing the 'P scan' button then starts the scanning process off. It starts at the lower numbered memory channel, then up to the highest numbered memory channel — at a speed selected by the fast/slow tune buttons — then back down again and so on. There are two possible scan halt modes — either auto or manual, selectable by a switch which is inside the top of the rig, so you have to remove the cover to change it.

In auto, the stopping process is determined by the squelch control; when the squelch breaks the scan stops. Because of the greater occupancy on the HF bands, this feature is best used on VHF when the converter is fitted. The manual facility requires pressing the 'pause' keypad button to stop scanning, and ignores the squelch.

I am not over impressed with this type of scan facility. The problem is that you have to sit in front of the rig all the time on HF, as there are so many signals about — except maybe 10m at the moment. On VHF it is much more useful to use the auto mode. Even then, you can guarantee that the squelch will open as soon as it gets to a signal and you will have to retune for proper resolution on SSB or FM. It also takes an awfully long time as explained later.

The other gripe, one I have made before, is that the scan stops dead until the signal goes, requiring manual intervention if you want to start it again, or if you don't want to listen to the station it has stopped on. Much more useful is for the scan to restart after say 5 seconds, as present on other Yaesu rigs. In this case, you only need to take hands to the rig if you want to stop it.

The other scan mode is for the memories. You can either scan through all 12 sequentially or, by use of the M SELECT button, program the rig to only scan some of

the memory channels. Again though, you have to restart the scanner if you get stuck on a signal you don't want.

You can use any of the scan facilities to program the memory with any useful channels. Simply transfer the frequency it has stopped at to the VFO, then transfer this back to a selected memory channel.

Backup

The memory channels can be kept as permanent stores by fitting backup batteries into a compartment on the rear panel — 3 AA types are required and will last about a year. These are really essential, unless you always leave the mains supply to the rig switched on at all times. My own choice was to program 9 of the memories with the centre frequency of each HF band — making band changing easy with the memory to VFO transfer capability — and the remainder with the local radio station (!), SSB and FM ends of 2m since the VHF converter was fitted.

One thing that happened a couple of times should be mentioned. If you switch the rig off at the mains switch and the back-up batteries are fitted, nothing happens when you apply AC power again! The only way I could get the '8800 back in action was to remove a battery, then switch on, replace the battery and reprogram the memories. This happened several times on this particular sample.
(This seems to happen when the memory battery voltage drops to less than 50%, so if the receiver is not permanently connected to the mains, the voltage should be checked once every three weeks.)

There are, of course, a lot of other interesting things going on between 150kHz and 29.999MHz and you may well have other choices. For example, have cordless telephone users (both business and private) realised that armed with a good aerial for LF, you can hear both users at least 100 miles away!

CAT Interface

While not being able to use this for reasons explained previously the possibilities are endless. One use, for VHF DX chasers, would be to program all the beacon frequencies on 2m (or other nearby signals usable as beacons) into the memories and scan these using the computer. As the squelch and 'S' meter outputs are available for external use, you could easily log these automatically, if you have a real time clock. It can even print out bar charts, or raise alarms after the signal has reached a certain 'S' meter level, while monitoring say 28MHz beacons at the same time. You could monitor and log repeater occupancy, or check round some shortwave broadcast stations.

Using the external computer removes the limit of 12 memories. You can have hundreds or even thousands of memories stored on disk for recall. One use of this, mentioned in the manual, is for the computer to automatically check all transmission frequencies of a given station and at the times one would expect propagation, then select the frequency which gives the best signal strength!

Power on/off control is also available, as it setting the mode of reception.

Front Panel Facilities

Other than those already mentioned, the front panel gives control over the tone, AF gain, attenuator, AGC, noise blanker, and power on/off.

The AGC is selectable at two speeds — fast or slow. Although the AGC is fast in response and generally adequate, the slow decay time is a little too slow and takes a while to recover.

The noise blanker has an additional switch on the rear panel for the pulse blank width — narrow for ignition type interference and wide for Woodpecker signals. I didn't find the blanker particularly effective on narrow mode, being very much dependant on the signal strength, most of the time it didn't appear to do anything worthwhile. In wide mode, Woodpeckers were very effectively extracted, dropping from S9 + 20dB to less than S1 on the meter, albeit with a bit of residual audio noise. This is still a lot better than many so-called Woodpecker blankers in other rigs.

The attenuator wasn't used very much during the review, as the strong signal handling capabilities weren't taxed too strongly. However, it is there if you want it and is of the continuously variable type with an overall range of 65dB of control.

If you do recall a memory frequency, you cannot change frequency at all using the main tuning button, unless you transfer the frequency back to the VFO. However, there is a fine tune knob, just below the main tuning knob which will enable you to shift about +/− 500Hz while in memory mode or between the 20Hz/500Hz synthesiser steps.

For some reason, many of the buttons seem to have very loose covers on them. They don't actually fall off; it just seems to be the type of knob button Yaesu have used. A bit disconcerting though!

Rear Panel

One of my usual gripes with Yaesu rigs is that they invariably come with a European type plug fitted. Now, I don't have these in my house (we use the old 13A type . . .) so it has to come off and be replaced with one that will fit. The manual tells you to contact your dealer if the plug supplied won't fit your socket. As the UK must import a fair number of Yaesu rigs, can't we have the correct plug supplied as a matter of course? (But traders claim that if the original plus is removed before sale, buyers suspect that the equipment is not new! — *Ed.*)

Having got over that, the rear panel allows use of an external speaker — essential for the better quality sound with broadcast station since the fitted speaker lacks any bass response — a 600 ohm line output, 'remote' jacks (for control of external devices via the timer mode), a 5 pin Din accessory socket for connection to the Yaesu *remote* VHF converter — not the internal one used here — or active antenna, plus power out (11V DC @ 50mA), and AGC / muting connections, Along the top are the CAT jack, wire antenna connections (50 and 600 ohm plus an earth connection), and SO239 50ohm HF antenna socket.

A dummy panel towards the bottom of the FRG8800 can be removed for the fitting of the optional internal VHF converter — very easy to fit as it turned out. Once installed, you add the VHF tuning range of 118 to

173.999MHz to the '8800, with exactly the same facilities available as on HF, including full frequency display to 100Hz. Any memory channel can be programmed with either HF or VHF frequencies (the CPU knows whether the converter is fitted and you can't enter VHF frequencies if there is no converter).

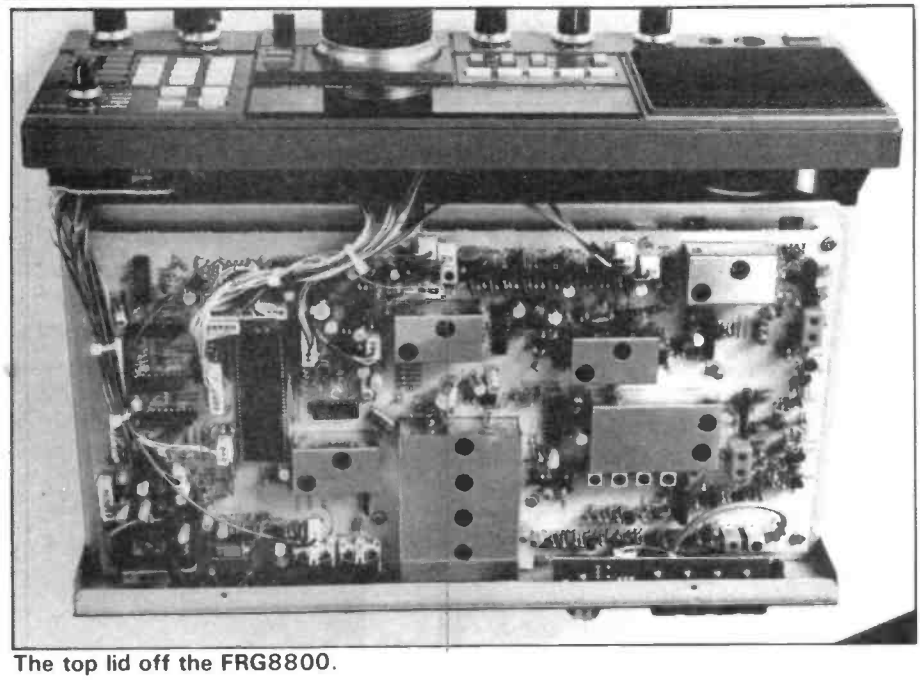
'Sproggies'

One of the practical problems facing any designer of a general coverage receiver, especially with VHF facilities as well, is that of spurious responses. It is impossible to have no unwanted responses whatsoever — the designer has to make sure that those that do occur are either acceptably weak for the frequency in use (you can accept a higher level on lower frequencies where signal levels are much greater) or occur at points in the coverage where they would not cause much concern. For instance, you wouldn't want sproggies dead on 10 or 15MHz (standard frequency transmissions), or on 145.500MHz etc. The other problem on VHF is that if you wish to use a scanning facility, you will have problems with the scanning stopping (and staying stopped!) on such unwanted signals.

Having said that, there are a fair number of unwanted responses on the FRG8800 scattered through the HF spectrum. However, the good news is these are mostly S1 or less and shouldn't be troublesome. A few were at higher levels, notably 7.235MHz (S2), 22.960 (S3) and 23.073 (S5). At VHF again, a fair number at the S1 level but very few higher — one on 145.145 at S3 would stop the scanner at a low squelch setting and is perhaps close enough to 145.150 to cause a heterodyne on FM signals. Further up, a very strong one at 171.416 (S6) could cause problems if you are interested in this particular part of the VHF spectrum.

Not exactly a sproggie, but you can detect synthesiser noise, in the form of a buzz, when in the AM mode in a few places on the coverage but at a very low level.

No facilities were available during the period of this review to measure the VHF performance figures. However, it was noticeable that a considerable amount of Air Traffic Control signals and occassionally the Police, could be detected around 144.800MHz, where of course they shouldn't be. Not having a circuit of the convertor available, because of its newness to the country, the frequency translation process for the converter is unknown, but these are probably simply some form of image. (The latter problem did not occur during later tests elsewhere, and the editor suspects that some kind of local mixing within Tony's shack may have been responsible.)

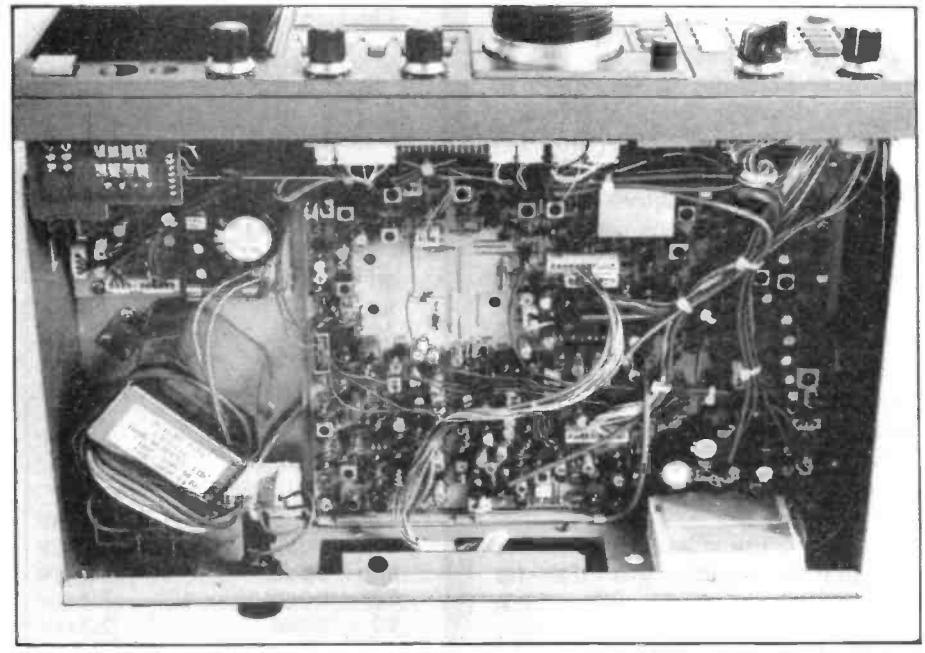


The top lid off the FRG8800.

In Use

The receiver was used over a period of many weeks for all sorts of purposes, from general SW listening, on both broadcast and amateur band, to scan monitoring of VHF frequencies. In general, the '8800 did all that was required of it, the only annoyance, rather than a problem, being the aforementioned unwanted signals on the 2m band.

My only real criticism, that showed up fairly quickly, is that the use of ceramic ladder filters has drawbacks as far as selectivity is concerned, especially on SSB and CW. The technology is not yet available to enable these filters to give a good shape factor at 455kHz. Although the SSB/Narrow



With the bottom cover removed.

AM filter has a nominal 2.7kHz bandwidth at −6dB, the skirt response at 60dB down is not comparable to that you would expect from a crystal filter and is considerably worse — a shape of around 4:1 compared with better than 2:1 for most crystal filters.

The practical effect is that if you tune to, say, 1835.4kHz on CW mode where there is an S9 + 10dB signal, another signal placed lower in frequency, such that its upper edge gives a 800Hz beat note on the other side of the filter, will give up to an S8 response, causing considerable interference to the wanted signal. These poor skirt responses showed up markedly on the blocking measurements at close frequency spacings.

During crowded band conditions, such as during a contest, there were considerable problems on receiving CW, with interference from adjacent signals, which, with the better rejection of a crystal filter you would not have been able to hear (for instance, my aged KW2000 gave a better performance under these conditions). I suspect that, the far improved performance with even the most basic of crystal filters would have outweighed the extra cost involved. On SSB reception, the filter's shortcomings were shown up by the ability to resolve a *strong* USB signal in the LSB position (and not because the station had poor sideband rejection).

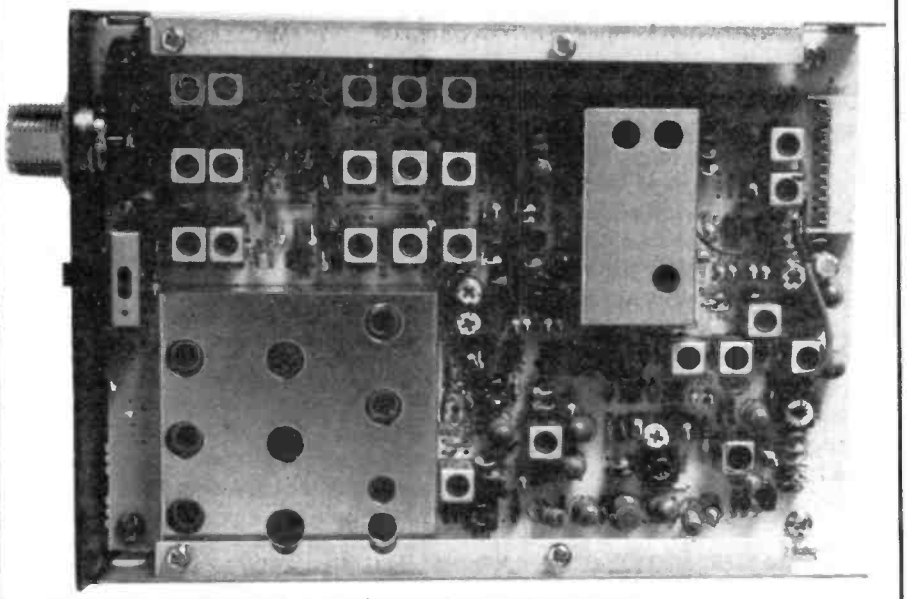
There is an effective narrow bandwidth facility for CW use, and this uses audio filtering to achieve this, but unfortunately too late in the receiver chain to do much to help the above problem of adjacent channel stations.

The squelch could be used on all modes, but is effective on FM as you would expect. One little oddity was that the 'busy' indicator, although agreeing with the squelch opening on CW, SSB and AM, didn't agree on FM, with the indicator often off with the squelch still open. Presumably the 'busy' indicator is carrier driven on all modes, but the squelch for FM is actually operated by noise rather than carrier.

I liked the memory facilities overall, especially the transfer features mentioned earlier, but thought it a pity that the memory scan will not restart automatically. Storage of mode and frequency together is a boon and saves a lot of knob twiddling/button pushing. However, the band scanning facility is rather slow if you want to make a big frequency span — it takes 100 seconds to scan 1MHz in fast mode and about 33 minutes in slow mode. . .Looking from 118 - 174MHz will take you a minimum of 93 minutes in fast mode!

One thing that you may notice missing is some form of 'notch' control, either in the IF or audio stages. Interfering heterodynes are a relatively common occurrence listening to amateur transmission

The inside of the internal VHF converter.



YAESU FRG8800 LABORATORY RESULTS

Dynamic range

(to MDS at 100kHz) 2-tone 14MHz = 82dB
(to MDS at 50kHz) 2-tone 14MHz = 78dB

MDS (−3dB) SSB 10MHz .05uV
MDS (−3dB) SSB 29MHz .07uV
MDS (−3dB) AM 10MHz 0.5uV

Sensitivity

SSB 14MHz 10dB S/N+N 0.12uV
AM 14MHz 10dB S/N+N 3.2uV
FM 20dB Quieting 0.5uV

Blocking

14MHz at 10kHz spacing for −3dB degradation = 61dB
14MHz at 50kHz spacing for −3dB degradation = 79dB
14MHz at 100kHz spacing for −3dB degradation = 89dB

S Meter **Linearity (14MHz SSB)**

Meter	Signal	Difference (dB)
S1	2.5uV	-
S2	3.5uV	2
S3	5uV	3
S4	7.5uV	3
S5	10uV	3
S6	14uV	3
S7	20uV	3
S8	30uV	4
S9	42uV	2
S9 + 10dB	130uV	10
S9 + 20dB	350uV	9
S9 + 30dB	900uV	9
S9 + 40dB	2.5mV	8
S9 + 50dB	7.5mV	10
S9 + 60dB	14mV	5

but there is unfortunately, little you can do about them on the '8800. A dedicated BC listener might not be troubled by the lack of this facility.

On broadcast stations, the 8800 gave a good account of itself and here the ceramic filters aren't really a problem. On AM, you have the choice of two filter bandwidths — for general listening the wider filter gives the best quality of course, but under crowded conditions the narrow filter will help get rid of adjacent stations, at some expense to the quality as one would expect. The internal speaker isn't bad for its small size, but a good external speaker helps a lot. There was little distortion perceivable by my untrained ears, even at high volume levels.

The VHF accessory gives access to both 2 metres, plus PMR, Air Band and various other transmissions, either using the short telescopic aerial supplied, or via a more conventional antenna fitted to the SO239 socket on the rear of the converter itself. For general listening, a wideband discone type would be best and would make the most of the '8800's very wide frequency span.

The FM facility was best evaluated on VHF and gave good results, the squelch responding well, with little evidence of it being effected by audio peaks, as in some squelch systems. The filter response seemed somewhat asymmetrical when tuning through a signal — this could be the filter or possibly the discriminator, but had little practical effect on results.

As you can see from the measurements, in common with most radios (!), the 'S' meter isn't really to be trusted in terms of allowing 6dB per S point below S8, although the higher levels are rather better.

Conclusions

For the price, the FRG8800 isn't a bad buy at all if you want a general coverage facility for all modes, good memory facilities, and with VHF option at extra cost. It meets all its HF performance figures in terms of sensitivity, but is not in the top class of dedicated amateur receivers in respect of dynamic range or blocking (its behaviour with strong nearby signals) performance.

For serious SSB/CW use, you will find the selectivity a bit lacking but could add an outboard notch reject facility (see HRT November '84). On the plus side, the CAT system, put to proper use, could save a lot of time in certain applications if you have a personal computer. In terms of general facilities there is little lacking other than as noted above, and good use is made of the digital system for memories etc, with band and frequency changing a very fast process once you have the hang of the various options.

Incidentally the receiver weights about 6kg, and is fitted with a carrying handle, so could be useful for taking round the world with you.

Thanks to SMC of Southampton for loan of the receiver and the accessories. The current price (check though before ordering due to fluctuating exchange rates) is £559 for the basic receiver, £90 for the FRV 8800 internal VHF converter, and £64.80 for the CAT Interface (RS232 compatible).

SHORT CIRCUIT

In this new, occasional series of simple projects that may be built in an evening, aimed at the beginner, old timer, Ernie Vaughan tells how to built a diode detector shortwave receiver.

I hope all you lucky readers who own Trio, Drake or other communication receivers, do not turn up your snooty noses at this very simple 'crystal' or more aptly diode detector receiver. This is intended for the newcomer to construct; to give him or her a taste of amateur radio, but more experienced constructors may be surprised at the results which can be obtained with such a simple set. Having constructed and got this simple receiver working satisfactorily, the newcomer will, hopefully, be inspired to go on to building something bigger and better.

Practical Learning

In my opinion the best way to learn about radio is by construction. Theory is an asset, but it seems to me no use having a head full of ideas if one can not put them into practice. We all know that short wave broadcast stations transmit at much greater power than radio amateurs and their signals tend to travel much greater distances.

I have constructed this receiver and using an antenna 30' long, tapped at 10' for the lead-in, together with a good earth, have picked up strong broadcast signals from the Middle-East, central South America and several from the USA.

A simple inductance using a ferrite rod, and a variable capacitor form the tuning circuit. This arrangement provides a relatively high 'Q' circuit on the 3.5-7.5MHz frequency range. A quick trial with the output of the tuner connected to an audio vacuum tube voltmeter, indicated peaks of signal in the 10-30mV range when strong stations were tuned in. This is more than adequate to operate an amplifier/loudspeaker arrangement.

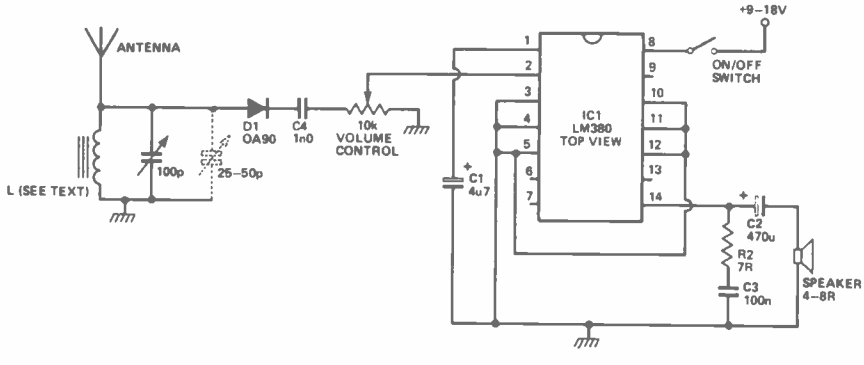
The coil, L, consists of 13 turns of 18swg insulated wire (preferably cotton-covered) wound not too tightly on the ferrite rod. Leave about 4" of lead at each end of the coil, then pull the turns apart until the winding is about 3" long. Connect one end of the coil to the stator lug of the 100pF capacitor,C, and the other end to the frame (rotor). Solder D to one of the stator lugs using a heat sink (ie grip the end of the diode being soldered with a pair of long nosed pliers). Should the tuning of the receiver prove to be too sharp, a 20 or 25pF variable capacitor may be connected in parallel with VC1 (see Fig.1) to act as a bandspread capacitor (ie for fine tuning).

Battery Powered

I chose an LM380 for the output stage as it requires few external components. The IC will give a reasonable volume on a PP9 (9V) battery but should the constructor require more input, two PP9s may be connected together in series giving 18V. Don't forget to connect the positive of one battery to the negative of the other, leaving positive and negative as supply volts. I have provided no layout as this is not critical except that wires should be kept fairly short.

The unit may be mounted in a small aluminium case, together with the battery or batteries and on/off switch. A white card board dial could be mounted on the front panel and a pointer cemented to the tuning knob for calibration purposes. We must not forget an insulated plug and socket for the antenna connection and also one for the output to the speaker, although this could be mounted in the same box as the receiver.

Good listening!



Circuit diagram and information for the simple shortwave receiver.

Shop

Most of the parts for this project are commonplace. In case of difficulty the OA91 can be obtained from **TK Electronics**, 11/13 Boston Road, London W7 3SJ for £1.20 and 19p respectively, plus VAT and 75p postage. A suitable 100pf capacitor, type Jackson Dilecon, can be obtained from **Electrovalue** of 28 St Judes Road, Englefield Green, Egham, Surrey TW20 0HB (0784 33603).

Addendum

The introduction to this artivle **Converting CB Displays**, *published last month, should have read:-*

A number of magazines have published articles on the conversion of both illegal AM and legal FM CB rigs for use on the 10 metre amateur band using frequencies from 29.300 to 29.700MHz. Most tend to use the system where the CB units original channel 1 represents 29.31 MHz easing the calculation of frequency from the channel number. The author felt that for a small outlay, the display could be made to read the frequency directly, ie the calling channel of 29.600MHz becoming 60 on the display.

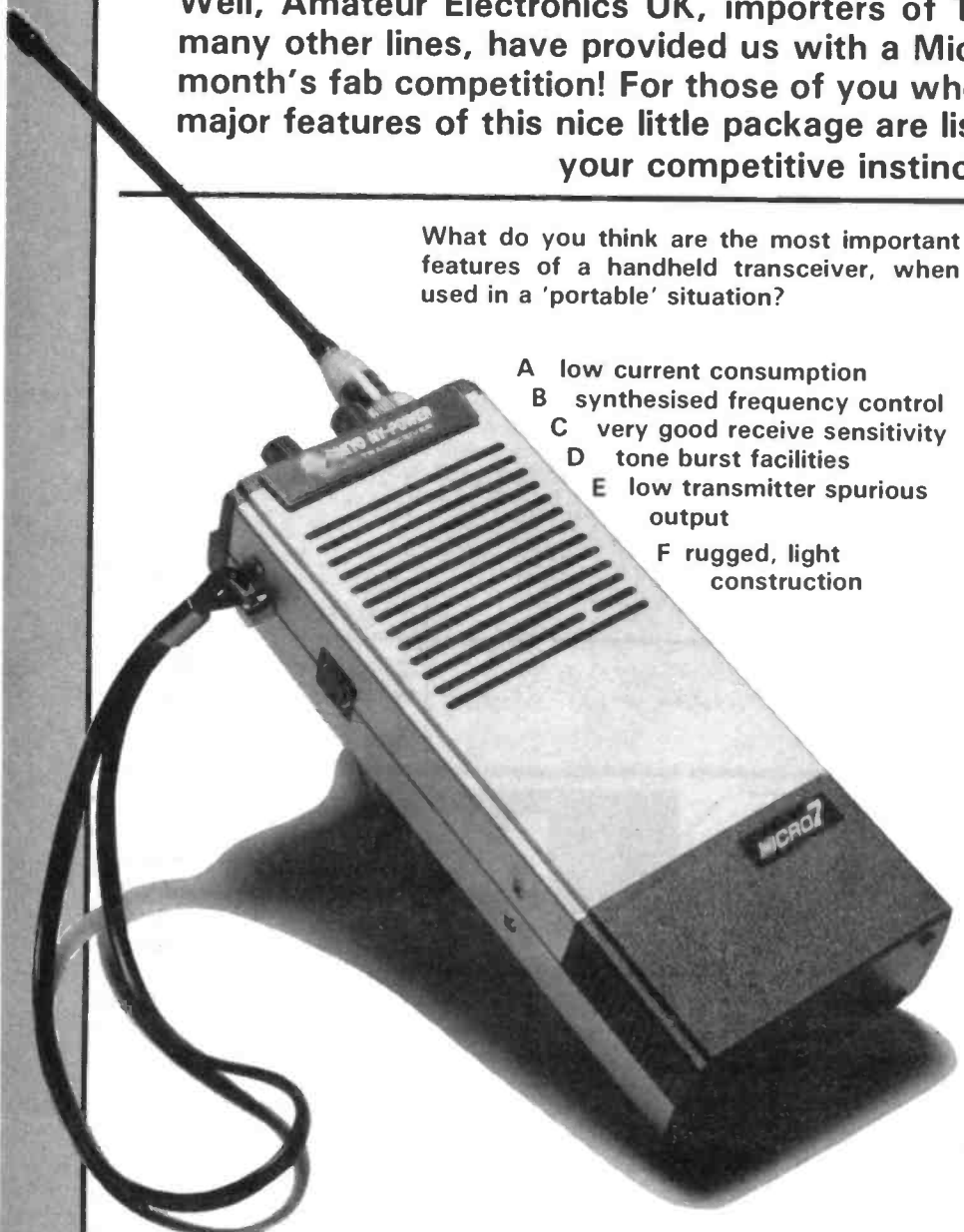
The PLL System

The CB rig chosen for conversion was the DNT M40FM, since this was freely available at all of the radio shows the author visited. This rig uses the MC145106 phase-locked-loop chip, containing not only the phase detector but also the counter for the reference frequency of 10.24MHz and the divide by n counter for the voltage controlled oscillator, see **Fig. 1**.

A few comments should be made about the PLL circuit since it contains some unusual features. The divide by n counter receives from the channel switch binary 168 to 207 to control the receive VCO over the necessary frequency range. This range is 10.695MHz below the received frequency. The output frequency of the VCO is too high to be connected directly to the MC145106 chip. Hence the output is mixed with the receive crystal oscillator output to produce a frequency in the acceptable range – these frequencies are 1.68 to 2.07MHz.

COMPETITION
Win a Tokyo Micro-7

Remember the Tokyo Micro-7 handheld reviewed here last month? Well, Amateur Electronics UK, importers of Tokyo equipment among many other lines, have provided us with a Micro-7 for the prize in this month's fab competition! For those of you who missed the review, the major features of this nice little package are listed nearby, to bring out your competitive instincts.



What do you think are the most important features of a handheld transceiver, when used in a 'portable' situation?

A low current consumption
B synthesised frequency control
C very good receive sensitivity
D tone burst facilities
E low transmitter spurious output
F rugged, light construction

How To Enter

Look at the list of possible features of a handheld transceiver listed nearby. The HRT editorial team have examined this list and decided which they personally feel is the order of importance of these features. Simply rearrange the list in the order you feel is the most important. If, for example, you feel, of the list that 'rugged light construction' is the most important feature and 'tone burst facilities' the least, your list would begin with F and end with D. All entries coinciding with our list will be put into a hat and the winner drawn by our lovely editorial assistant.

Complete the coupon clearly and fully — if you are the winner this will be used as a label. Send the coupon to us. **IMPORTANT:** write your choice of the order on the back of your envelope in addition to on the coupon.

Send your entry to: Micro-7 Competition, Ham Radio Today, No.1 Golden Square, LONDON W1R 3AB. Closing date is first post on 3rd May '85.

You may enter as many times as you wish, but each entry must be on an official coupon — not a copy — and sealed in a separate envelope.

The rules

Entries will not be accepted from employees of Argus Specialist Publications, Amateur Electronics UK or Garden City Press. This restriction also applies to employees' families and agents of the companies.

The 'How to enter' section forms part of the rules.

Prize provided by

AMATEUR ELECTRONICS AE LIMITED

Tokyo Micro-7 Competition

Complete fully and carefully — if you are a winner this will act as a label for your prize. Post to Micro-7 Competition, Ham Radio Today, No.1 Golden Square, LONDON W1R 3AB. Closing date: first post, Friday 3rd May '85. Don't forget to follow the advice in the How to enter section, including writing your choice of the order of features on the back of the envelope!

Name . . . . . .

Address . . . . . .

. . . . . .

. . . . . .

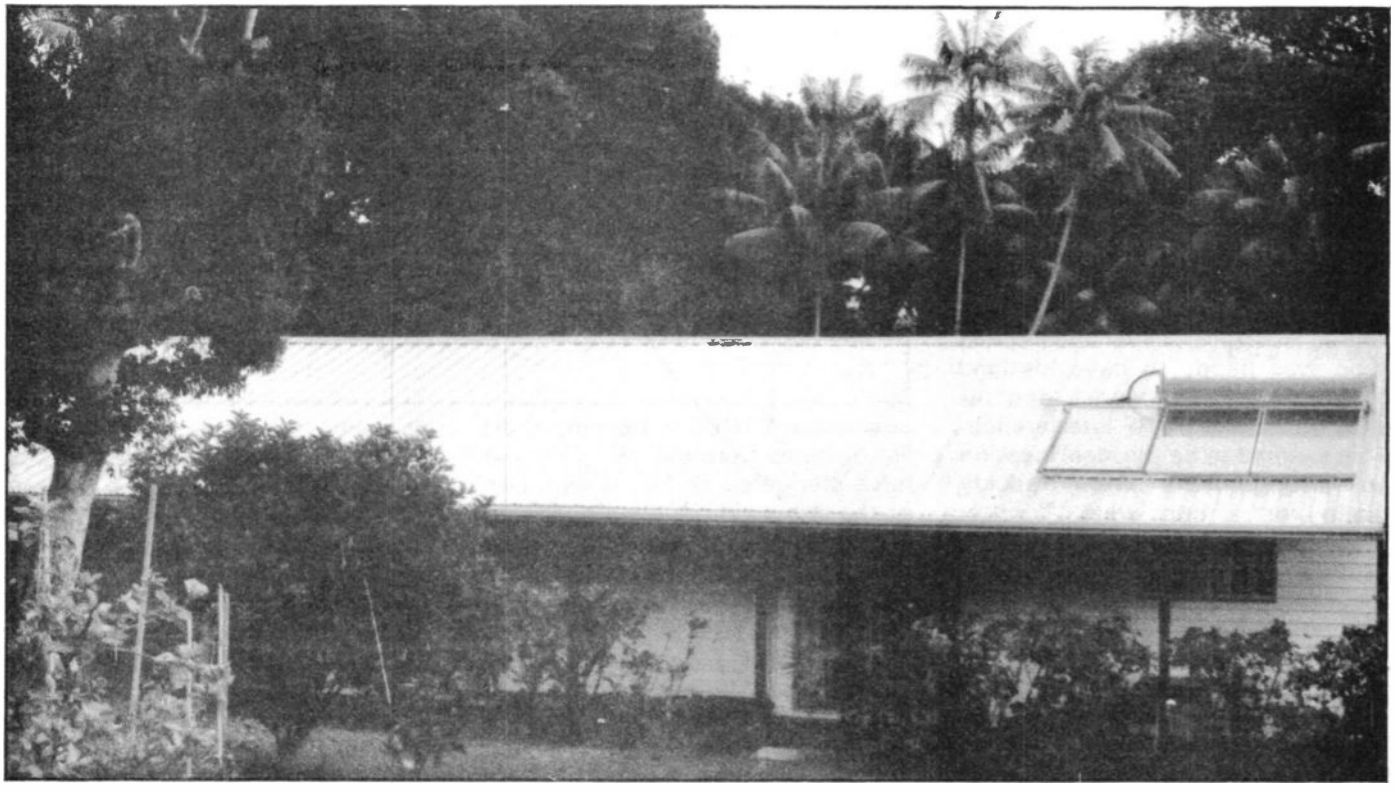
. . . . . post code . . . . . .

Your order of transceiver features
ie. A,D,F etc . . . . . .

Tokyo Micro-7 features

* 3 channel capability (1ch. fitted standard)
* 200mW FM
* Double conversion receiver with crystal filter, 1uV input for 18dB S+N/N claimed min.
* complete with 1/4 λ antenna and earpiece

South Sea Sojourn



The idea of mounting a DXpedition to the tiny DXCC country of Lord Howe Island first surfaced during one of my regular skeds with Richard Newstead, G3CWI/VP8ANT, while he was active from Antarctica.

Have you ever dreamed of operating from a Pacific Island, the sea softly lapping at your feet and a cool Pina Colada close to hand? Well, Martin Atherton, G3ZAY, had, and to his surprise this (almost) came true...

"When I leave here", he told me one evening on 20 metres, "I'm going to take a long holiday and cycle across Australia from Perth to Sydney". Greeting this with the scepticism and laughter I felt it deserved, I went on to remark about the mentally unhinging effect of Antarctic isolation! Then — as we had often discussed DXpedition possibilities and I wanted to visit Lord Howe ever since receiving a very attractive QSL from VK2AGT/LH showing an aerial view of the place — I rashly said that if he reached Sydney in one piece I would fly out to join him so that we could put the island on the air. "You're on!" was the ominously brief response, and nine months later in April 1984 I received an airmail letter telling me to be in Sydney by early July.

Lord Howe Island is situated in the Tasman Sea, 500 miles NE of Sydney and 300 miles from the Australian coast. It is crescent shaped, 7 miles long, nowhere more than ¾ of a mile wide, and at its southern end has twin mountain peaks — Mounts Lidgbird & Gower — rising to about 3000 feet. Its status as a separate DXCC country is due to its large separation from the Australian mainland.

For most travellers, access to the island is only possible by air on regular flights from Australia and Norfolk Island. Light aircraft now land on a 3000 foot runway, but until 1974 the island was served by flying boats arriving and departing from the lagoon. Shipping services exist, but carry freight only, and are not much cheaper than the airlines. The only way to arrive by sea is on a private yacht and Lord Howe is a very popular destination with the summer "yachties".

Preparations

A few phone calls to the London "bucket" shops produced a return ticket to Sydney for nearly £200 less than the official Qantas/British Airways fare. But nobody had heard of Lord Howe Island let alone sold tickets to the place! The only solution seemed to be to make the onward travel arrangements through an agent in Sydney. Les Cullen, VK2WU, President of the Down Under DXers Contest Club, was extremely helpful both in putting us in touch with a firm, which specialised in

package tours to Lord Howe and in advising us on where to stay on the island.

There are now about 280 permanent residents, and accommodation for up to 500 tourists. At the time of our visit the place was almost deserted (being the middle of their winter) as there were only about 25 visiting tourists and many of the residents were holidaying on the mainland. Nevertheless, most of the restaurants, clubs and excursions were functioning, since their owners had nothing else to do!

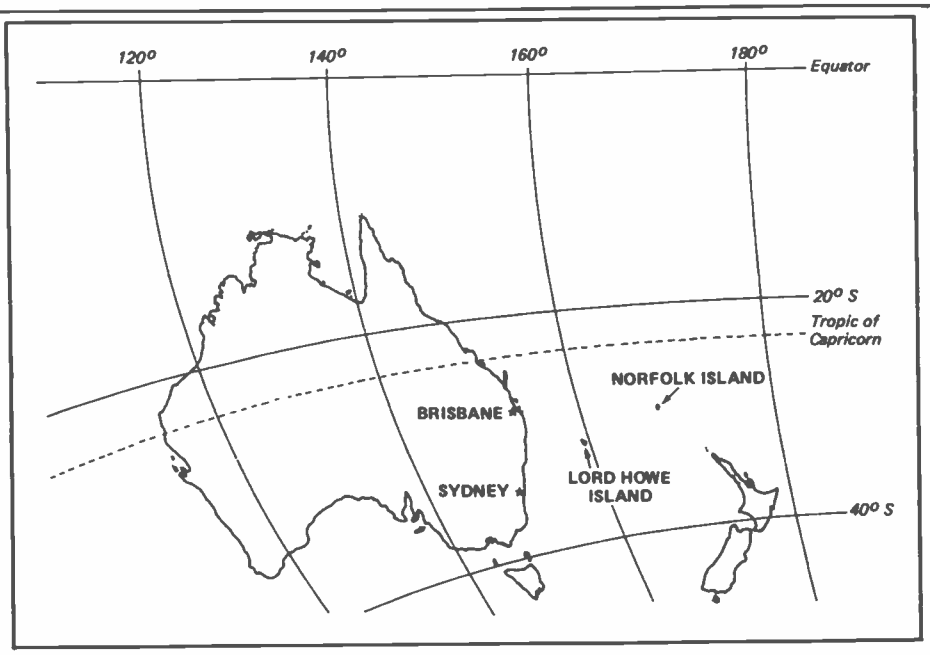
It seemed that most previous DXpeditions had operated from the "Polynesian Apartments", a group of self-catering chalets owned by a retired Australian naval telegraphist who was happy to have his land festooned with antennas and his VCR wiped out by RF interference. This seemed to be the ideal location so arrangements were quickly made for a one week "winter break", July 11th-18th, at a low season bargain price.

The next task was to organise the equipment, and it rapidly became apparent that this was going to be a problem. Richard had taken an IC2 in order to operate bicycle mobile on 2 metres, but had no HF gear with him at all. Thus my short list for the expedition was as follows:

Item	Weight
2 HF Transceivers	30kg
2 HF Linear Amplifiers	30kg (at least)
200 feet of co-ax	5kg
AEA Morsematic keyer & paddles	2kg
Headphones, tools, mics, wire, etc	4kg
	Total 71kg

The two transceivers would be essential in case one broke down while we were on the island, and would in any case be desirable so that we could make the most of good band conditions by having two stations active simultaneously. The linears, though not essential, would probably double the QSO rate and allow us to work real DX on the LF bands.

As the free baggage allowance on flights to Australia was 20kg (+ hand baggage) and the excess charges were about £20 per kilo for the round trip, it would have



cost about £1000 to take my short list of items from the UK. If I could have staggered on board with one of the linears in my hand baggage, and convinced the security staff that it didn't conceal a bomb, the excess charge would still have been about £700!

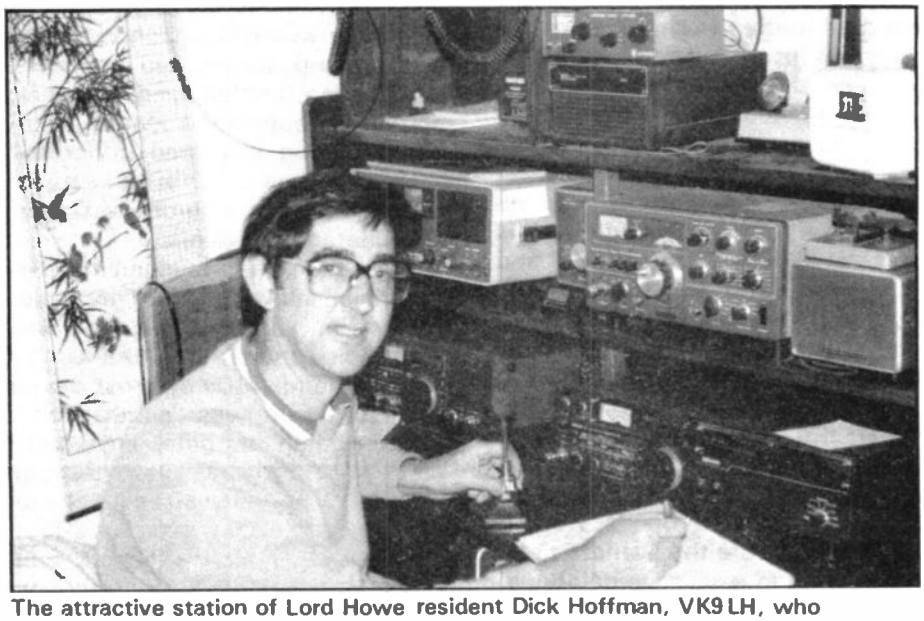
It seemed that the only hope was to buy or borrow equipment in Australia, and once again VK2WU and the Down Under DXers came to the rescue with a promise to help us track down whatever couldn't be brought from the UK.

In the end, I arrived at Gatwick airport with a suitcase containing a high power TS120 transceiver, an AEA Morsematic keyer, paddles, co-ax, tools, antenna wire, microphones and headphones, and a rather large piece of hand baggage containing clothes for a month! 38 hours later, after visits to transit lounges at Frankfurt, Abu Dhabi, Singapore, Djakarta, Bali and Melbourne (there is a reason why cheap flights are cheap!), I staggered through Sydney airport and checked into the local Youth Hostel to recuperate. Richard had arrived there by bicycle from Canberra a few days earlier.

Les, VK2WU, immediately invited us to stay at his QTH in the Blue Mountains some 50 miles from downtown Sydney, and told us that the Down Under DXers had been as good as their word. Sandy, VK2AD, had agreed to lend a 12 volt PSU for the TS120, and Jan, VK2CIA (ex SP9PCA), would part with his spare Icom HF rig for a couple of weeks. The linears however, were going to be a problem because of weight restrictions on the flight to Lord Howe. It seemed that the winter schedule of three flights a week was being operated by a small 12-seat aircraft restricted to carrying 9 passengers so that it could take enough fuel to get back to the Australian mainland whenever bad weather prevented a landing on Lord Howe. The baggage allowance was 17.5 kg per passenger, with very small excess amounts (charged at $2.00 per kilo each way) permitted only if the aircraft was below its maximum weight. The transceivers with their power supplies weighed close to 17 kg each so the linears were reluctantly scratched from the plans.

Lord Howe Island

The final preparatory task was to arrange licensing and obtain our VK9L callsigns — VK9L being the prefix assigned to Lord Howe. Richard, a CW enthusiast, had already exchanged his VK6ARN call for VK9LW rather than operate as VK6ARN/VK9L (!) and I was relying on the ability of the Australian Department of Communications to issue my new licence over the counter. Everything went smoothly and it took less than half an hour at the office in North Sydney to make me the owner of VK9LX. The officials had simply asked for a look at my licence and a copy of a letter from the Radio Amateur Licensing Unit confirming that it was still in force, plus of course the fee of $19.00.



The attractive station of Lord Howe resident Dick Hoffman, VK9LH, who earns his living as an artist, specialising in landscapes.

It was a bit unfair, but we just had to try out our new callsigns from VK2WU's super-station before setting out for Lord Howe. 400W into stacked monobanders generated some enormous pile-ups with people not hearing, or not wanting to hear, the "portable VK2" at the end of our calls!

Bound for Lord Howe

The check-in procedure at Sydney airport was fairly rigorous, with not only the luggage but also the passengers being weighed. It was tempting to transfer some of the heavier stuff into our pockets to reduce the excess baggage charge, but a quick experiment showed that the resulting external appearances were very odd indeed.

The flight was an informal affair. One of the passengers was invited to take the co-pilot's seat and the pilot himself served the coffee and biscuits! By 1430 local time we were approaching Lord Howe after a 90 minute journey but the weather which had been excellent at Sydney was deteriorating rapidly. The radar showed a solid mass of cloud, and the descent from 28,000 feet was extremely bumpy. When we finally broke through cloudbase at 500 feet the little 3000 foot runway next to the twin peaks of Mount Lidgbird (named after the discoverer Lt. Henry Lidgbird Ball) and Mount Gower looked an impossible target for the wildly gyrating aircraft. The pilot took it all in his stride, however, and the landing was perfect. We were safe, though a little green about the gills.

Our first impression of the island was of a very green, sodden landscape rising steeply into a low layer of grey cloud. The temperature was in the 60s and the rain torrential. Despite the weather, there was a crowd of about 30 people sheltering in and around the one room terminal building.

Bill, the manager of Polynesian Apartments, was there to take us to our new QTH, and also waiting to greet us was Dick VK9LH (formerly VK2AGT/LH, whose QSL card had first made me determined to visit the place) and his English born xyl Noelle. Dick took a quick look at our luggage and, realising that we hadn't managed to bring a linear, immediately offered us his FL2100Z. We'd landed safely and on our feet!

Although we didn't realise it at the time, Lord Howe's other resident amateur, Ken Hicks, VK9LK, was also in the crowd. Ken is the island doctor and is well known in Australia for his slow morse classes on 80 metres, almost the only time he gets on the air. We were not to meet him for several days, but when eventually we did, he offered to lend us a second FL2100Z!

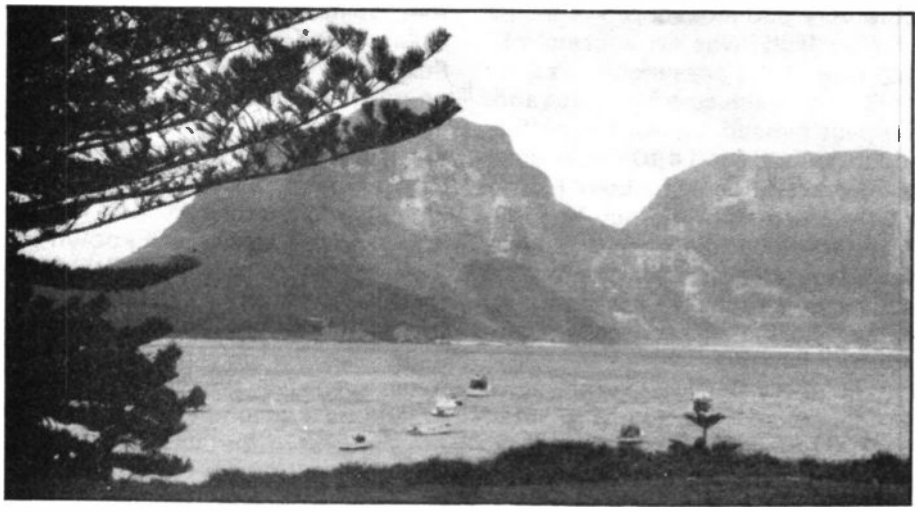
The rest of that day was a mad rush to get some antennas up before darkness fell, and by 1800 we had a 40 metre dipole at 35 feet (slung between two palm trees) and a sloping 20 metre dipole. The next morning the 20 metre dipole was converted to a two element wire beam, which at 30 feet provided more psychological dBs than real ones, and for 10 metres a sloping dipole was erected.

Conditions

In a nutshell, conditions during our stay were grim. Ten metres opened only to Japan and then on only a couple of occasions, with the loudest signals peaking at S1. Fifteen opened very weakly to W5,6,7 & 0 around mid-day, and JAs would come through from time to time, peaking mid-morning and mid-afternoon. Only three Europeans were worked on the band, 2 YUs and a UB5 around 0900 hrs. Note, Lord Howe Island is 10½ hours ahead of GMT!

Twenty was disappointing, with Ws only workable from mid-afternoon to early evening and again briefly around 2200 local time, at their dawn. Southern Europe was workable most days around 1800 local time (0730hrs) on the long path, and audible most mornings at 0800 local (2130hrs) on the short path. The paths to the UK and northern Europe were quite different, with Gs being worked on only a couple of days. The short path openings to Europe were particularly frustating as we could hear numerous stations beaming west and working Ws instead of north-east and working us.

Forty was a very pleasant surprise. There were excellent openings to the USA from an hour or two before our sunset to an hour or



The twin peaks of Mts Lidgbird and Gower

two after their sunrise and Europe was extremely good copy at S1-5 for up to 8 hours a day — four hours on the short path and four hours on the long path. However, our signal seemed to peak above the European noise level for only about one hour, around 0630hrs, just before our sunset and long after European sunrise.

Eighty was reasonably successful, considering that our antenna was an inverted V with the apex at 30 feet. Numerous JAs and Ws were worked, and one morning (at 2000hrs) about 10 Europeans could be heard taking it in turns to call us on sked. None of these made it into the log because, just as the band was peaking, they gave up and decided to work a Z21 who was calling them! Realistically, I doubt whether our signal, even at the peak, would have got through the typical July noise levels at their end.

Radio propagation in general was a reminder of Australia's geographical isolation. Most of the world's amateurs live a long way from VK, at least 3 or 4 F layer ''skips'' — a very different situation from Europe where there is a very large population within two ''skips''. We shouldn't really have been surprised that the HF bands were dead for most of the day.

Our final QSO tally was just over 5000, mostly JAs and Ws but with a reasonable number of Europeans on 20 and 40 metres.

An automatic telephone exchange meets the islanders communications needs and connects them with the mainland through 4 automatic HF radio circuits. These caused us some QRM on the amateur bands as we were only a hundred metres from the transmitters, but future expeditions should have no trouble as the island will probably be covered by the AusSat domestic satellite system.

An island radio station broadcasts for a few hours a day on medium wave and although there is no TV service, colour TVs and VCRs are, unfortunately for the visiting DXer, widespread.

The Local Operators

Of the two resident operators, Dick Hoffmann, VK9LH, and Ken Hicks, VK9LK, only Dick is regularly active on the HF bands. He and his xyl Noelle are the island artists, specialising in landscape paintings, leather and basket work. While working in the same room-cum-studio Dick is able to keep an ear on the marine and amateur bands. His equipment includes several HF transceivers, an FL2100Z linear, and a TH3 on a 35' scaffold pole.

When we visited the island Dick and Noelle had just completed the 10 years required before they could purchase their own property and were in the process of constructing their dream house on an empty lot close to their rented QTH. This was taking up a lot of Dick's time, but by the time this article is printed they should be safely ensconced and VK9LH should once again be fairly easy to find on 20m.

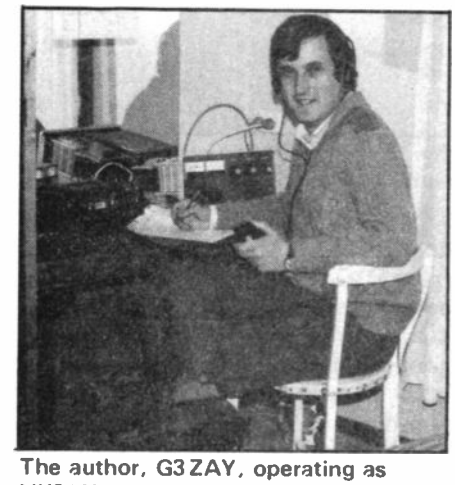
Ken Hicks, VK9LK, is no stranger to DXing as in the past he has operated with VK0 calls from Australian Antarctic stations, but he now confines himself to ragchewing and conducting CW classes on 80m.

Going Home

The one week on the island just flew by and in retrospect seems like a very brief succession of skeds separated by beach barbeques and swims in the lagoon. As always the antennas came down much faster than they went up and we were on the air until about an hour and a half before departure time. With only 9 people going out on the flight, the airline agent was able to telephone each passenger individually when the plane left Sydney to avoid too long a wait at the airport.

For visitors other than DX operators the island and its coral reef can offer a range of attractions including swimming, snorkelling, scuba diving, surfing, mountaineering, cycling, and walking. There is no single population centre, the houses being scattered uniformly across the non-mountainous areas and linked by a network of rather delapidated unlit roads.

The climate is milder than the Australian mainland in winter and cooler in summer. During our winter visit the temperature climbed into the mid 60s on most days, and the sea was substantially warmer than it gets anywhere around the UK, even in midsummer. The vegetation is sub-tropical, with palm trees and banyan trees covering the low ground.



The author, G3ZAY, operating as VK9LX

It would be a long way to go just for a DXpedition but if you find you can combine the trip with other activities in Australia, make sure you take an excursion to Lord Howe Island — a sub-tropical paradise.

RADIO Tomorrow

Your at-a-glance guide to what's happening around the clubs, on the air and in general radio-wise.

1 April
Horndean DARC: *Working Mobile — The Problems of Suppression* by G4DIU.
Rhyl DARC: *Equipment Demonstration with G3LEQ.*
Sutton and Cheam RS: natter nite.
Worcester DARC: construction contest at the Old Pheasant.

2 April
Rugby ATS: AGM. Note the change to Tuesdays effective from this meeting.
Bristol ARC: video.
Wolverhampton DRS: AGM.
Chichester DARC: *QRP with G4BUE.*
Fylde ARS: *A Homebrew HF Transceiver by G3KEN.*
E Lancashire ARC: Crime Prevention.
Bury RS: informal.
Loughborough AREC: constructors group.

3 April
Three Counties ARC: *Amateur Radio Satellites with a member of AMSAT-UK.*
Willenhall ARS: surplus equipment sale.
S Bristol ARC: *CW Operation by G3XED.*
Cheshunt DARC: *A Bit Of a Lift On with G3YLA.*
Worthing DARC: meets every Wednesday at the Parish Hall, South Street, Worthing at 7.30pm.
Wirral DARC: Seven Stars drink and waffle (d + w).

4 April
Cray Valley RS: construction contest.
N Wakefield RC: on the air night.

5 April
Maltby ARS: DF Hunt.
Axe Vale ARC: meeting at the Cavalier, Axminster.
Loughborough AREC: pub social!

8 April
Amateur Radio and Computer Fair organised by N Wakefield RC, at the Bretton Hall College, near Wakefield. Starting at 11am, admission is free and stands will cater for radio, electronics and computers plus handicrafts and films. Talk-in S22 and RB15. Details from G4RGH 0532 536633.

9 April
Dartford Heath DFC: pre hunt meeting.
Chester DRS: *HF Aerials and ATUs by G3ENZ.*
Westmorland RS: *Oldham Batteries.*
Bury RS: main meeting.
Loughborough AREC: constructors group.

10 April
Willenhall ARS: meeting.
S Bristol ARC: QRP 2m activity night.
Farnborough DRS: bring and buy sale.
Cheshunt DARC: natter nite.
Ipswich RC: meeting.
Wirral DARC: *VHF in Small Boats with G4ZHF.*

11 April
N Wakefield RC: lecture/visit.
Edgware DRS: informal.
Southgate ARC: surplus equipment sale.

12 April
Wolverhampton ARS: 144MHz DF hunt.
Coventry ARS: night on the air.
Dunstable Downs RC: *Solar Factual Data by G8AHS.*
Clifton ARS: meeting.
Maltby ARS: *Licence Rules and Regulations Q and A.*
Radio Society of Harrow: junk sale.
Loughborough AREC: junk sale and open forum.

13-14 April
RSGB National Convention at the NEC, Birmingham. See you there!

14 April
Dartford Heath DFC: club hunt.
Wirral DARC: DF hunt starting at 1pm from Heswall layby.

15 April
Rhyl DARC: activity night.
Worcester DARC: informal.

16 April
Bristol ARC: night on the air.
Wolverhampton ARS: meeting.
Wakefield DRS: natter nite.
Fylde ARS: *Modifying Portable Broadcast Receivers for Top Band DF by G8GG.*
Chester DRS: *Installation of PMR Equipment by GW1ATZ.*
Bury RS: informal.
Loughborough AREC: constructors group.

17 April
Three Counties ARC: *Kit Construction with Wood and Douglas.*
Wirrall ARS: *QRP Working by Rev G Dobbs, G3RJV.*
S Bristol ARC: computer night.
Cheshunt DARC: *Chairman's Lecture — BBC Outside Broadcast Communications.*
Wirrall DARC: The Ridger public house for d + w.

18 April
Cray Valley RS: AGM.
N Wakefield RC: pub social.
Chichester DARC: meeting.
Colchester RC: meeting.

19 April
Sutton and Cheam RS: *Tape Recording by Malcolm Cummings.*
Coventry ARS: *PCBs and a small project.*
Clifton ARS: meeting.
Maltby ARS: *Short Wave Listening by G8NVS.*

W Kent ARS: AGM.
Radio Society of Harrow: activity night on top band
Loughborough AREC: 1st 160m DF hunt start 20.00.

21 April **RSGB Low Power Contest 07-11hrs, 1300-1700GMT, single operators on 3.5 and 7MHz only,**
RSGB 70MHz and SWL contest 09-15GMT.
Bristol ARC: computer night.
Wolverhampton ARS: *Wolverhampton Repeater Group and its repeaters.*
Midland ARS: surplus equipment sale.
Chester DRS: *Entertainment Electronics by GW8ICT.*
Bury RS: informal.
Loughborough AREC: constructors group.

24 April Farnborough DRS: *AMTOR by G4EMR and G4CJO.*
Cheshunt DARC: natter nite and RAE revision.
Ipswich RC: AGM.
Wirral DARC: Mobile Treasure Hunt from Irby at 8pm.

25 April N Wakefield RC: meeting.
Edgware DRS: *Operating Techniques by G3SJE and company.*
Greater Peterborough ARC: *VHF Now and Then with G5UM.*

26 April Coventry ARS: night on the air, bring along your PCB project.
Dunstable Downs RC: *The Best of QSL.*
Clifton ARS: meeting.
Maltby ARS: computer night.
Radio Society of Harrow: *Listening In by G3WCB.*
Loughborough AREC: meeting.

28 April **Southend DRS Mobile Rally at the Rochway Centre, Rochford, Essex. Stands cater for black boxes, components, bring and buy and much more. Ample parking nearby. Rest room for the weary and refreshments available. Talkin S22.**

29 April Worcester DARC: club night.

30 April Bristol ARC: meeting.
Wolverhampton ARS: home built equipment contest.
Wakefield DRS: *Amateur Radio in SE Asia.*
E Lancashire ARC: informal.
Chester DRS: Outside activity evening — the Yeld-Kelsall, Chester.
Bury RS: informal.
Loughborough AREC: constructors group.

1 May Three Counties ARC: *Horizontal FM by G4RRA.*
Wirral ARS: *DF Techniques.*
Worthing DARC: meets every Wednesday at the Parish Hall, South Street, Lancing at 7.30pm.
Cheshunt DARC: *The RSGB with G3VPK, RSGB zone C rep.*
Wirral DARC: Eastham Ferry Hotel d+w.

2 May Cray Valley RS: *The Micro Ham by G6CSY.*
N Wakefield RC: on the air night.

3 May Dartford Heath DFC: AGM.
Wirral ARS: annual dinner at the Heatherland Restaurant, Thurstaston.
Coventry ARS: visit.
Maltby ARS: *Getting on 23cm by G6OYL.*
Axe Vale ARC: meeting.
W. Kent ARS: construction contest.
Radio Society of Harrow: activity night on 10m.

6 May Horndean DARC: *Salvage of the SS Great Britain with G4BEQ.*
Rhyl DARC: ATV demonstration by GW8XLL.

7 May Dartford Heath DFC: pre hunt meeting.
Chichester DARC: club meeting.
E Lancashire ARC: *The Tornado Fighter Aircraft.*
Bury RS: informal.
Loughborough AREC: constructors group.
Fylde ARS: *A Few Words About The RSGB by G3XSN.*

8 May Farnborough DRS: *HF Contest Operating by G3TXF.*
Cheshunt DARC: natter nite.
Ipswich RC: meeting.
Wirral DARC: club station on the air.

9 May Edgware DRS: informal.
Southgate ARC: *Wind Loading and Safety of Towers by G3UDO of Allweld.*

10 May Coventry ARS: night on the air.
Maltby ARS: slow scan TV.
Loughborough AREC: RTTY evening.
Dunstable Downs RC: DF hunt on 160m and 2m.

11 May **Glasgow Amateur Radio Exhibition at the Cardonald College, starting at 11am. Parking available, many stalls and a lecture series. Further details from W of Scotland ARS. GM4JDU on 050 581 2708.**

12 May Dartford Heath DFC: club hunt.
Wolverhampton ARS: 144MHz DF hunt.
Drayton Mobile Rally
Wirral DARC: DF hunt.

14 May Wolverhampton ARS: meeting.
Wakefield DRS: *CW Operating.*
Chester DRS: Secret Listeners and W0ORE Lecture to Welsh Convention videos.
Westmorland RS: AGM.
Bury RS: main meeting.
Loughborough AREC: constructors group.

15 May Three Counties ARC: junk sale.
Wirral ARS: Display of Members Homebrew Equipment.
Cheshunt DARC: *Radio Paging by G6AXO of Harlow RS.*
Wirral DARC: Bassett Hound d+w.

16 May N Wakefield RC: Royal Observer Corps visit.

17 May Sutton and Cheam RS: AGM.
Maltby ARS: Visit by Lowe Electronics.
Loughborough AREC: social — darts and ale.
Coventry ARS: *Microwaves.*

19 May **Mid Ulster ARC Rally starts at 12 noon in the Thomas Doran Training Centre, Parkenaur (?) County Tyrone. All proceeds to charity and a good day's fun and entertainment for all. Further details from GI1CFS, QTHR.**

20 May Rhyl DARC: activity night.
Worcester DARC: informal.

21 May Fylde ARS: equipment sale.
Midland ARS: *Aerials for the Small Garden with G3BA.*
Chester DRS: meeting.
Bury RS: informal.
Loughborough AREC: constructors group.

22 May Farnborough DRS: HF Field Day Preview and natter nite.
Cheshunt DARC: natter nite.
Ipswich RC: Planning for the E Suffolk Wireless Revival.

23 May N Wakefield RC: social night.
Edgware DRS: constructors contest and NFD briefing.

	Greater Peterborough ARC: Preparing for VHF NFD, hopefully on 2m and 70cm.
24 May	Coventry ARS: night on the air Loughborough AREC: 2nd 160m DF. Dunstable Downs RC: *Weather Satellites by G8LOK.*
25-27 May	Wirral DARC: Special event station GB2IWF to mark the international waterways festival at Ellesmere Port Boat Museum HF, VHF and UHF.
26 May	**Maidstone YMCA ARS 1985 Biennial Mobile Rally at the 'Y' Sports Centre, Melrose Close, Cripple Street, Maidstone. Doors open at 11am. Refreshments available and many attractions.** East Suffold Wireless Revival at the Hollies. **Plymouth Amateur Radio Rally at the Devonport Secondary School, Park Avenue, Devonport, starting at 10am. Stalls include secondhand. Talkin' on S22 and RB2. Refreshments available.**
28 May	Mid Warwickshire ARS: natter nite. Wakefield DRS: bring and buy sale. E Lancashire ARS: informal. Bury RS: informal. Loughborough AREC: constructors group.
29 May	Three Counties ARC: home computer night. Cheshunt DARC: *Contest Operations Primer! by G3WFM.* Wirral DARC: pre season practice DF hunt from Heswall layby at 8pm.
30 May	N Wakefield RC: monthly meeting. **Edgware DRS/Ham Radio Today: Straight Key Evening. Catch us on 2m and 70cm and work the old pump handle in a pleasant evening's ragchew on 3.5MHz.**
31 May	Coventry ARS: VHF DF Contest.
1-2 Jun	**HF NFD 1600-1600 CW only on 1.8, 3.5, 7, 14, 21 and 28MHZ.**
1 Jun	Three Counties ARC: *Insurance for rigs with Mr Gibson.*

Will club secretaries please note that the deadline for the July segment of Radio Tomorrow (covering club activities from 1st June to 1st August) is 26th April.

Contacts

Axe Vale ARC	Bob Newland	029 74 5282
Barking RES	R. Woodberry	01 594 4009
Bath DARC	G4UMN	Frome 63939
Bristol ARC	G4YOC	Bitton 4116
Bury RS	Bryan Tydesley	0282 24254
Cambridge DARC	D. Wilcox	0954 50597
Cheshunt DARC	Roger Frisby	0992 464975
Chester DRS	Alan	Chester 40055
Chichester DARC	C. Bryan	0243 789587
Clifton ARS	Mr Hinton	01-301-1864
Coventry ARS	R. Tew	Coventry 73999
Dunstable Downs RC	Phill Morris	0582 607623
East Kent RS	Stuart Alexander	0227 68913
East Lancashire ARC	Stuart	0254 887385
Edgware DARS	John	01-306 4342
Exeter ARS	Roger Tipper	0392 68065
Farnborough DRS	Mr Taylor	0252 837581
Fylde RS	PRO	0253 737680
Greater Peterborough ARC	Frank	0733 231848
Halifax DARS	DL Moss	0422 202306
Harrow RS	Dave Atkins	0923 779942
Kidderminster DARS	Tony	Kidderminster 751584
Leighton Linslade RC	Pete Brazier	052 523 270
Loughborough ARC	Philip	0509 412043
Loughton DARS	G6FWT	01-508-7190
Maltby ARS	Ian Abel	0709 814911
Mid Sussex ARS	G1FRF	079 182937
Mid Ulster ARC	DF Campbell	0762 42620
Mid-Warwickshire ARS	G4TIL	Southam 4765
N. Wakefield RC	S. Thompson	0532 536633
Preston ARS	George Earnshaw	0772 718175
Reading DARC	Chris	Reading 471761
Rhyl DARC	GW1AKT	Nantglyn 469
S. Bristol ARS	Len Baker	0272 834282
S. Manchester ARC	Dave Holland	061 973 1837
Southdown ARS	P. Henly	0323 763123
Stockton DARS	John Walker	0642 582578
Stowmarket DARS	M. Goodrum	0449 676288
St. Helens DARC	A. Riley	051 430 9227
Telford DARS	Tom Crosbie	0952 597506
Three Counties ARC	R. Hodgson	0428 77368
Verulam ARC	H. Clayton Smith	St Albans 59318
Wakefield DRS	G8PBE	Wakefield 378727
Welland Valley ARS	J. Day	0858 32109
West Kent ARS	B. Guinnessy	0892 32877
Westmorland RS	G. Chapmman	0539 32877

Final preparations for the RAE

With the May RAE nearly upon us, our resident teacher, Sharon Metcalfe, BSc, G6LCC, provides some timely last minute advice.

So in a fit of enthusiasm, you entered for the next RAE. Then the exam seemed so far off that you *knew* you'd have plenty of time to learn all those facts. Now, with only a few weeks to the actual event, are you as confident? You may be one of the many 'older' candidates who haven't sat any type of exam since their schooldays — more years than you care to remember! So, where do you go from here in order to maximise your chances in the remaining time?

Whether you have been going to organised classes or not; now is the time to set aside at least half an hour a day for revision. By the way, it is worth remembering that studying for more than 45 minutes without a break can be counter-productive; the brain finds it difficult to concentrate for longer at one stretch. (Try two sessions separated by a 15 minute tea-break — a change of topic can also help.)

Where To Start

You may have been using various books to help you understand the basics of electronics as part of your course of study. By now you should have assimilated that information (or given up in despair on that particular topic?) and be treating the current *Radio Amateurs Examination Manual* by G L Benbow (published by the RSGB) as your 'bible'.

Looking through the RAE Manual may give you your own ideas about what to start with — and you may not need to read any further. More likely, you see a wealth of information, all of which, to make matters worse, seems equally important. It is worth remembering that facts are more easily memorised if first written down in your own abbreviated form (so buy yourself a nice new notebook and pen to inspire you). Working under definite headings, such as the book's chapters, will also help. A good way to begin is with a list of every equation given in the manual, together with what each letter stands for and the units used for their measurement. This will also enable someone else to test you since frequent revision is the best aid to remembering. For example, one equation could finish up as shown in Fig.1.

However, you may be able to reduce the actual learning if you have the mathematical ability to deduce one equation from another, or know enough algebra to re-arrange a known equation to find any required letter from the jumble. For example, if you are asked to calculate a power (Watts) and are given values for the current (I) and resistance (R), you can work out the relevant equation from knowing Ohm's Law ($V = IR$) and that power is given by $W = IV$. Since $V = IR$ and $W = IV$, then $W = I \times IR$ (by substituting for R) which is $W = I^2R$. Another example is where the RAE Manual quotes both the equations in Fig.2 for working out the total resistance in a circuit containing resistors in parallel. With some practice, you should be able to work out the second equation by just knowing the first. By the way, if maths is your weak point, you'll find that personal tuition with a friendly amateur (bribe them with a couple of pints) will make all the difference. The calculations given in the manual are a good basic guide and you should be able to work them all out.

$$\frac{1}{R} = \frac{1}{R_0} + \frac{1}{R_1} + \frac{1}{R_2} + \ldots.$$

and

$$R = \frac{1}{\frac{1}{R_0} + \frac{1}{R_1} + \frac{1}{R_2} + \ldots.}$$

Fig 2.

Remember, you are allowed to use a calculator in the exam. This may be unnecessary advice, but make sure you know how to use your calculator, especially the keys needed to enter such values as 6pF as 6×10^{-12} F. This can only be done on a 'scientific' calculator, so you may need to borrow one if

Fig 1.

$$f = \frac{1}{2\pi\sqrt{LC}}$$

Resonant frequency of tuned circuit, Hz

Inductance, Henrys

Capacitance, Farads

yours does not have an exponent (10 to the power of) function. (You also gain the value of π at the touch of a button, so you don't need to remember 3.14159 etc. If you find in your calculations that you are several powers of 10 away from a correct answer, you should check that you have done your working out with whole units, be they Farads, Hertz, Amps or Henrys — and distances are in metres. If you can bear it, try to make your calculations without sneaking a look at the four multiple choice answers first; you'll then have the satisfaction of knowing that you've got at least one question right.

Aide-Memoires

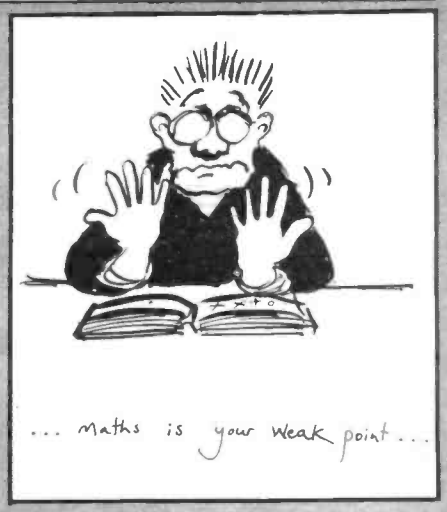
If the RAE Manual is your own, you might find that the next step is to read through a section, eg the silicon atom, and underline any key words that will help you to remember its contents. If you are not particularly conversant with, say, the inner workings of atoms, you may well find yourself being put off studying at this point. However, your aim is to pass the exam with what you *understand well enough to reproduce* so, head for the 'useful' information which is usually contained in the last sentence. Once you have found what you think is the essence of particular topic you are studying, note this down. For example the silicon Vs germanium sections of transistor theory could be summarised 'more current flows through germanium (Ge) than through silicon (Si) at high temperatures'. Then for your final condensed notes (which I'm afraid will have to be learnt eventually) all that is necessary to jog your memory on subsequent reading through may be:

at high temps I(Ge) > I(Si).

When looking for key words, you will find that the definitions of words printed in italics in the manual are well worth remembering. Going through the book in this manner will, I know, only give you a limited comprehension of electronic theory and its application to radio. However at this stage, the aim is to 'cram' as much *solid* information as possible; and you can't hope to remember work that still seems quite foreign to you. Having underlined your key words, you should then write your condensed notes in your notebook. Use diagrams annotated with 'essential' information wherever possible — pictures are usually easier to revise from. When it comes to memorising circuit diagrams, you should draw and redraw as many times as possible to ensure they are truly committed to memory.

Examinations should not be treated as purely memory tests, but it is a sad fact that most — including the RAE — are little more. So take heart if you have not done any maths or science since you were fourteen, passing the RAE can still be within your grasp. My friend Gail was one such candidate who, knowing that her understanding of radio theory was limited, started to learn sections of the RAE Manual by rote. She was very determined and her callsign G6MAA is proof of her success *at the first attempt.*

People who had learnt typical values of components by rote were actually at a distinct advantage in the latest (December 1984) exam. One question was set on the values



of components needed for a 'key click' filter. I know several candidates with a good grounding in electronics who wasted a considerable amount of their exam time trying to work out the values from first principles, before finding that there was insufficient data given. Those who had learnt such information straight from the manual were able to give an immediate answer. So *do* try to commit such little details to memory. If you are experienced in electronics, you may not find the exam to be the doddle you'd thought; for, whereas the 'average' candidate doesn't know more than what is contained in the RAE Manual, you may find yourself coming up with all kinds of 'clever' answers which are beyond the scope of the syllabus!

Learn The Licence

One section that you have no choice but to memorise is that on the licensing conditions. This is where the less scientifically minded candidate can excel. Indeed, the 'older' candidate can sometimes

Pictures... easier to revise from...

win hands down over a school leaver, as many questions can be answered from general knowledge and developed 'commonsense'. Be sure to include any changes printed at the front of the manual or as given in Radio Communication. (Any member of the RSGB will be able to help you here.) When reading through the regulations, please take note of such basic details as exactly what Great Britain means in this context and who issues permits for working from alternative premises.

. . . list every equation given. . .

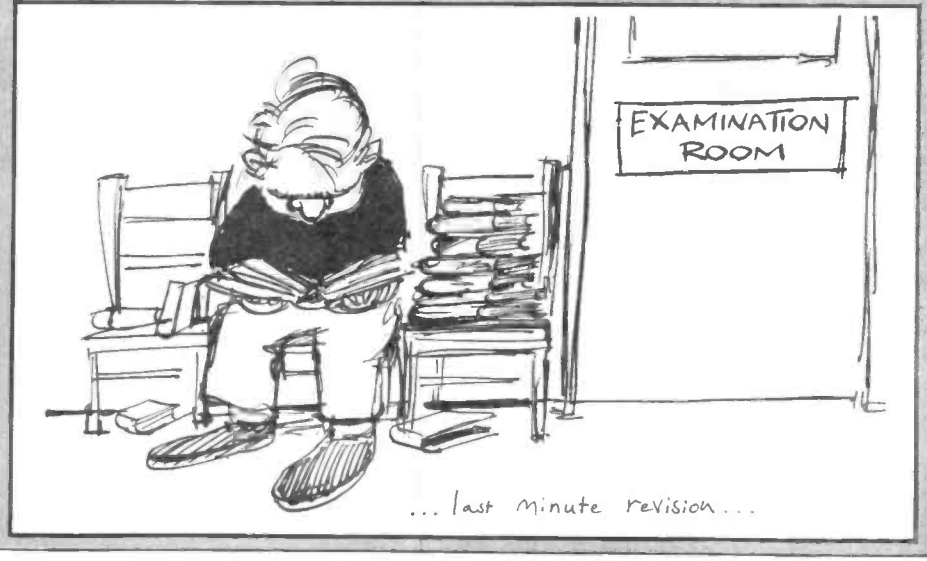
By all means, try to learn some of the numbers given under the Class A schedule, but if this looks too daunting, try to pick out the more obvious facts. I would summarise these by noting that the permitted PEP (peak envelope power) from 3.5-440 MHz (with the exception of the 70 MHz band) is always 26 dBW and this power limit applies to SSB operation from 1240 MHz upwards. Thereafter you'll just have to hope that you get a question you can answer! Similarly, the classes of emission A1A, A1B etc can probably be remembered more easily if the three components are treated independently (see **Table 1**). If this still seems too much like hard work, you just learn the more common ones eg F3E, J3E and A1A.

Looking at a breakdown of the content of the exam, such as in the manual, can also help put your task into perspective. In paper 1, most of your marks will come from the licensing conditions but you will need to have a little knowledge of transmitter interference. You could start your revision here by learning about the words in italics eg drift, chirp etc. It may also be within your grasp to learn simple circuit diagrams, such as a typical keyclick filter as I mentioned earlier — you only have to *recognise* them in the exam after all. However, you maybe forgiven if, at this late stage, the diagrams of the suppression of low-frequency spurious resonance seem beyond you. One diagram in the manual that is very informative is the block diagram showing the station equipment needed for the minimum of interference. It has already been annotated for you and as such will help clarify the chapter.

The second paper has several sections and it should be possible to pass the RAE while leaving out one of the sections completely. *(Not the electrical theory and calculations one please — it has far too many questions based on it.)* However, if the radio receiver section looks double Dutch to you, don't despair. (Indeed I could never look through the circuit of the trf receiver and state what each bit was for, but I still got a Distinction on this paper!) I suggest that you do as I did and concentrate on the block diagrams. Additionally, you could learn about the wanted signals and image frequencies produced by mixers and very little else. The chapters on the transmitter and on propagation and antennas are relatively simple to understand, so definitely learn these thoroughly.

. . . try to pick out the more obvious facts. . .

The chapter on operating practices needs some thought as to what to learn. The Q-code *looks* impossible to learn but by listening to the amateur bands you'll hear their use and it's always easier to learn something heard in context; at least ask some amateurs which one's they use regularly and try to remember these. (But watch out for non-standard versions — it's like asking experienced drivers how to drive so as to pass the driving test — they've always acquired 'bad' habits!) Your shortened list will pro-



... last minute revision...

First Symbol Type of modulation of of main carrier	Second Symbol Nature of signal(s) modulating main carrier	Third Symbol Type of information to be transmitted
N: emission of unmodulated carrier	0: no modulating signal	N: no information transmitted
Main carrier amplitude modulated (includes sub-carriers angle modulated):-	1: single channel containing quantised or digital info. without use of modulating subcarrier	A: telegraphy for aural reception
A: double sideband	2: as 1 but with use of modulating subcarrier	B: telegraphy for automatic reception
H: single sideband (ssb)	3: single channel containing analogue	C: facsimile
R: ssb reduced or variable carrier	7: two or more channels containing quantised or digital information	D: data transmission, telemetry, telecommand
J: ssb suppressed carrier	8: two or more channels containing analogue information	E: telephony including sound broadcasting
B: independant sideband	9: composite of one or more channels containing quantised or digital information, together with one or more channels containing analogue information	F: television (video)
C: vestigial sideband	X: cases not otherwise covered	W: combination of the above
Main carrier angle modulated:-		X: cases not otherwise covered
F: frequency modulation		
G: phase modulation		
D: main carrier is amplitude or angle modulated either simultaneously or in a pre-arranged sequence		
P: unmodulated sequence of pulses		
K: pulse sequence modulated in amplitude		
L: pulse sequence modulated in width/ duration		
M: pulse sequence modulated in position/ phase		
Q: carrier is angle modulated during the period of the pulse		
V: combination of above pulse emissions or those produced by other means		
W: cases not otherwise covered with main carrier modulated, either simultaneously or in a pre-established sequence, with two or more of the modes:- amplitude, angle, pulse		
X: cases not otherwise covered		

Classification of types of radio emissions. Scan this but *do not* attempt to remember it all!

bably look something like QRM, QRP, QRT, QRX, QRZ, QSL, QSP, QSY and QTH. Remembering these may be your limit and note that each has a questioning and a statement form, so you can safely opt to learn just one meaning for each. (What are your brains for it not to rework your knowledge and apply it to exam questions?!) It may help you to know that the December 1984 RAE didn't have one question on the Q-code. The Morse punctuation and procedure signals are also best ignored unless you have already learnt them. After all, this whole chapter is only useful for five out of sixty questions, which hardly seems a profitable return for a lot of hard learning!

The Big Day

So you have come to the day. It really is worrying to have to wait until 6.30 pm to sit the RAE, so if you were planning to take the day off work 'for last minute revision' — are you sure that it won't make you extra nervous? By all means take your RAE manual and notebook to work with you to read on the train, at lunchtime etc but, unless you know from experience that last minute cramming aids your recall, you could find yourself becoming more confused and even overworked. Indeed, staying up to 3am on the night before (or rather the morning of) the RAE could do little to improve your chances. A good night's sleep, so that you can think clearly, is bound is to be more beneficial.

You will of course remember to take to the exam a couple of HB pencils, a good rubber and a well-charged calculator. Does your centre require any certified photo for identification? Please don't forget these vital pieces of equipment. In fact, you might find it handy to have everything ready in a plastic bag the day before to be certain of no 'slip-ups'.

. . . if the radio receiver section looks double Dutch to you, don't despair. . .

You will need to arrive at the centre in good time but arriving half an hour before the exam is due to start will only make you more jittery. So aim to arrive with just a spare five or ten minutes to park the car and find the loo!

And so to the exam itself. have you turned off all the alarms on your digital watch? You're going to feel highly embarrassed if your alarm goes off in the silence, especially if you can't find the off button quickly! Look around at the other candidates as you are getting settled. Do they all look half your age! If so, you need a morale booster at this stage. The following was actually told to me as last minute advice when I took my teaching diploma, but I kept it as my motto when I took the RAE, to keep a sense of proportion. "Remember that as an 'older' candidate, you have far more commonsense and general experience than an 18 year old and as such are far more likely to pass the exam." Keep saying this to yourself and, assuming you've done your preparation for the RAE well, it only remains for me to wish you good luck and hope that once you've got your ticket you'll have fun on the air.

MICRO NET

Dave Bobbett, G4IRQ, gives an update on Packet Radio, including news of some interesting tests, and looks at the latest developments on the micro'/radio scene.

The first thing I must do this month is to draw attention to the fact that I am no longer at the address shown in the call book, having now moved on to pastures new, so to speak. Working from the relative chaos of half unpacked boxes means that various things have yet to be resolved but I can be contacted as detailed in the address box at the end of this column; if you have just written to me QTHR, don't worry as I have made arrangements to have mail sent on for a while yet. Don't forget that I'm always keen to hear from Micro-net readers, so please *do* drop me a line if you have something relevant or irrelevant to say.

At around the time that this issue of HRT reaches the news-stands, the government's latest budget plans will be announced to parliament; an event which normally doesn't evoke a great deal of comment from any sector of the specialist press. However, one item of special interest to those concerned with computer technology in general, will be the question of the BBC's licence fee proposals. If an increase is not forthcoming it is apparently likely that the various computer-related programmes and the continuing BASICODE program support will be the first to get scrapped. Just like the majority of people, my first reaction to any licence fee rise is 'Oh no, not again', but when you think about it there is more to it than that. Under it's charter the BBC is charged with the goal of providing a service which will 'educate, inform and entertain' the British public. To my way of thinking the computing programmes clearly fall into all three categories.

The peculiar thing is that whilst everybody acknowledges the fact that the new technologies are central to any future economic success which the UK may have, and whilst everybody likewise accepts that people must be educated in these fields — nobody seems to understand the simple idea that the money spent in educating or retraining people in these areas is an *investment* in the future.

And So To Lighter Things . . .

Nestling in amongst the mail this month were some interesting readers letters, the first coming from J. Spooner, G8OPI, of East Sussex who wanted to know if there were any Packet Radio programs available for the Sinclair 48K Spectrum. Perhaps this would be the right moment to mention that there are at least two generically different approaches to the problem of implementing a Packet Radio system on a home micro'. The first of these — which may be seen as being the 'real McCoy' — essentially consists of a black box Terminal Node Controller (TNC) which has two input/output ports.

One port is concerned with the control of the transceiver's transmit/receive switching and is responsible for the sending and receiving of audio coded data between the TNC and the rig. The second port communicates between the TNC and whatever unit is chosen as a terminal — the chances are that this would be a micro-computer. Whatever is used must have an RS232 port fitted to it. The micro' can be set up as a simple 'dumb terminal' using a short program. All that is required is for it to send data typed on the keyboard 'to' the TNC and decode and display coming 'from' the TNC. If required, the dumb terminal program can be expanded so as to offer useful facilities such as the copy of all exchanges onto disc or tape for future reference, or perhaps storing frequently used words and phrases to reduce typing errors.

Following the acceptance of what is known as the AX25 protocol by the American Radio Relay League and adopted recently by the RSGB, it is reasonable to assume that AX25 will rapidly become the international standard. These days, most commercial TNCs can at the very least handle this particular protocol and some units will also support others. All this sounds reasonably wonderful you may think, but there is unfortunately a catch. Of the two ready-built TNC units currently available, one of them is made in the USA and costs in the region of £500 (a price which was calculated *before* the pound reached near-parity with the dollar) and the other costs £280 — with a saving of £30 if you fancy the idea of making your own case.

So, getting back to G8OPI's original question, the first route to packet radio is to i) fit an RS232 interface to your micro' if it doesn't already have one and then ii) spend at least twice the cost of the computer on a purpose built TNC to hang on the end of it. Ouch!

An Alternative Route for Some

The other way to go about trying out a Packet Radio System (PRS) is to buy one of the PRS Simulator software programs, such as AMTEXT (by G3WRI) or the 'Cambridge Packet Radio Program' (by G6GIX and G8WJL), *both of these being for the BBC Micro only*. As far as I have been able to

```
 10 REM ******************************
 20 REM *   Experimental    AMTEXT   *
 30 REM *         300  Baud          *
 40 REM *    Receive Only Program    *
 50 REM *            BY              *
 60 REM *  Paul A Brown  -  G3WRI    *
 70 REM *    29th December 1984      *
 80 REM ******************************
 90 REM:
100 ON ERROR RUN
110 *TV255,1
120 MODE3 :VDU19,0,4,0,0,0 :A=&FE08 :B=&FE09 :C%=1 :D%=84
130 *FX151,16,45
140 *FX151,8,18
150 REPEAT UNTIL (?&FE08 AND 1)
160 E%=(?FE09 AND 127)
170 IF E%=126 THEN 180 ELSE 150
180 A%=?A :IF A% AND C% THEN 200
190 GOTO 180
200 REPEAT :B%=0 :B%=?B :IF A% AND D% THEN GOTO 240
210   IF B%<9 OR B%>127 THEN 250
220   IF B%=124 THEN PRINT': GOTO 150
230   VDU B%
240   A%=?A :UNTIL NOT (A% AND C%) : GOTO 180
250 *FX15,0
260 PRINT'"***** ERROR *****"' : GOTO 150
```

Fig.1 Simple program for receiving AMTEXT with a BBC 'B' micro

find out, there are no PRS simulator packages available for other microcomputers at present, which is a great shame when you consider the popularity of the Spectrum, Dragon, Atari and Commodore machines.

It is important to stress that these BBC-based programs are only PRS *simulators*, their authors point out that they are primarily intended for experimental use and because the AX25 protocol is not implemented, they are not suitable for international Packet Radio use. Incidentally, I have christened these programs *simulators* so a to differentiate them from any future software developments which may be capable of emulating the recommended AX25 protocol. They are capable of the same data identification, transfer and error checking procedures as any other basic packet system except they do it in a different way, reducing hardware overheads at the cost of being machine specific. Having said that, however, these programs do represent a very cheap way of 'testing the water'. Further details of these two programs can be found in the February '85 issue of HRT and ordering details are in the box.

Introducing Sarug

Another of the specialist interest groups which I've come across lately is one that caters for those who use Sinclair micro's in conjuction with amateur radio. The Sinclair Amateur Radio User Group (SARUG) publishes a newsletter five times a year which contains hints, tips and programs for the ZX81, Spectrum and Spectrum+ machines.

SARUG's December newsletter runs to 16 sides of A4 and contains reviews of commercial equipment and software, readers program listings (in this case, a Spectrum version of the Maidenhead QRA locator system and a UK repeater database) and also a mixture of 'fixes' for the various machines. In this issue, which is the only one I have presently seen, there were no 'goodies' for Sinclair QL users, but I suspect that it is only a matter of time before that situation is rectified. As with any other machine, there always tends to be a lull before specialist software becomes available.

More Packet News

I have recently received a letter from Paul Brown, G3WRI, who, obviously not content with writing the AMTEX packet program, is now launching himself into what could be described as the 'field trials' stage of developing this system. Every Sunday morning on 3.660MHz (lower side band) ± QRM and between 1000 and 1100hrs GMT, G3WRI and other members of the Westmoreland Radio Society's Packet Radio Group will be transmitting AMTEXT test packets. This will be part of the British Amateur Radio Teleprinter Group's new 'DATANET' venture, which is intended to act as a meeting place for all operators who are interested in RTTY, AMTOR, Packet or any other form of data communication. In the unlikley event of the frequency being a bit quiet, a 'CQ DATANET' call should get things moving along.

BARTG would welcome both reports and comments concerning the new net from anybody willing to put pen to paper — general comments should go to the BARTG Chairman (G3PPD) and AMTEXT-related communications should go to either G3WRI at his call-box address or G3XJI via Prestel (Micronet 800) Mailbox No. 919991873.

Don't forget to mention the date and time of any received transmissions of course. Paul tells me that the WRSPRG would greatly appreciate

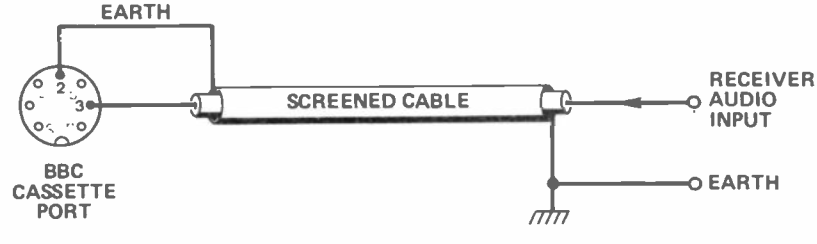


Fig.2 Connecting the BBC 'B' micro' to a receiver

reception reports which contained some extra feedback along the following lines:

1) Strength of both the received signal and any interference present.
2) How easily the signals were resolved.
3) The percentage of error-free packets received during the reception period.
4) Any drift or tuning problems.
5) The type of equipment used and also the method of sampling the incoming audio.

If you own, or can purloin, a BBC micro', you don't even need to have the complete software package because Paul has written a short program which will work in a 'receive only' mode (see **Fig. 1**) for these AMTEXT transmissions. Interfacing the micro and the rig is easy enough: **Fig. 2** shows the pin connections for the computer's cassette socket and it is simple a question of connecting the micro' up to the rig's tape-recorder output or other *low level* audio feed. However, *please do be cautious* — especially with valve gear, otherwise you risk cauterising the cassette interface chip.

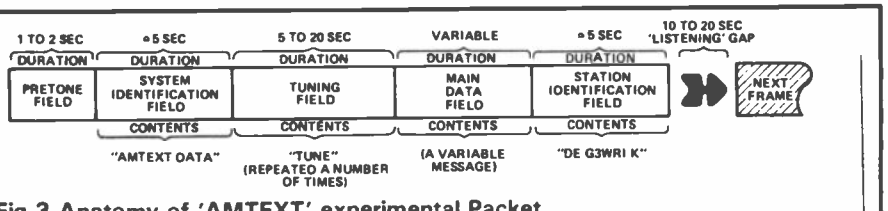


Fig.3 Anatomy of 'AMTEXT' experimental Packet

The February '85 edition of 'Micro-net' gives details of the permissible input levels for the BBC computer, and it is wise to check not only the amplitude of the AF feed but also whether (or not) the audio is superimposed upon some DC level — this latter point is especially important if you are considering a DIY approach.

As for the Packet Radio tests themselves, these will consist of a number of test frames, each of which will be separated by a 10 to 20 second listening period before the next frame is sent. The format of the test frames is shown in **Fig. 3** and consists of five main sections: a Pretone Field, a System Identification Field, a Tuning Field, the Main Data Field and finally a Station Identification Field, the purpose and content of each is briefly summarised in the diagram.

One problem with using SSB is that modern rigs tend to have very steep-sided filters which 'roll-off' dramatically once you get much above 2.1kHz or thereabouts. If you do have a sideband filter option, it's probably best to go for the widest usable bandwidth which conditions allow.

The transmission data rate is 300 baud and as I understand it, the BBC cassette interface is fairly tolerant of speed variation. With a 'slow' or 'fast' cassette recorder, both the *speed* of the data and the *frequency* of the tones change. What interests me is how the computer will react to a situation where the data speed remains the same but the tones vary as the receiver is adjusted.

One related development which Paul is already considering is the use of the micro' to remotely tune the transceiver so as to 'lock' onto the signal — I think that these experiments are destined to become very interesting indeed . . .

News Just In. . .

As I was just about to lay my typewriter to rest for another month, I received details of one more BBC-based communications package. Written by Russell Whitworth, G4CTP, of London, the 'Beebcom' program is really two programs in one and, like the PRS simulators mentioned earlier, works by making use of the BBC's cassette interface.

In the first of its two modes of operation, 'Beebcom' configures the micro' so as to act exactly like a 300 baud ASCII 'teletype', using the 2400/1200Hz tones of the cassette interface. *Because a number of other micros are capable of generating ASCII in this format, communication with other suitably equipped stations is possible.*

The second 'File Transfer' mode of operation is more complex than this and essentially consists of a form of packet radio which is designed to transfer user-specified areas of the computer's memory from one machine to another. The program automatically optimises the packet size (ie. the amount of data in each 'burst') for the current signal conditions — so that large packets will be sent under good conditions and smaller ones when conditions are bad. Presumably this is achieved by monitoring the number of times data packets have to be re-transmitted because of corruption and the resulting error-rate is used to determine the packet size.

In addition to this, the normal error-checking and correction processes are implemented so that uncorrupted data reception can be assured. For example, it would be possible to directly transfer a BASIC program from one machine to another without the risk of getting 'dodgy data'.

The review program, which arrived on a good quality C12 cassette, was accompanied by 11 pages of detailed and clearly printed instructions on how to use the system and accompanying drawings showing how to connect things up generally and how to overcome the interfacing problems encountered on certain Icom rigs (which use an annual method of transmit/-receive switching).

ADDRESS BOX
Please enclose an SAE when contacting these addresses as some are run on a voluntary basis. All prices include VAT.

'Cambridge' Packet Radio Program
Price £2.50 inc. P&P
'AMTEXT' Packet Radio Program
Price £2.50 inc. P&P
Both from:

RAMTOP
Great Billing Rectory
Northampton
NN3 4ED

Packet Radio Terminal Node Controllers (TNC's):
PKT-1 TNC Price £499.10 plus £2.50 P&P from:

ICS Electronics Ltd
PO Box 12
Arundel
West Sussex
BN18 0NX

PK-1 TNC Price £279.00 (Cased), £249.00 (Uncased) plus £2.50 P&P from:

Vomek Software
11 The Dell
Stevenage
Herts
SG1 1PH

Sinclair Amateur Radio User Group (SARUG) 5 Newsletters per year. Price £5.00 plus 5 SAE's. Details from:

Paul Newman (G4INP)
SARUG
3 Red House Lane
Leiston
Suffolk
IP16 4JZ

To contact 'Micro-net':

DG Bobbett (G4IRQ)
PO Box 49
Colchester
Essex
CO4 3SF

Please send general comments and reports on the BARTG 'DATANET' to:

BARTG Chairman
Stuart Dodson (G3PPD)
63 Malvern Avenue
South Harrow
Middlesex
HA2 9EU

Free Readers' ADS!

FOR SALE

FRG 7700 Yaesu's famous general coverage receiver 0-30MHz AM FM SSB CW. Boxed and in good condition £225 ono or swap for 2m multimode transceiver with cash adjustment. Phone Dilwyn 834 0747 (Manchester).

YAESU FT101ZD AM used mainly on Rx complete with Fan, FF-501DX, YE-7A mike £450. Also ham radio and amatuer radio from first edition to Dec 84, offers? Tele 0484 655568 evenings or weekend.

EXTEL M30 B215 KSR send/receive full baord 6 volt teleprinter. Excellent condition. For sale, cash offers invited Dent, No.4 The Mead, Old Basing. Basingstoke RG24 ODT, Evenings (0256) 52460.

FOR SALE HW8 Tx/Rx wkd 106C mods S-meter. RIT £70. Good condition. Ring Mr. Sorbie, Larkhall 887176.

YAESU FT 200 with PSU, mike, manual £180. Pye W15 AM complete, mike, cables, £20. Buyer collects. G3ATI 0234 54504 evenings.

ICOM IC720A, CW filter, mic, manual, mint, bargain at £550. IC2E handheld, autotone burst, speaker/mic, charger, 2 ants, £110. PF1 pocket phones, working well on RB0, £30. G4BJM. Phone 0908 567362 after 6 pm.

FOR SALE FRG 7700 with FRT 7700 both mint £250. Super Star 360 FM one year old, mint condition untouched original, best offer over £110. Phone Brian (London) 01-515 5517.

FT-757GX AM/FM/SSB/CW transceiver 2 cw filters; general coverage receiver 500 kHz to 30 MHz. RF amp and attenuator if shift variable bandwidth audi processor and compressor. Morse key, noise blanker, 2VFOS fan etc. £550. GM4SID 0224-584774.

TRIO TR7800 and PS10 PSU with memory back up supply, £150. MFJ 901 Versa tuner, tunes coax, wire and balanced lines. (4:1 balun built in) imported from USA, new unused £50. GM4DHJ tel 041 889 9010.

YAESU FT757GX multimode HF transceiver with matching heavy duty PSU and scanning microphone 2 months old and in mint condition. Redundancy forces sale £750 ono. Phone Stoke on Trent (0782) 44737 or 44877.

FOR SALE must clear microwave modules 2m/23cms transverter (new model) 2W out £175 ono. Metalfaye 17 ele cross Yagi 70cms brand new £40 ono. Phone Paul G4XHF (0293) 525201.

YAESU FR101 receiver; FL101 transmitter. digital display on receiver; manuals for both; both in good condition. Yaesu YD844A desk mike 600 ohm 50 kohm switch £350 ono. Super star 2000 25.965-28.005MHz AM/FM/SSB/CW. £150 ono. Mr. Pugh, 5 Back Lane, Normansheath, Malpas, Cheshire SY14 8DR.

EDDYSTONE receiver 670A £30; GEC scope 5" tube large-audio £20; various counters old type £5 each; 3 tuner amps working £5 each; car radio working £5; VCR 97 scope tube £6; TSL VHF tuner valves good £5; small scope (V139A tube)working £5; stereo speakers on board with tweeters £6; Mullard valve tester with cards £50. G6DDZ QTHR.

FOR SALE Icom 720A general coverage transceiver never used £600. Power supply with speaker ICPS20 £125. Diawa automatic antenna tuner CNA 1001 £125. All boxed and mint condition. Would split. Telephone Coventry 21810.

FT75 crystal controlled £70; FV50 VFO to suit £15; FT620 6M 15W out £175. 770R working, needs dial cord £35. Wanted SSTV equipment receive and transmit. GW4HBK. Phone 0495 228516.

KENWOOD TS530S, mint condx. includes installed 500Hz filter and matching SP230 loudspeaker. Inspection possible, buyer collects. £450. Apply 11 Chilton Close, Abingdon. Oxon. OX14 2AP (G4PSL).

Receiver for sale, RCA AR88D 500kHz to 32MHz. Has just been revalved, very good condition £60 ono. Telephone Tyne and Wear (0632) 834876, (Hebburn), after 6pm.

FOR SALE Kenwood TS530S VFO-240 SP-230 MC50 MIC. £625. Yaesu FT107M transceiver £625. Equipment is unmarked and in pristine condition. Buyers to collect. Ring Stuart 0642-211685, G400K QTHR.

TRS-80 computer system including CPU, green screen, cassette deck, printer, £200 + software CGC £250 ono. Also Trio TR-2300 VGC including NiCads charger, manual, Helical. £100 ono. Exchange both for TR-9130 or similar? Buyer collects! Tel. Macclesfield (0625) 614510, Andy G1HEH.

HW100 with HW101 mods and CW filter, SB610 monitor scope, SB650 digital frequency display, SB600 mains PSU and speaker, with manual, leads. Package deal £200. G3TFM QTHR. Tel Stratford on Avon (0789) 294055.

FOR SALE 934 'Reftec' transceiver, new frequency + 'reftec' colinear aerial and coaxial £250. Reason for sale: poor location. Buy collects. Tel: Ellesmere (Shropshire) 2368.

CENTRONICS 352-200CPS printer plus manuals and box paper. £220 ono 10MB winchester disc plus box PSU £80. 4 ele quad £20. Ringo Range 2m £10. Wanted 10xy for 2m and 70cm. Ring Glenn after 7pm. 0734 863881.

COLOUR GENIE computer, 16K, hi-res graphics, sound generator, parallel and serial ports. Microsoft 12K basic. Only 6 months old, in VGC £110 ono. Cowell G4XKH (098 064) 675.

TRIO/KENWOOD SM220 station monitor/scope (new) £220 ono. Microwave modules 2m/23cms transverter (new model) 2w out £185 ono. Metalfaye 70cms 17 ele cross Yagi (new) £38 ono NEWC 12" monochrome high resolution monitor (as new) £69 ono Phone Paul Crawley (0293) 515201.

AC VOLTAGE stabiliser. 600 watts mains in 240 volts stabilised out. Unused industrial units with handbook. £70. Telephone Peterborough (0733) 253446 evenings.

BELLING-LEE radio interference filter L1416 with leads 2amp £4. Belling flex lead suppressor 2-core for fan, etc. £3. other post office high pass filters. Low pass. suggest inspection mixed BA, etc bolts, nuts. Tuning condensers, smaller. Alan G3MBL Tel: 01 445 4321.

TRS80 64K Model 4 twin disk computer with Seikosha quality printer DMP. Complete + paper. 130 + discs. Disk storage. Many books, programs, w/pross, filing, reports, edit/ass, scripsit, manuals, mains filters + lots more equipment. Sell (offers) or exchange for VHF/UHF Base station + WHY 047385526.

PAIR of Dymar handheld portables, three channel FM frequency range 80MHz 102MHz good condition, complete NiCads £30. Pair of Starfones hand held UHF £25 0903 66329.

SCARAB RTTY unit MPTU-1 with Spectrum interface and software £65 ono. Tel daytime Bristol 0272-772508, evenings Bristol 0272-834799.

BELCOM LS202L good condition, covers 26.000 MHz to 29.999MHz. Modes include, FM, AM, USB, LSB, and CW. Frequency readout. Genuine reason for sale. 6 months old £200 ono. Ring Peterborough (0733) 310348 Mr. Smith.

FWO Eddystone 840 HF/MF comms Rx covering MW/SW broadcast bands through ham 1.8 to 28kHz AM ANL for SSB An efficient and handsome general coverage Rx £80. Tadley 2476.

YAESU FTV901R transverter 2m module £130. BNOS 144-10-100 linear £95. Jaybeam 10 ele parabeam £40. Welz JP15 meter £35. Yaesu FC902 ATU £90.

Phone Martyn, Lapford 471 (Devon).

SWAN 100MX transceiver £250, Atlas 210X transceiver £225. Take QRP p/ex WHY. Audiologic hifi bookcase amp tuner cassette, cheap offers. 35mm kowa camera 50mm 1.8 lens £20 wanted desk mic YAESU FT301 ATU or any other accessories. G3MXO 021 788 0518.

KWS 204 HF 100 transmitter 1.8MHz to 20MHz SSB AM CW in 9 bands. Complete with circuits and manual £100. Steve G4SXW, Sittingbourne 0795 28230. Also Trio 9R59DS. General cover receiver 0.55-30MHz with manual and patching lead for KW204 available.

FOR SALE Trio TR9000 2m multimode immaculate condition, £250. Pye UHF base station working £15. 19" rack approx 36" high £15. Telephone Ken, Farningham 862301, 7.30 to 9.00 pm.

HALLIERAFTERS HT37 Tx £125; Hallicrafters SR400 Tx/Rx 400W £200; Collins 32X3 Tx £250; Collins 75A4 Rx £375; G3GBB (0284) 66496 evenings and weekends.

SELL EXCHANGE telequipment laboratory oscilloscope D53 DC-15MHz £150. Marconi LCR bridge TF1313 0.25% Accuracy £50. Marconi oscillator TF1101 20Hz-200kHz £50. Heathkit laboratory signal generator IG42 100kHz-30MHz (not kit) £30, unmodified, no repairs. would exchange for FT200/FP200. Telepone Guisborough 33241 after 6pm.

PHOTOCOPIER Cannon C50 working but needs slight attention to carriage with spare boards for above. Hence bargain at £50. Signal generator type 101 UHF 400-610MHz £35. Singer electric typewriter, needs attention, has RTTY tape punch attached £5 ono. Telephone Tamworth (0827) 51591.

YAESU FT757GX Immaculate, only a few months old £575. FTV707 transverter CW 2m module £75. Hansen SWR/power meter £30. 20a power supply, £45. or £6 75 the lot, finance forces reluctant sale. Tel Bournemouth (0202) 301691 (day), 572871 (eve).

TRIO TR8300 10W 70cm, fitted 12 channels, boxed perfect, £150. Pye PF70 working 70cms 2 channels, with charger, battery, £50. Fidelity CB SWR meter, mobile antenna and macher, all as new £40. GW6AYM QTHR 0792 204146.

SHARP P6 dot matrix printer, cable and handbook, tractor and friction feed can be seen working £125. Also 60 floppy disks for MZ80A or MZ80B various software £100 for more details phone 04867 2462.

70CMS PALM 4 handheld, seven crystals £85. MMT 432/144R transverter, attenuators for 3W or 10W input £110 Dx200 300kHz to 30MHz continuous receiver, original packing, £75. Acorn electron with printer ROM interface, software etc £200. Gary, G6TBT 01 995 4701 evenings.

TRIO R1000 communications receiver. 200 kHz - 30 MHz. Includes DC kit, boxed ex cond £200. Phone Warrington 36784. Norman.

SX200N scanner as new £180 ono. Tyneside 2661610. 2731194 daytime.

2M FM mobile rig blazetone 200 144-146MHz. Phone 0742 372051 £120 ono.

EXPERT PD8500 transceiver AM/FM/USB/LSB, high mid low bands built in digital clock, five memory's, auto-scan buttons, digital keyboard entry, also citizen base station microphone only £120 ono. Tel 0422 817957 after 7pm ask for Peter.

SINCLAIR SPECTRUM 16K with cassette recorder, little use £70 or swap for AR88 in good condition phone Tollard Royal 07256 306 Dorset.

10 GHZ HARDWARE clearout. Please state wants with SAE EC10 Mk1, £50. KW107 supermatch, new and unused, £150. PF3 pocketphone, xtals for RB0,2,4,11 and SU8. New charger, 3 NiCads (one new) and holster. Offers. G3KSU QTHR 0983 65551.

KENWOOD TS430S all filters and FM board fitted, base and hand mikes, FC707 ATU, HF P/SWR meter 0-1000 AW, all with boxes and manuals, can be seen working, cost over £1100 accept £800 ono. Reason? 2m station wanted. Andy 0462 814511 after 6pm.

TRIO R.300 excellent condition £85. Bearcat 220 scanner £140. Sony ICF 2001 synthesised receiver as new £115. Standard C800 VHF autoscan fitted 10 channels plus 1 channel Tx £65. Phone Peter 01 643 5063.

YAESU FT207R 2m transciever NC2 charger/AC adaptor, YM24 speaker, mike, mag, mount, ⅝ whip, NiCads case, £150. Phone (07072) 71524.

COMPUTER DRAGON 32, all leads PSU etc. Approx £50 of software, for quick sale £110 ono. Phone Stamford Bridge, Yorks (0759) 72024 G1LTS.

FDK MULTI 700AY 2m 144-148MHz simplex to 143.950MHz variable RF output 1-25W. CW mobile bracket and manual had little use. £160. Woodstock 812278.

COMPLETE 2M BASE station. FDK750XX multimode output, Yaesu 20A power supply, rotator, eight element beam, ⅝ wave vertical, two way antenna switch, band pass filter, absorbtion wave meter, all cables, plugs, etc. £375. Telephone Southampton 692503.

YAESU 757 transceiver with automatic antenna tuner and heavy duty power supply one month old £890. Grundig satellite radio cost £400. 4 years old little used £150. Phone daytime 01 592 7800 or evening 0277 823434.

AR88D RECEIVER 500kHz-32MHz immaculate, good performer £65. Buyer collect. Phone Bill G4YZE Bolton (0204) 41317.

YAESU FRV-7700D converter £58. Datong 2m converter, complete with mains power unit converter £32. Global AT1000 aerial tuner, suitable any short wave receiver. £30 all complete with details and post paid. Mr Moore, 76 High Street, Ide, Exeter, Devon EX2 9RW.

FOR SALE labgear LG50 Tx, 80-10M, VFO, 50W, tatty but working £15. Farnell 12V 10A PSU vgc £25 2m Jaybeam antenna 5 ele vgc £7. BC221 frequency meter with PSU and charts, needs attention £10. James McIlroy G4EQX QTHR 0705 816176.

TRIO TS780 2m + 70cm with desk MC80 microphone SP70 SPKR as new excellent condition £700 or exchange Icom 271 with Mutek front end. G6TRC David 0642 557773.

IC271E MuTek f/end Adonis 5034 £600. Tokyo H7-power linear/preamp. 3 or 10W in 1602 out £150. Ex-computer PSU 30 amps continuous 13.9V £75 ono. TN16/APR4 tuning unit 38-95MHz 300-1000MHz Cw PSU £30. £800 the lot. Wanted TS780 or FT225RD and 70cms multimode. Telephone G6YRT 0734 596485. After 8pm or weekends can deliver 50 miles radius.

FOR SALE Icom IC490E, 70cm multimode, immaculate, little used, 14 watts, memory backup, manual, £350. Trio TR2500 as new with ST2 base unit, 2 NiCad packs, rubber duck, quarter wave flexible, case £200. Phone GM3HBT, Larkhall 883306 after 6pm.

FRG7700M as new £310, FT102 mint £550, FL2100Z new £500, FC102 new £155. All mint condition. Tel: 0792 401058.

STAG 357 multimode 11m transceiver AM/USB/LSB, excellent condition £30. Sharp, Cornwall House, St. German's Road, Exeter.

YAESU FT203R 2m FMTx/Rx 25W, 9 months old, immac, boxed £195. Tel 0304 375136.

FT208R, Nicads charger £140. Grundig satellite 3000, VHF/SW/MW/LW general coverage receiver LCD clock, LED freq display £120. Scarab MPTU-1 terminal unit suitable RTTY/AMTOR+Spectrum 48K and VIC20 RTTY progs £50. Tel: Jerry 01-553 7094/7308 8am to 5pm.

TRIO 7010 SSB/CW 2m Tx-Rx, ideal class B Morse, both in excellent order sell £90 each or exchange general coverage receiver. MMS2 morse tutor the best £125. Also other morse records tapes etc. Dave Northampton 36914.

SALE Yaesu FT225RD 2m all mode with muTek front end £425. Ring 0453 83 3411 (Nailsworth) Glos.

SSTV Wrasse ;sc422A scan-converter transmits and receives b/w and colour. Three picture memories, original packing, manual. Will pay Securicor delivery. £425. GD4HOX 0624 73264.

FLDX500 Tx FRDX500 £250 ono. Would exchange QRP rig. TRS80 computer extended colour 16K £80. Would exchange 2m SSB(CW Tx/Rx. Collect or carriage extra. Will

split Tx/Rx sale if necessary. McAllister, 1 Dunphail Road, Glasgow.

FOR SALE Yaesu 707 HF radio and rack complete in original boxes, consisting of power pack, antenna tuner, memory and transceiver. Excellent working order, cost £690 from amateur radio exchange Newton Le-Willows. No offers below £595. John Odgers, 136 Moss Lane, Liverpool L21 7NL.

YAESU FT7 Mobile transceiver excellent condition with BNOS power supply, headphones, microphone mounting brack. First class compensation delivery £260. Tel John 091-4162606 Tyne Wear.

FOR SALE Advance 2100 oscilloscope, double beam, with instruction book and service manual, leads etc, £100. Mr Davy, 12 Clover Drive, Thorrington, Essex, CO7 8HL.

REALISTIC DX200 receiver 0.4-30MHz with handbook. Good condition £50. J. Walton, 3 Maltkiln Cottage, Staindrop, Darlington, Co. Durham, DL2 3AG. Tel Staindrop 60774.

JAYBEAM 70cms 48 element £20; Met 2m 14 element £25; both aerials nearly new. Trio TS780 dual bander mint condition £695. M/M100S 10W in 100W out £95. Mr Sycamore, 50 Hillcross Avenue, Morden, Surrey SM4 4EB.

G-WHIP flexiten mobile antenna with coils for 8 bands, 80-2m £29. Bremi BRL200 10m linear, 250V AC plus 2 spare valves £40. Or exchange either for Sinclair Spectrum, Philips 1500 video cassettes £3 each. All carriage paid GM4EWM QTHR. Phone 034384 2530.

GNOME 35 photographic enlarger colour or black and white, with F3.5 click-stop lens new £42. Also dish warmer 24" x 15" 240V thermostate controlled new £8. Telephone Hereford 269953 G4SJZ QTHR.

ATV transmitter MTV435 as new £125; converter as new £22.50; MBM48 antenna £27; Eddystone 770R 19-165MHz good condition £85; Eddystone 770U needs attention £30; delivery by arrangement, G3CXI 11 Hardy Road, Bishops Cleeve, Cheltenham, Glos. Telephone 0242-67-3834.

ARGONAUT 509 for sale fine QRP rig £235 incl Securicor delivery. Phone Kevin 05047 66151.

TRIO TS-510 Tx/Rx plus PS-510 PSU £190. HRO receiver with full set coilpacks. HRO general coverage and bandspread coilpacks. HRO parts, offers wanted. DNT 10M FM Tx/Rx with repeater £30. Tel St. Albans 39333.

DISC DRIVE Apple compatible, working order, realistic offers around £100. Telephone 01-283 1880 work, 01-310 5123 home.

ICOM IC-R70 communications receiver as new only five months old, complete with box and manual £450. Buyer collects, South Bucks 0494 40001 evenings only.

MIZUHO 2M. SSB CW base portable rig with telescopic and flexi antennas NiCads charger and carrying case plus fist mic. £80. Shure 444 base mic wired for Yaesu £25. G-Whip multi mobile antenna six bander £25. Telephone 0293 515711.

GEC SCOPE 5" large good £20; Eddystone Rx MOD 670A good £25, Philips VCR97 with shield good £5; R475 Rx good £25; Dawes valve voltmeter - AC good £15; small scope homemade works £10, G6DDZ, 5 Collingwood Ave, Muswell Hill, London.

70MHz TRANSVERTER for sale FTV107R transverter with 4m module, £95 ono. G3SYS, c/o CP van Hagen, G1BIJ, 18 Fraser Court, Handbridge, Chester. Tel: 0244 676570.

FOR SALE Yaesu FRG7700 receiver and FRT7700 ATU both mint condition £275. Super Star 360FM mint condition, untouched original, hardly used, best offer over £110. Consider P/X HF equipment. Phone Brian 01-515 5517.

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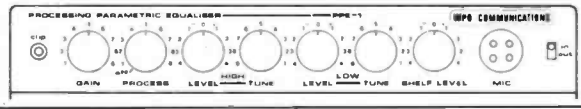

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