HAM RADIO TODAY

AN ARGUS SPECIALIST PUBLICATION

SEPTEMBER '84

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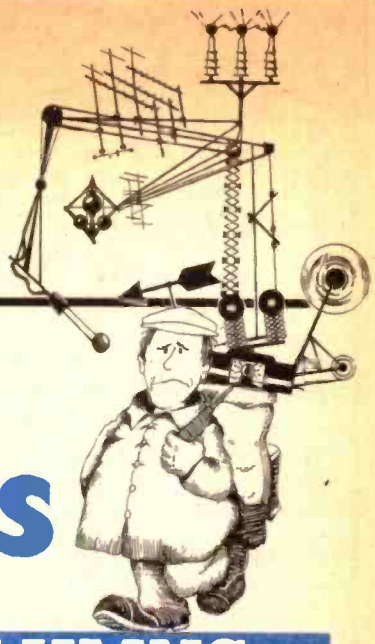

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LETTERS

FIFTEEN ALL

Sir, to all those who do *not* support the introduction of a novice licence — I *do*. Two can play at this game.

P. Thompson

AMATEUR RADIO NOVICE LICENCE CAMPAIGN

Sir, A mistaken impression is being given of the proposed UK novice licence and the reasons why it is now necessary. I hope you will allow me to clarify the position of the ARNLC.

Firstly, the idea of a novice licence is not new. I have been pursuing it for 15 years, as has the RSGB for some 37 years, so for people to now say that the aim of the novice licence is to pamper to 'CBers' is a false argument. A novice licence has nothing to do with CB. Its aim is to put back into the hobby of Amateur Radio what was there when I started, an apprenticeship in radio: learning by doing. At the moment the air waves are full of Black Box operators, a lot of whom do not stay, because they have never gotten a true 'feel' for the hobby.

The present route into the hobby from the chaos of CB is unacceptable. Those who think that this route will not in time damage our hobby are not being realistic. The fact is that to attract people into our hobby we must offer an alternative to CB — which must be a lower class of amateur radio licence. It would be easier but very restricted, but what is wrong with that, given its aim? Let us not have the class A vs class B argument all over again. After all, when the class B licence was introduced the same could have been said that the class B's were being "molly-coddled" etc. Now there are more class B than class A licensees.

The novice licence would put the self-training back into the hobby. How many new G4's have had their first QSOs on CW with the American novice licensees? A novice licence would have no age requirement, 10 watts maximum power, be CW *only* on the CW parts of 28, 21, 7 and 3.5 MHz amateur bands. The licence would be valid for 2 years — if you did not upgrade in that time then the licence would be lost for 1 year.

The novice licence has proven extremely popular in the 28 countries that have already introduced one. It has brought a lot of people into the hobby who would otherwise not have found it; some of these people have gone on into the field of radio/electronics to become very highly qualified. Can we afford not to give such people an opportunity to discover the hobby? Whilst there are those in amateur radio who show false prejudice then I predict that the future of the hobby as I have known it is in great doubt.

The novice licence has the full support of the RSGB, the G-QRP Club and other respectable bodies. I have also received hundreds of letters of support.

Ian Abel, G3ZHI, Secretary ARNLC

"WHO THE HELL ARE THEY CALLING COMMON!

*Ian has also provided HRT with a fairly detailed proposal for the licence. The letter contains most of the main points but misses out on perhaps the most fundamental. To obtain this licence, a morse test at 5wpm and a technical examination must be attempted. The examination would cover radio theory, operational theory and licence conditions — **at a lower level than the present RAE**. The examination would be set by the City and Guilds and the morse test would be "examined by appointed amateurs, such appointments being made by the RSGB or local Radio Interference Officer." The latter sounds OK in theory but the "appointed amateurs" could hardly be expected to provide this service voluntarily. . .*

*So, what ARNLC are proposing is basically an additional lower grade of licence, certainly not quite a charter for free-loaders. As far as the Editor is concerned, and he has said this before, the present RAE can be passed by **anyone** with sufficient interest and **application**. On the basis that a novice licence should be introduced because the RAE is too difficult, definitely no dice.*

However, there is another way of approaching this. Although many of the HF bands are overcrowded, the 28MHz band is very quiet. And who has heard anyone on 18 and 24MHz lately. . .

How about this ARNLC? — a class 'C' licence offering CW operation at 10W maximum on a 25 KHz of 3.5MHz (the CW end of this band can be pretty quiet) and 50kHz of 28 MHz — and perhaps with equal rights to the present Class A licence on 18 and 24 MHz. The CW test to be administered by the Post Office on a similar basis to the present Class 'A' test and a C&G examination with the emphasis on operational procedure and the prevention of interference.

I don't think a licence of this kind will decrease 'black box' operation much, but it will fill up some underused segments of our allocation and introduce quite a few more people to the delights of

CW operation. What say you, readers?

PRACTICAL JACK

While it might appal the purist, the choice of MOSFET in Jack Hum's 6m converter seems to me almost ideal.

Having used this MOSFET recently, both in 70MHz IF amplifier design and broadband video, I have interpreted the data sheet into a practically orientated form. Some of this information is here summarised for the interest of constructors.
Transfer admittance 10ma/V
Drain/Source voltage (MAX) 20V
Drain Current (Max) 20mA

A noise figure of typically 0-7dB can be obtained at 100MHz with a source resistance of about 1k8 in parallel with about 2pF and a gate 2 bias (Vg25) of 4V. (In order to achieve a reasonable gain a high impedance tuned drain load is needed).

Andrew Armstrong, G3YZW

MISCARRIAGE OF JUSTICE

Sir, Warning to all Amateur Radio Operators!!; one believes that this is a pleasant harmless hobby?? but may I suggest that they change to Stamp, Butterfly collecting. It has been said in the past that the easiest way to become a law breaker was just to own a car but, according to the Argus, Thursday, 21 June 84, this isn't so! One ham, of 11 years operating, didn't give out his call sign and forgot to enter in his Logbook! Bingo, £100 fine and £50 costs. Also in the same paper, clubbing another person with an iron bar (which could have killed?) £75 compensation to the innocent victim (I wonder if he ever gets it?) and the culprit told not to do it again? Sell your rigs, tear up your log books — iron bars are cheaper to buy and use??

Reg Moores, G3GZT/VS6CD

Radio ham fined £100

A radio ham, who 11 years ago was the youngest person to hold an amateur licence, transmitted without using a call-sign or making a log, Brighton magistrates heard today.

Computer consultant, Paul Thomas Russell, 26, of Montpelier Road, Brighton, admitted failing to log a call, failing to notify a change of address to the licensing authorities, and two offences of not using a proper call-sign, all in breach of conditions of holding a licence.

He was fined £100 with £50 costs. The prosecution was brought by the Home Office, under the 1949 Wireless Telegraphy Act.

ABUSE OF RAYNET

Sir, May we, through your letters section, bring to the attention of your readership an issue of vital importance to all Radio Amateurs, and also to the future of Amateur Radio in general.

The issue is the use of Amateur Radio frequencies by the RAYNET organisation for exercises on behalf of County emergency planning officers to do with 'Home Defence'. These exercises, using the two meter and seventy cms bands, seem to becoming more and more regular, and during these exercises many licence conditions are being broken, and complete disregard for normal Amateur conventions is the rule.

The RSGB refuses to enter into discussion of this matter, many letters have been written to the RSGB council without the courtesy of a reply, and letters to RADCOM have been refused publication. Because of this reaction, this society has been formed, the membership of which includes amateurs of all shades of opinion throughout the British Isles and also in other countries, but united on this issue. The main aim of this Society is:- to maintain the impartial use of the frequencies allocated to Amateur Radio, by ensuring that they are not used for propaganda purposes, nor for any military, quasi-military, or for any sectarian purposes.

This society is non-political, and is not anti-RAYNET, having many members of RAYNET in its membership. Our main worry is that this use of Amateur Radio frequencies will put in doubt the future of Amateur Radio.

I am enclosing a copy of a leaflet that our members distributed at the RSGB national convention recently. If you or any of your readers would like more information, please contact me at the address below.

Sid Frisby, G4NFF

Sid may be reached at 42 Holsworthy Road, Bowthorpe, NORWICH, Norfolk. Whilst I agree with much in the letter, I was disturbed by a paragraph in the SPARS manifesto, distributed at the NEC, which read "To monitor the amateur radio frequencies so as to detect any further abuse, and to advise operators of their obligations as to their conduct whilst using amateur radio frequencies, in order to establish behaviour which is acceptable to all other amateur radio operators on a legal, social, and moral basis."

This rather smacks of Mary Whitehouse and Big Brother — in direct contradiction to the concerned liberalism of much of the manifesto.

Please address correspondence to:
Ham Radio Today,
1, Golden Square,
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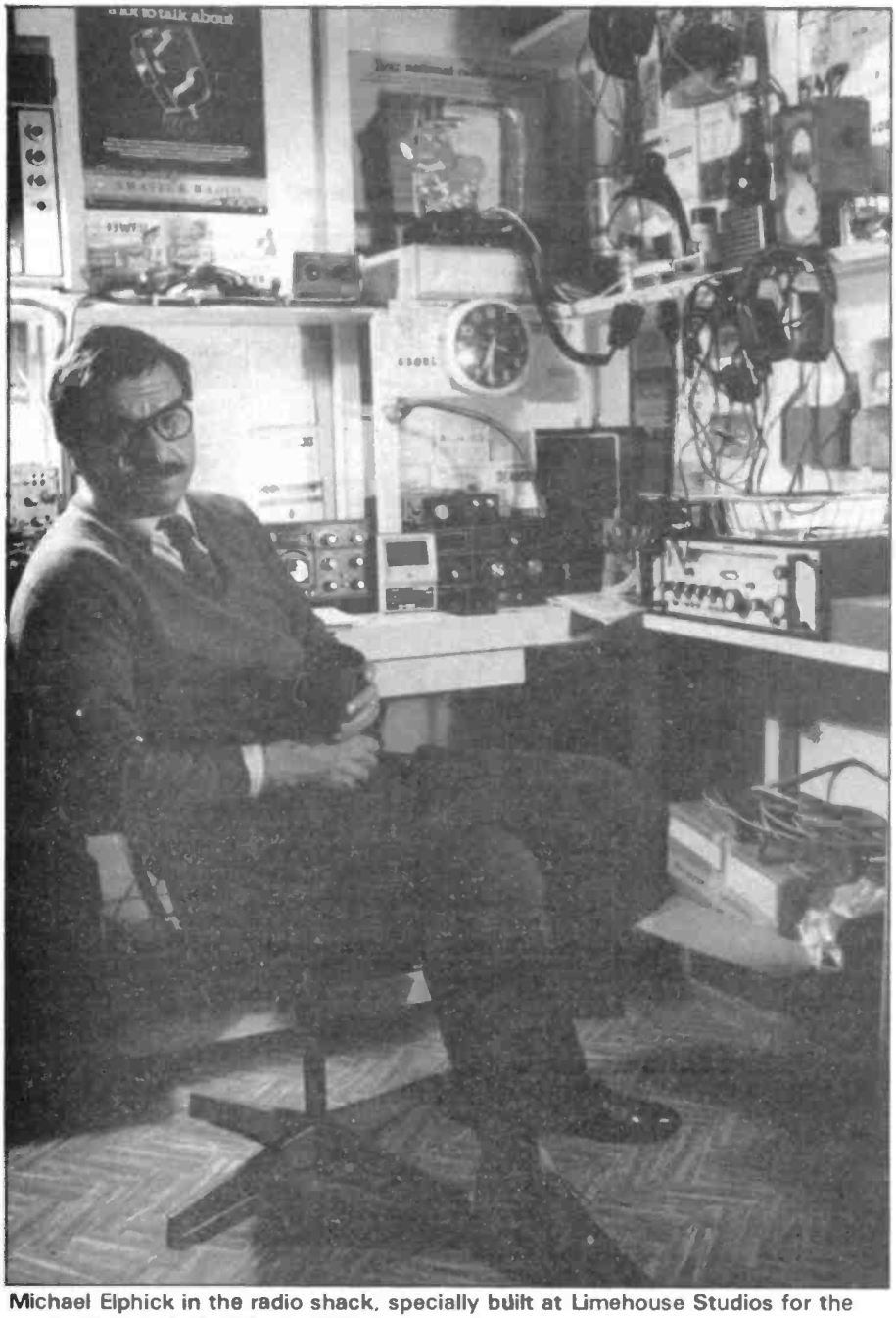
RADIO TODAY



Michael Elphick in the radio shack, specially built at Limehouse Studios for the production of Paula Milne's 'CQ'

Ham Radio Today — The Movie!

The last time Amateur Radio was dramatised for TV was Tony Handcock's hilarious but rather quaint 'The Radio Ham'. News recently reached the *HRT* office of a new and promising play about our hobby. 'CQ', a new play by 'Driving Ambition' author Paula Milne, has just completed shooting at Limehouse Studious. This has been produced for Limehouse Productions and Channel 4 by Susi Hush and directed by Moira Armstrong.

The play is the story of Norman, an amateur radio enthusiast who becomes the 'voice' of a round-the-world yachtsman and wins local fame on radio and TV with his daily bulletins of the lone sailor's progress — until a sudden loss of radio contact with the yachtsman threatens his new-found celebrity status.

Meticulous attention has reportedly been paid throughout the production to the modus operandi of the amateur radio world. Equipment for Norman's shack was obtained from Amcomm Services Ltd of Harrow and the various books and wall charts from the RSGB. Peter would like to thank both of these for their great helpfulness.

All the individual call-signs featured during the play are genuine, although currently unused. The production had a technical advisor, Peter Marcham, G3YXZ, who ensured authenticity in the radio conversations, and also advised on the correct equipment for Norman's radio shack. This includes a transmitting aerial attached to the roof of Norman's house which, in exterior shots, is shown nestling among the chimney pots and television aerials. HRT readers, particularly those who dwell in cities, may cast envious and even disbelieving eyes on the possibility of a 5 element yagi from a semi-detached surburban. Well, this is actually part of the plot...

That being said, the street, Norman's house and the aerial-filled skyline are actually miniatures specially built for the production by Richard Henry, a former BBC senior designer who now concentrates on his hobby of model making.

'CQ' stars Michael Elphick as Norman, the insurance loss adjuster by day, whose prowess across the airwaves earns him the renewed respect and admiration of family and friends, and Michael Graham-Cox is Alec, the nautical wayfarer whose erratic exploits make such a profound difference to Norman's life. The cast also includes Marjorie Yates as Norman's wife, June and newscaster Gordon Honeycombe

as a television presenter.

Full details of the screening date are not presently available but it is hoped that the play will be shown around mid-October in a fairly 'prime' evening slot. Watch this space for more information...

Scottish Amateur Radio Convention

This year's Scottish Amateur Radio Convention, to be held in Glasgow on Saturday, 8 September, should be an even bigger event than last year's 'record-breaker' at the same venue according to the organisers.

More traders have been attracted to exhibit this time than have appeared at any previous show north of the Border, a larger amount of various aspects of the hobby has been arranged and new record attendances are expected.

The RSGB will have an information stand with books and there will be the traditional large bring-and-buy sale.

The organisers, from the West of Scotland Amateur Radio Society, have arranged a programme of lectures including: "Amateur radio — an alternative approach" by Rev. George Dobbs, G3RJV, of QRP fame, "Modern Developments in Electronics" by Chris Bartram, G4DGU, of Mutek Ltd., and "An EME DXpedition to Andorra" by the HADRABS contest group.

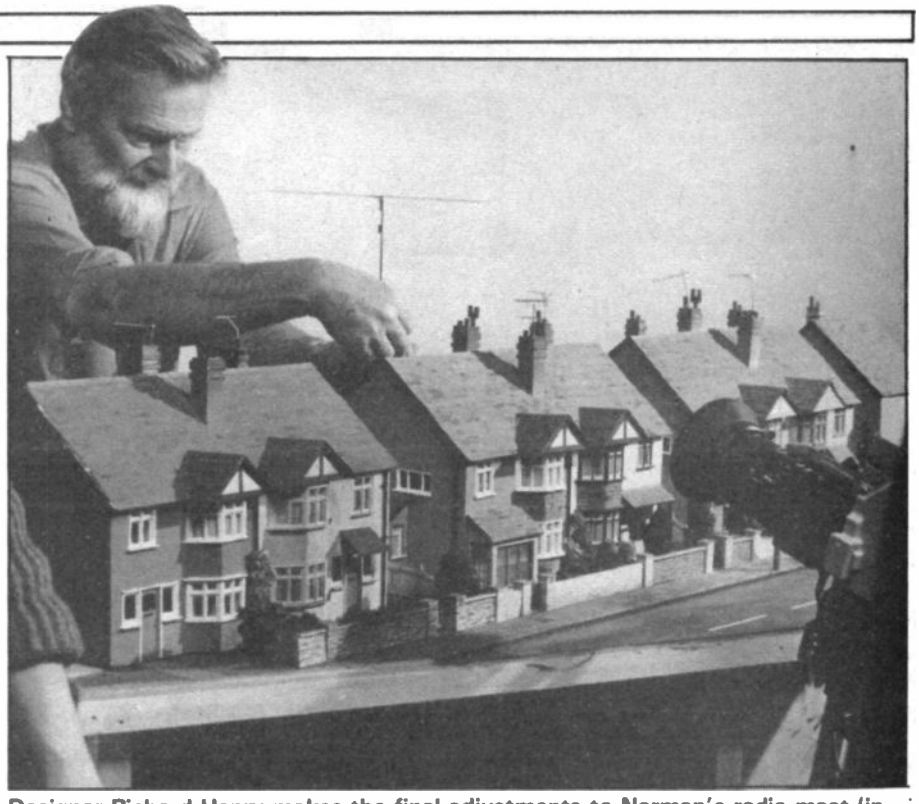
The convention takes place in Cardonald College which apparently proved an "ideal location" when it was used for the first time last year. It is situated just a short distance from the M8 which affords easy access from most parts of Scotland and the south. Facilities include extensive car parks within the college grounds, bar, restaurant and facilities for snacks.

A demonstration HF station will be on the air all day and, on VHF and UHF, talk-in will be provided on S22 and the GL repeater on RB14. The convention will be open from 11 am till 5 pm and admission is £1.

Attention Omega Builders!

Doubtless most of you will be aware that there have been some problems raised in the development of the QRO PA module for Omega. We have made some progress towards their solution. This is the latest position.

We have produced an initial development unit using TRW PT9784 devices. Driven from the existing QRP PA, it delivers around 120W on the lower bands falling to 80W on 10m.



Designer Richard Henry makes the final adjustments to Norman's radio mast (in miniature form — an XYL's dream!)

This indicates a gain of around 12dB, some 4dB below that quoted by TRW, the manufacturer of the output devices.

Although the unit is electrically robust, the gain falls rather short of the 100W+ to be expected from these top quality devices when driven from the 3W PEP available from the QRP PA module. According to data supplied by TRW. the 1.5:1 or better VSWR matching presented by the development module using a circuit originally produced by that company should result in a saturated power output of more than 150W on all bands. The performance which we have recorded in practice runs considerably short of the TRW test circuit.

Having scratched our heads to the point where the hair is falling out, we have given the problem to TRW's R&D labs in Bordeaux, France. They are being exceptionally co-operative and we expect an answer shortly. Be assured that we will pass on the good news just as soon as we have it.

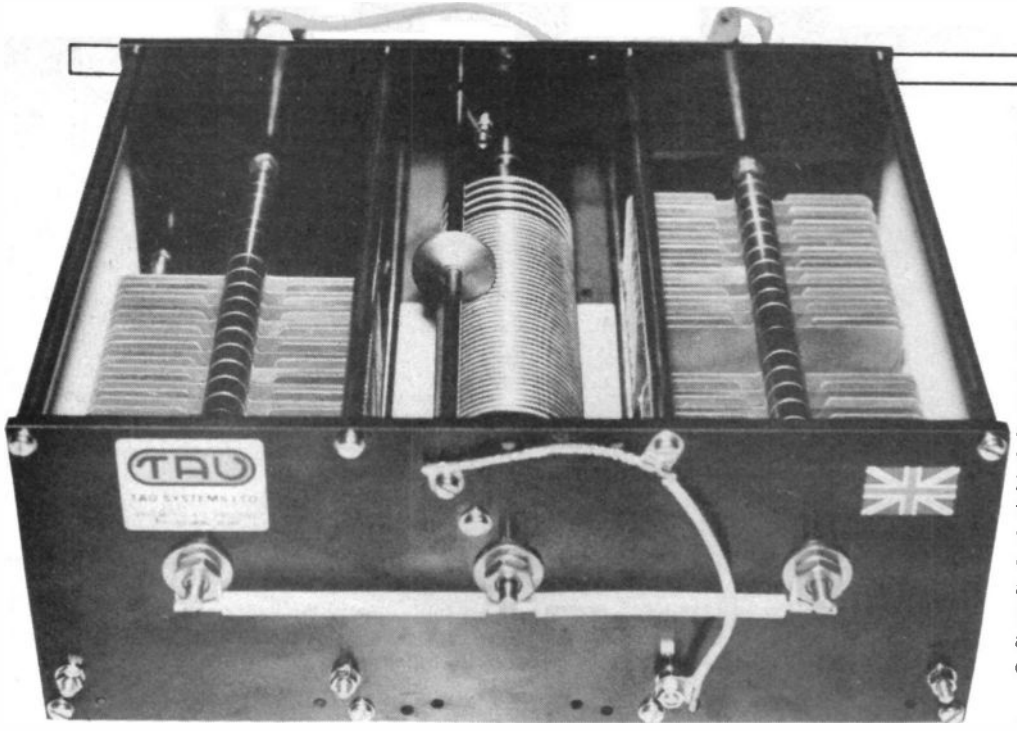
During development tests with the solid state changeover board we have noticed that the BF259 transistor can go outside its voltage rating when run with raw RF at the 120W level. This was not picked up on earlier development because, although it passed its qualifying tests to 250W, we were not using the output of a broadband amplifier with its attendant high harmonic overswing voltages. Changing the transistor to type BUX87 should allow an adequate safety margin.

We are doing everything possible to expedite development of the recalcitrant PA and that, when we are ready to publish the design, it will have the excellent performance characteristics of the rest of the Omega project. **G4JST/G3WPO**

ATU Kits From TAU

Tau Systems have recently marketed two new types of HF ATU — in kit form. The unique feature of the ATUs are the wide spaced 'transmitting type' capacitors and 'roller coaster' tuning coils used — until Tau came on the scene these had become practically unobtainable as 'new' components. Many is the desperate amateur I have observed, raking over piles of junk at a mobile rally and muttering 'split stator' and 'roller coaster' under his breath! Both the roller coaster, and various of split and single stator wide spaced capacitors are obtainable as individual components from Tau. Tau will also supply non-standard value capacitors to order — although these will naturally cost extra. The power ratings of the capacitors is either 1kW or 5kW PEP.

Coming back to the ATUs, the first of these is their 'Super Transmatch ATU with split-stator capacitor, roller coaster and single stator capacitor which handle impedance transformation ratios of at least 10:1 and is suitable as it stands for un-balanced aerials such as long wires and vertical antennas fed against ground. With the addition of an optional ferrite balun (a number are available for a selection of transformation ratios and rated at a



Do-It-Yourself rollercoasters and capacitors included in the Tau System's ATU kit

variety of RF powers) balanced antennas such as dipoles, yagis etc may be used with the ATU. The design is based upon the classic "Super Transmatch" from the American ARRL handbook.

The second is their "L and C match" ATU, a slightly simpler device than the aforesaid but which Tau claim can handle impedances from 5 ohms to 5000 ohms resistive and 2000 ohms capacitive to 2000 ohms inductive. The ATU is based on an old Marconi design and according to ebullient Tony Johnston, G40GP, Tau's Technical Director, should operate at the high impedance levels with no fear of flashover. Having seen the quality of the Tau components, in particular the insulation and wide spacing of the capacitors, at close quarters, the Editor is inclined to agree with him.

Tony, a keen 160m operator with quite a few countries to his credit, recently made a whirlwind visit to the *HRT* offices to show off the Super Transmatch and Tau components. The Tau philosophy is very much that British Engineering is the best in the world — amply supported by the gear in Tony's shack which is 80% UK made.

In addition to the ATUs and ATU components, Tau also manufacture a very tough clip-on spacer for open wire feeder. Enough of these for 18m of open wire feeder are included in the Tau "Aerial Kit", along with dipole centre and end insulators, which retails at £12.70.

The Super Transmatch kit is available in two variants — the 1kW version is £160 and the 5kW is £185. These can be ordered direct from Tau (0695 24662) or can be obtained from SMC or Amateur Electronics (UK). According to Tony, distribution is being currently negotiated with other UK and overseas dealers.

Tony Johnston, G40GP, in the shack

So You Want To Study The Radio Amateurs Examination?

Loughborough Technical College are holding a RAE course in the Department of Electrical Engineering and Computing at Radmoor, Loughborough, Leics on Tuesday evenings, commencing on the 11th September for 26 weeks. Morse code is studied from 6-7pm and Radio Theory and Licence Conditions from 7-9pm. The tutor is Doug Doughty, G3FLS, and the fees are £7.30 for the Morse and £15.90 for the theory. For further information, telephone 0509 215831.

Dacorum College at The Marlowes, **Hemel Hempstead** are holding an RAE course on Wednesday evening from 6.30-9pm (and Mondays 6.30-9pm if there is sufficient demand) commencing 26th September. Enrolment is on 10th September and course tutor is CB Burke BSc., G3VOZ. For further information, please ring 0442 63771.

Bradford and Ilkley Community College are holding a very interesting course in Amateur Radio, commencing in September 1984. The syllabus is 1st year, preparation for the City and Guilds RAE; 2nd year, optional — this is also available for existing Class 'B' licencees who wish to obtain an 'A' licence; 2nd/3rd year, a project based course for holders of the RAE certificate who wish to gain more in-depth knowledge of amateur radio topics. The courses are being run by the Department of Electrical and Electronic Engineering and the tutor is P. Nurse. Enrolment commences on 11th September.

Beckenham Adult Education Centre are holding a Beginners Morse Class commencing in September. Enrolment is either by post during the period 28th-30th August to Bromley Adult Education Service, Aylesbury Road, Bromley, or in person at 28 Beckenham Road, Beckenham, Kent (01-650-4208). The tutor is Fred Henschel and students are encouraged to reach 12wpm by the end of the course in May.

Walsall College of Technology are holding a course leading the RAE. Enrolment is on the 4th,6th and 10th September. For further details ring Aldridge 52706.

During the session 1984/85 the **Langley College of Further Education in Langley**, Slough, Bucks, will again be offering classes for the Radio Amateurs' examination. The course follows a modular scheme.

1. Thursday	1730-1900	Operating Techniques (on the air operation)
2. Thursday	1900-2020	Morse
3. Wednesday	1900-2100	Theory

Students can choose modules to make an individual programme. The College has a fully equipped station (G3XPL). In addition, the College hopes to offer short courses (8 weeks) on such topics as "Use of Test Equipment by Radio Amateurs". Enrolment will be at the college on either of the following dates: Tuesday 11th September 1984 from 12 to 8 pm or Wednesday 12th September from 12.30 to 8 pm.

For any further information please contact Mr. A J Parcell, (G8BIX), the course tutor at the Department of Technology on 0753 49222.

Hendon College in North West London will be offering a course for the Radio Amateurs Exam, starting in September 1984. They have been running the course for the past three years, with excellent results. The tutor will be

Tony Essex, G8WCX, and the course is held in the Williams Building, Hendon College of Further Education, The Burroughs, London NW4 4BI. Classes run from 7-15 to 9-15 on Tuesday evenings. Enrolment is on 12th September from 2-8 pm.

The RAE courses at **Paddington College in West London** are claimed to be something special! Not only do they cover the syllabus for the City & Guilds RAE exam, but also make use of the facilities provided by the Electrical Engineering Department, allowing students to carry out practical experiments in the electronic theory covered by the course. The course is none the less pitched at the student with no previous experience of radio or electronics. Paddington College also has an active club station (G4UWU) operated by the course tutors and past students.

Because of the extended scope of the course, attendance is required twice a week during term time between the end of September and the examination in May (30 weeks). Inevitably, this means the course fees are slightly higher than those charged by some colleges (special rates are available for pensioners, those at school fulltime, and the unemployed, residing within the ILEA area). However, over the past few years they have maintained a pass rate better than 90%.

Enrolments are on the 10th, 11th and 12th September between 1-4 pm and 6-8 pm in the evenings at Paddington College, Paddington Green, London W2 1NB. If these times are inconvenient, just turn up on the night. Course tutors are: David Peace, G4KKN, and David Hunt, G6MFR. For further information contact David Peace on 01-402 6221 Ex. 54.

Arnold College of Further Education in **Mapperly, Nottingham** are offering a very comprehensive range of classes in Amateur Radio.

For those wishing to take the RAE there are two options: full courses, for the May examination, are on Wednesdays at 7pm and commence on 19th September, whilst there is a 'crash course' on Thursdays at 6.30 p.m, commencing on 20th September, for the December examination. Both these courses are suitable for those with a basic knowledge of electronics.

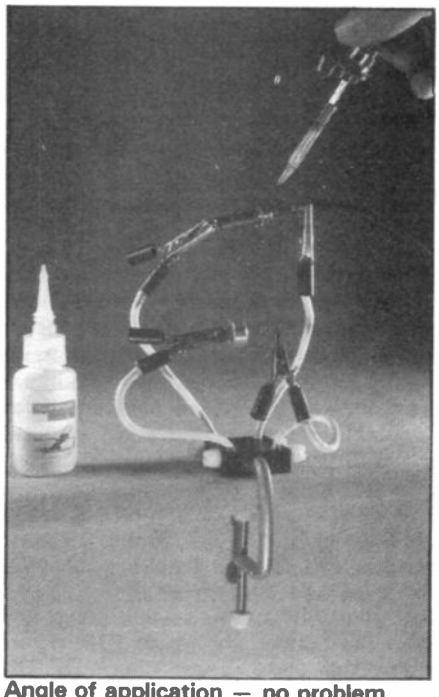
In addition to the above, the college offers construction classes, a course entitled 'After the RAE', for licenced amateurs who wish to take their technical knowledge a stage further, and a course called 'Introduction to Amateur Radio', commencing June '85, for those who wish to find out what they are letting themselves in for when they take up the hobby.

Further details of the above are available from R G Wilson in the General Studies department (0602 876503).

HRT will be pleased to accept details from colleges and adult education centres of RAE courses for publication in the next issue of the magazine.

The "Third Hand"

Few DIY jobs are more frustrating than the one that needs "three hands" — two to hold the work and a third to apply solder or adhesive. The smaller the component, the more difficult it usually proves to position it accurately and firmly.



Angle of application — no problem with this Gripmate

Gripmate, produced by an innovative Sussex company, is one of those "Why-didn't-somebody-think-of-it-before?" inventions — a tiny clamp that provides not just one extra 'hand' but four, able to grip small electronic components and similar items in an infinite number of positions.

A base block clamped to any bench or table top carries four semi-rigid wires, each fitted with a crocodile clip to hold the work. Alternatively, any of the wires can be replaced with one holding either a magnifying glass for close-up work, or a magnet where this is more appropriate than the clip.

Gripmate is only only rather clever but inexpensive. The four-handed model costs £4.85 (a basic type with two arms sells for £1.00 less), and the magnifier and magnet come for £2.50 and £1.50 respectively — all inclusive of VAT and postage, direct from Kemplant Ltd. Durfold Wood, Plaistow, Billingshurst, W. Sussex RH14 0PN.

New Club For The Midlands

The inaugural meeting of the Welland Valley Amateur Radio Society took place on Tuesday June 5th at Welland Park College.

18 radio amateurs and future 'hams' met to set up this new radio society which it is hoped will attract more members from both Leicestershire and Northamptonshire. The aim of the society is to encourage and develop amateur radio in an area which up till now has not had a local group. During the evening the club radio station, G4WVR, was in operation the first contact was with VU2AU in Nagpur, India.

The society is to meet in future on Mondays at 7.15 at the college and it is intended to make the first meeting of each month a special meeting with perhaps a guest speaker, a demonstration or visit to a place of technical interest. Alan Faint, G46TZY, (Market Harborough. 62827) was elected chairman and Dave Lunn, G3LSL, (M.H.880746) was elected secretary.

Licenced and prospective amateurs are cordially invited to join the society and should either contact Alan or Dave, or just turn up at a meeting.

9L1FTN — New 28 MHz Beacon

By Roger Frisby, G4OAA of the Cheshunt DARS

Well, we made it — 9L1FTN came on the air on the last day of the Region 1 Conference in Cefalu. It was touch and go to the last. Wally Hood of the Colston Case Co (Goff's Oak) agreed to pack the beacon and waive his freight forwarding charges and it finally arrived at Lungi Airport, Sierra Leone on Monday 9th April. Unfortunately so did Sierra Leone's President Stevens returning from a visit to London. Confusion at the airport meant that Vidal, 9L8K, was not notified until Tuesday and the documentation went somewhat awry. Vidal obviously had some problems in clearing customs as I received the following telex dated Thursday 12th April: "Beacon collected 1700Z yesterday from Lungi. Jumped several guns swinging sledgehammer to collect. Thanks all CDARC members and others for knightly effort. Beacon is really grand. Installation commences now." I sent a message to Cassandra 9L1YL and to Dr. John Allaway G3FKM in Cefalu resulting in an announcement. I have heard since that this went down well as help and co-operation with third world groups was a major talking point at the conference.

Friday the 13th was a lucky date for us. Just after I arrived home from

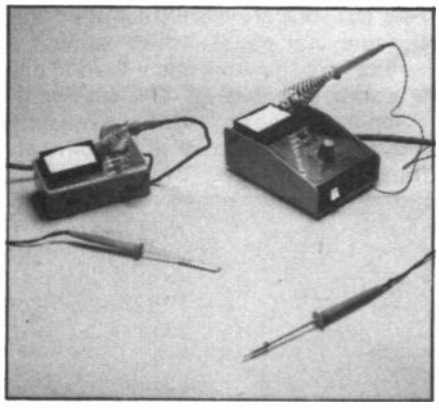
work at 6.15 pm, Dennis G3TIK phoned to say that 9L1FTN was on the air — the phone didn't stop ringing that evening! Speaking to Vidal on the air I learned that because of a fault, the shack mains supply had been disconnected for the first few days of operation and that he had been taking a fresh car battery up every morning. It's quite a difficult journey up to the shack from the town, and it's all credit to Vidal for his efforts. He also told me that he was only measuring an output of 1.5 watts. Whether a fault exists or this is because of Vidal's unfamiliarity with the equipment's adjustment I don't know, but with 1.5 watts to a dipole, the beacon has been audible here for several hours each day, on most days, since switch on. The earliest I have heard it has been 11.30 GMT and the latest 20.55 GMT. In early May, peak signals are occuring around 18.30 GMT.

For *HRT*s overseas readers, here are a few technical details of 9L1FTN:
Frequency — 28.27250 MHz (keying to 28.273350 MHz)
Location — Kortright, Mount Aureol, Freetown; 08° 30N, 13°20W
ASL — 400 metres
Antenna — Vertical half wave
Power — 10 watts to antenna
Supplies — 240 volts AC or 12 volts DC with auto-changeover
Keying — FIA ''de 9L1FTN'' at 12wpm with 20 second interval. When running on standby supply, up to eight dits are sent before the callsign, depending on the state of battery charge.
(This item courtesy of the Cheshunt District Amateur Radio Society)

Roger Frisby, G4OAA, with the 9L1FTN 10 metre beacon

New Miniature Low Voltage Soldering Irons

A series of miniature low voltage soldering irons, the Oryx Micro Series, has been introduced by Greenwood Electronics, the Reading-based electronics production equipment specialists.



The Oryx 'Micro' soldering irons

These professional irons, the smallest in the Greenwood 'Oryx' range, have been designed for intricate circuit work. They provide maximum heat in a concentrated area and offer typical tip temperatures of around 320°C. Typical unit weight is *only 4 grams*, though.

The Oryx Micro soldering iron range includes, 5,6,9,11,12,18 and 25 watt models and operating voltages include 6,12,24 and 50 volts.

A power supply station stand and cleaning facility, the Micro P66, offers 115/240 VAC mains operating and delivers a safety isolated output for the 6V, 6W Micro iron. A more elaborate version, the Micro PT66 variable temperature unit is also available. With this unit the tip temperature of the iron can be controlled between 120°C and 400°C via control knob on the base stand. Information can be obtained from: Greenwood Electronics, Portman Road, Reading, Berks. RG3 1NE. Tel: 0734 595844.

If Junk Sales Were All Like This...

The second Junk Sale 'Extravaganza' held in early Spring by the Cambridgeshire Repeater Group was an unqualified success with an attendance of over 400. Amidst comfortable seating and pot plants bidding was quick and fast for the 528 lots for sale ranging from complete HF stations to bags of components. Security patrolled car parking was provided adjacent to the large hall, and tea, coffee, and biscuits were available as well as a licenced bar on site, (which had only six pints left in the barrel at the end of the day!); several radio traders attended to those who wished to buy new equipment, and a vintage wireless stand and GB3PT RTTY demonstration station (both with operational gear) attracted much interest.

The most commonly-asked question on the air after the event was, of course, '' when's the next one?''. In view of the enormous success, next year the organizer will be extending the event into a 'Mini rally' to provide even more for everyone. See you there? Contact man — **Chris, G4HCL.**

Cirkit Steps Up Business In Toko Components

The renewal today, of an exclusive United Kingdom distribution agreement between Toko Incorported, who are the world's largest manufacturer of wound components, and Cirkit Holdings PLC, marks the beginning of the two companies' second decade of association.

The original agreement, signed in 1974, with Ambit International, one of the principal founding members of the Cirkit Holdings group, made them the first franchised Toko distributor in the UK, and since this time the number of products stocked has grown steadily.

In addition to being the sole UK stockist of Toko coils, Cirkit holds a comprehensive inventory of their other components including filters of all types, fixed inductors, bi-polar ICs, numerically controlled LSI, Vari-cap diodes and push button switches. Most recent addition to the Cirkit range of Toko products is helical filters.

Commenting on the renewal of the Toko franchise, Cirkit's chief executive, Christopher Sawyer said, ''Perfected over some 30 years of development, Toko's miniature transformers are now produced in quantities of more than 100 million units per month and are used in virtually every radio and television set, hi-fi and communications system produced around the world.

Ken Michaelson, G3RDG, has asked us to convey his apologies to Ian Wade, G3NRW, and Peter Martinez, G3PLX, for the omission of acknowledgements to them for the use of certain subject matter which was used in his article entitled 'A Guide to AMTOR in the June issue of *HRT*.

HAM RADIO TODAY NEXT MONTH

TEQUILA AND TRI-BANDERS - radio Mexican style!

Introducing MICRO NET - the bi-monthly forum for radio amateurs with a computer in the shack.

THE ALPHA TRANSCEIVER - Constructional details!!!

PLUS

A synthesised VFO for 2m transceivers. By G3WPO and suitable for our 'Talkbox' design.

WRITE FOR HAM RADIO TODAY!

We are always looking for new contributors to the magazine and we pay a competitive page rate. If you have built a project or you have some experience that you would like to pass on, or if you have a particular point of view that you would like to get across to others, drop us a line and describe what it is you'd like to write about. We'll get back to you to tell you if we're interested and to tell you all the boring details. Don't forget to tell us your address and telephone number (preferably a day-time telephone number too).

The ALPHA Transceiver

Here is a project for an HF SSB/CW transceiver which is capable of operation on any single band from 160-20m and can hold its own against the latest commercial rigs. Design by Frank Ogden, G4JST, and Tony Bailey, G3WPO.

Everybody knows about the joys of mobiling on two metres; the ubiquitous black box has added a completely new dimension to our hobby. Regrettably only a few of us so far have discovered the even greater joys of taking an HF black box into the car. Chatting through the local repeater does take the tedium out of a long journey, but holding a QSO with a station in Australia while driving through the middle of London is even better!

Tony and I felt that the greatest drawback to HF mobiling was the complexity and cost of existing equipment. Nobody in their right mind leaves a brand new FT757 invitingly under the dash. Equally it is a real bore to have to pull out gear from the car everytime one wishes to use it in the shack. Also, base station equipment tends to be distracting and complicated to use whilst driving. We both saw the answer to all this as a high performance, minimum knob-count purpose designed transceiver.

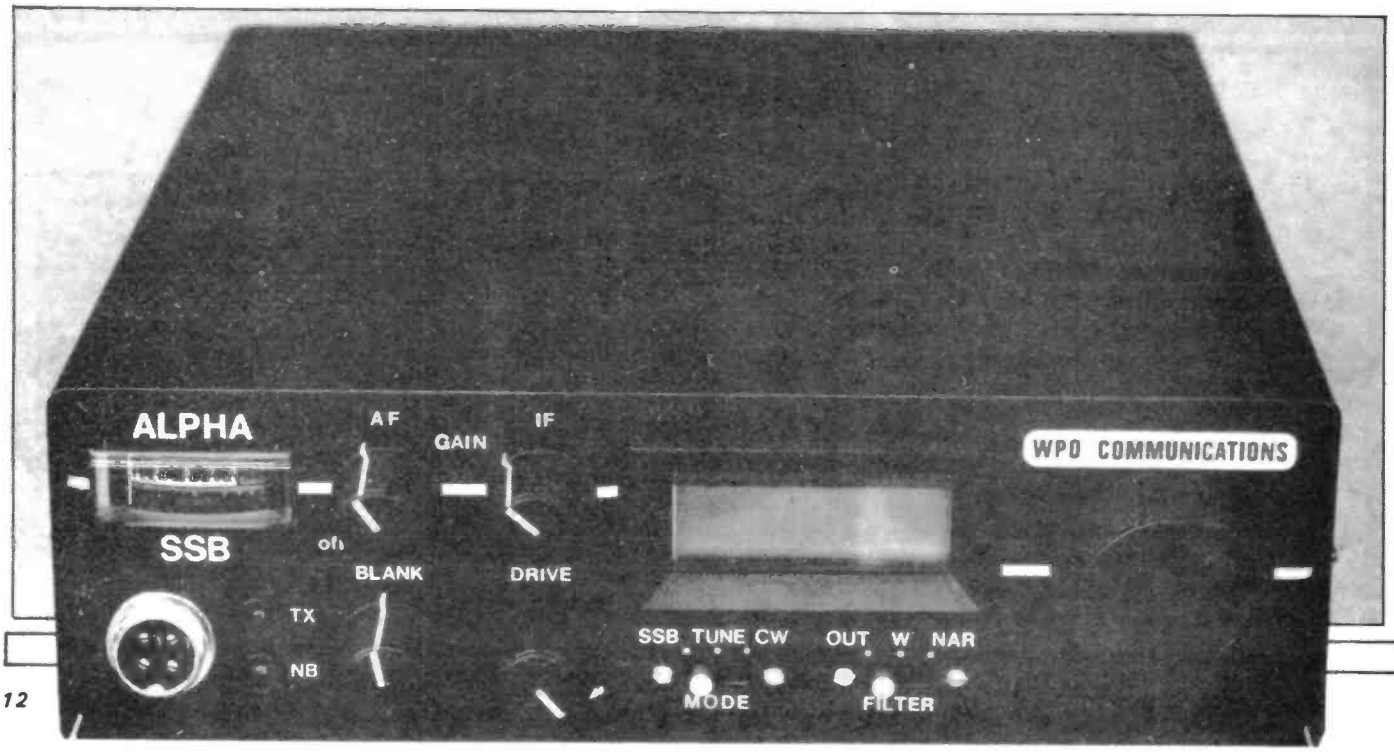
A Single Band

The biggest design decision was to restrict operation to a single band. Band switching is a major hurdle when the object of the exercise is to keep cost and complexity to a minimum. Some people may regard this as a major limitation, but in reality this is not so. Mobile aerials tend to be difficult to manufacture in multiband form while retaining a reasonable degree of performance. Because it is not practical to make them longer than about six feet, they also tend to have a narrow bandwidth. Restricting operation to a single band enables greater radiation efficiency to be obtained — which means more chance of an interesting contact!

Our Alpha transceiver is essentially a single band design, but the alteration of just a few cheap components will customise the set for operation on any band from 160 to 20 m, including the new 30 m sector (although you can't, of course use SSB on this band). If you get fed up with, say, 160m, simply replace a crystal, six toroids and a few small capacitors and you will be set up for 20 m or whatever. **This article will give details for 160 and 20 m only — requests for the mods to get it on the other bands will be treated sympathetically providing there is a demand!**

The Specification

Alpha uses a synthesised VFO, and a high level Schottky ring mixer feeding into a high performance



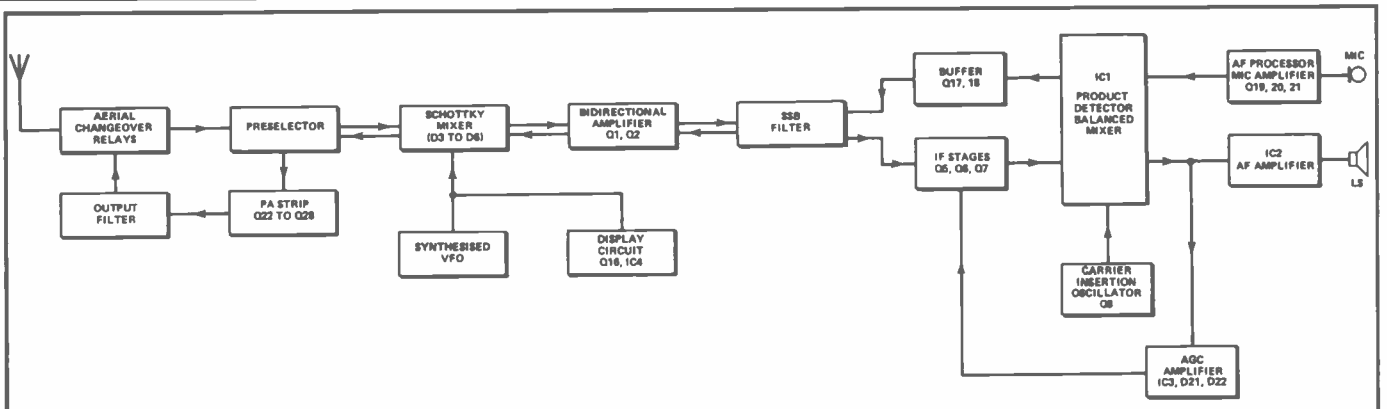


Fig.1 Block diagram of ALPHA

8-pole 10.7 MHz IF to create a receiver system guaranteed to give 90 dB+ of dynamic range (two frequencies spaced 100 kHz apart in-band against the equivalent input for a minimum discernible signal). For a full description of our measurement procedure, please refer to page 113 of the ARRL *Solid State Design For the Radio Amateur*. This performance puts Alpha among some of the best performers available anywhere. We have backed this with a full RF sidechain type noise blanker to reduce the inevitable car ignition noise to acceptable proportions. This same facility also reduces the Woodpecker from, typically, S9+20 dB to around the S3 level.

In transmit, Alpha puts out a minimum of 50 W PEP from a 13.8 V supply; more than enough power to receive European 5+9 reports using a centre-loaded bumper mount quarter wave aerial on daytime 20 m working, or to work the World from home. An in-built speech processor (permanently wired into the microphone circuit) effectively boosts talk power by over 12 dB typically. The push-pull transmission line MOSFET output stage is 'unburstable' as Tony and I have proved many times during development. We can honestly (cross our hearts) say that we have not lost a single output transistor in spite of the horrible things which we have unintentionally done to our new little baby.

Reports

I can't really (well, I hope I can!) expect the critical readers of *Ham Radio Today* to believe the outstandingly good reports we have received when using the set both mobile and connected to a quad loop antenna at home. However every word is true. The transmit audio, even accepting that it is fed through the on-board processor, is as clean as any commercial set on the market, we are told. The ultimate test is when people tell you that "your modulation is very good" without knowing that you built the rig yourself.

The punch of the signal carries well through the QRM. Sunday morning a couple of months ago saw G4JST sitting in his car outside his garage playing about with the new toy. I tuned in idly to an N1 station calling CQ from New York. His signal was only around S3 so I went back to him not expecting a reply. I nearly fell out of the car when he came back to me — the US station was running 1 kW PEP output but we managed a reasonable two-way QSO in spite of European interference.

Circuit Description

Receive

The signal from the aerial socket is routed from the changeover relays (activated by the PTT switch on the microphone) to the preselector bandpass circuit L1, L2. Diodes D1 & 2 offer protection to the easily damaged Schottky mixer diodes in the event of RF leakage from the changeover relays. After filtering, the signal passes via T1 to the Schottky diode ring, D3 to 6, through matching transformer T2 to the dual gate MOSFET bi-directional amplifier Q1, Q2. This circuit uses DC switching to take one of the transistors essentially out of circuit — Q2 in receive and Q1 in the transmit mode. Transistors Q3 and Q4 perform the DC switching. Note that delayed AGC is applied to gate 2 of Q1 during receive. More about the AGC action later.

Please note that those components indicated by an asterisk on the main circuit diagram are chosen according to band. The drawing shows the values for operation on 20 m. Detailed changes are given in the components list and in the constructional details for 160 m.

A PIN diode D8, together with its associated transformers, cuts off the signal path to the crystal filter F1 during heavy interference spikes. Switching action for the diode is provided by JFET Q13. This transistor, normally on, cuts off when the noise blanker sidechain Q15, Q14 amplifies a signal derived before the crystal filter to the point where the rectified DC interference pulse, generated by D25, D26 is sufficiently big to cut off Q13. This same pulse is also applied to Q10 which acts as an audio switch. Note that the impulse blanker will only operate effectively when the interference pulse is substantially greater than the wanted signal. Front panel control VR2 sets the gain of the noise blanker sidechain.

Matching to the crystal filter is controlled by R6, IFT2, T9 and R13. If a unit other than that quoted in the parts list is used, then these components will require modification (as will the PCB). The characteristic impedance of the filter is 600 ohms.

SSB amplified by the three-stage IF amplifier at 10.7 MHz is fed to the product detector/transmit balanced mixer IC1 (KB4412). AGC generated by level detector (D19,20) AGC amplifier IC3 and rectifier D21,22 is applied to the first two IF stages via voltage follower Q11. Q12 is an additional current follower for driving the S

meter. AGC hang characteristics are defined by C46, R48, with preset resistor RV1 setting up the log-law IF gain stage Q6. This should be adjusted so that the voltage drop across R17 is around 0.5 V at no signal.

'S' Meter

The diode chain D10 to D17, together with resistors R19 to R23, give an approximately (very!) log characteristic to the overall receiver AGC. This results in an 'S' meter response which actually means something. A 15 k resistor for R51 (meter series shunt) together with the 100 uA movement gives an S9 reading for approximately 50 uV input at the aerial socket. The voltage double AGC rectifier configuration enables the AGC line to swing negative with respect to ground — this produces excellent AGC characteristics for signals in excess of 10 mV input.

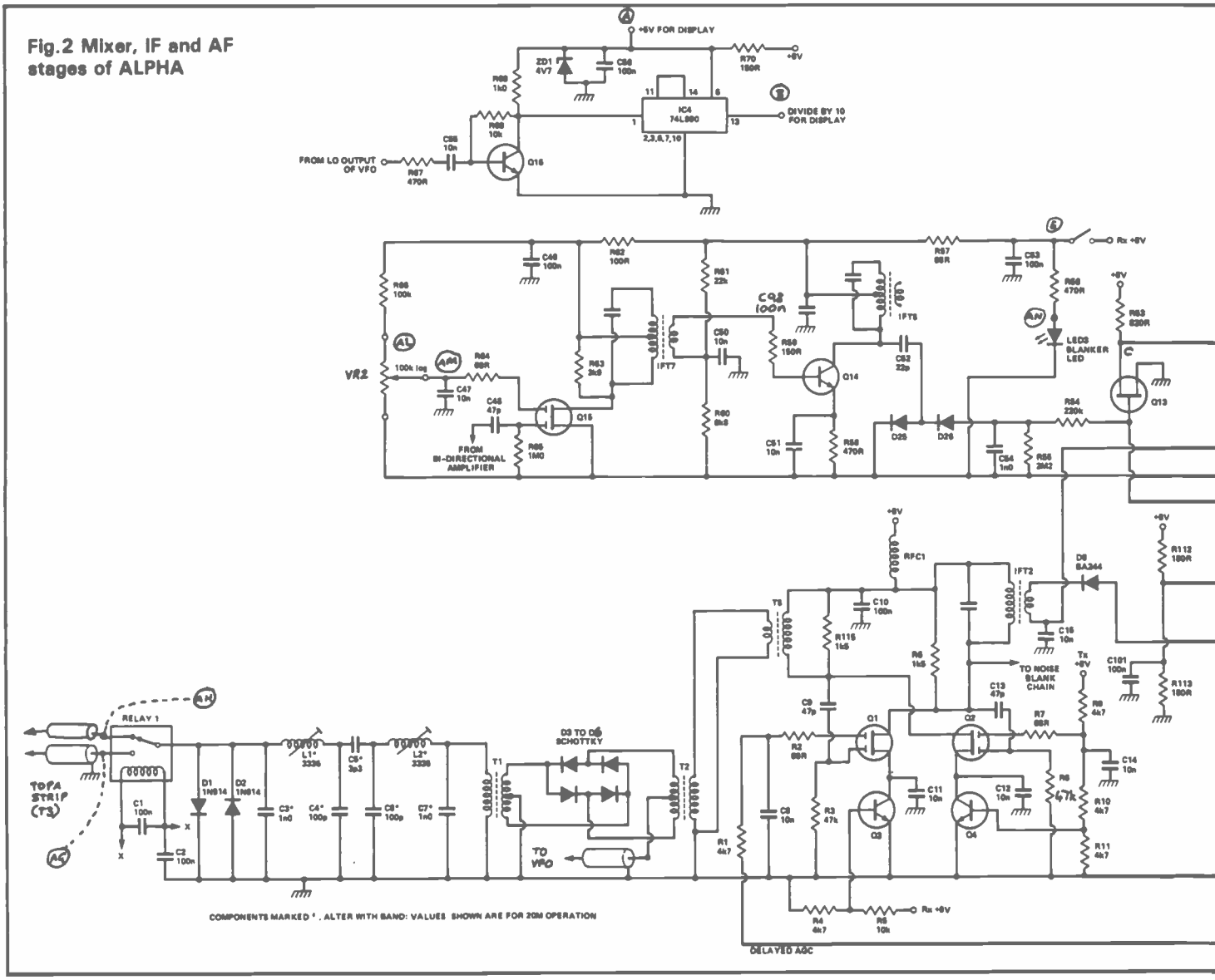
The audio stages following the product detector are completely conventional. Q10 is a noise gate driven by the impulse blanker circuitry. Q8 provides the carrier insertion signal for the product detector. It is essential to the successful construction of any highly sensitive SSB set such as Alpha that signals from the carrier insertion oscillator do not find their way into the front end of the IF strip. Such unwanted coupling will result in the powerful AGC characteristic creating all manner of unwanted low frequency oscillations and effects on levelling time. *We strongly recommend the use of our PCB for the construction of this project.*

As the set is intended for SSB primarily, no additional IF filtering has been incorporated for CW use, but CW facilities have been built in. Additional AF filtering for CW reception has been allowed for, and the multipole active filter used in Project OMEGA can be fitted into the design. Details will be given in Part Two.

Transmit

Signals from a low impedance dynamic microphone are fed through the RFI filter, C61, R78 and C62, to voltage amplifier Q19, 20. Negative feedback controlled by RV9 sets the overall gain. This preset is the mic gain control and is used to establish the amount of processing produced by the circuit Q21, D28 and D29. Intermodulation products introduced by the clipping action of the limiter diodes are taken out by the action of the crystal filter. To obtain effective speech processing with a baseband

Fig.2 Mixer, IF and AF stages of ALPHA



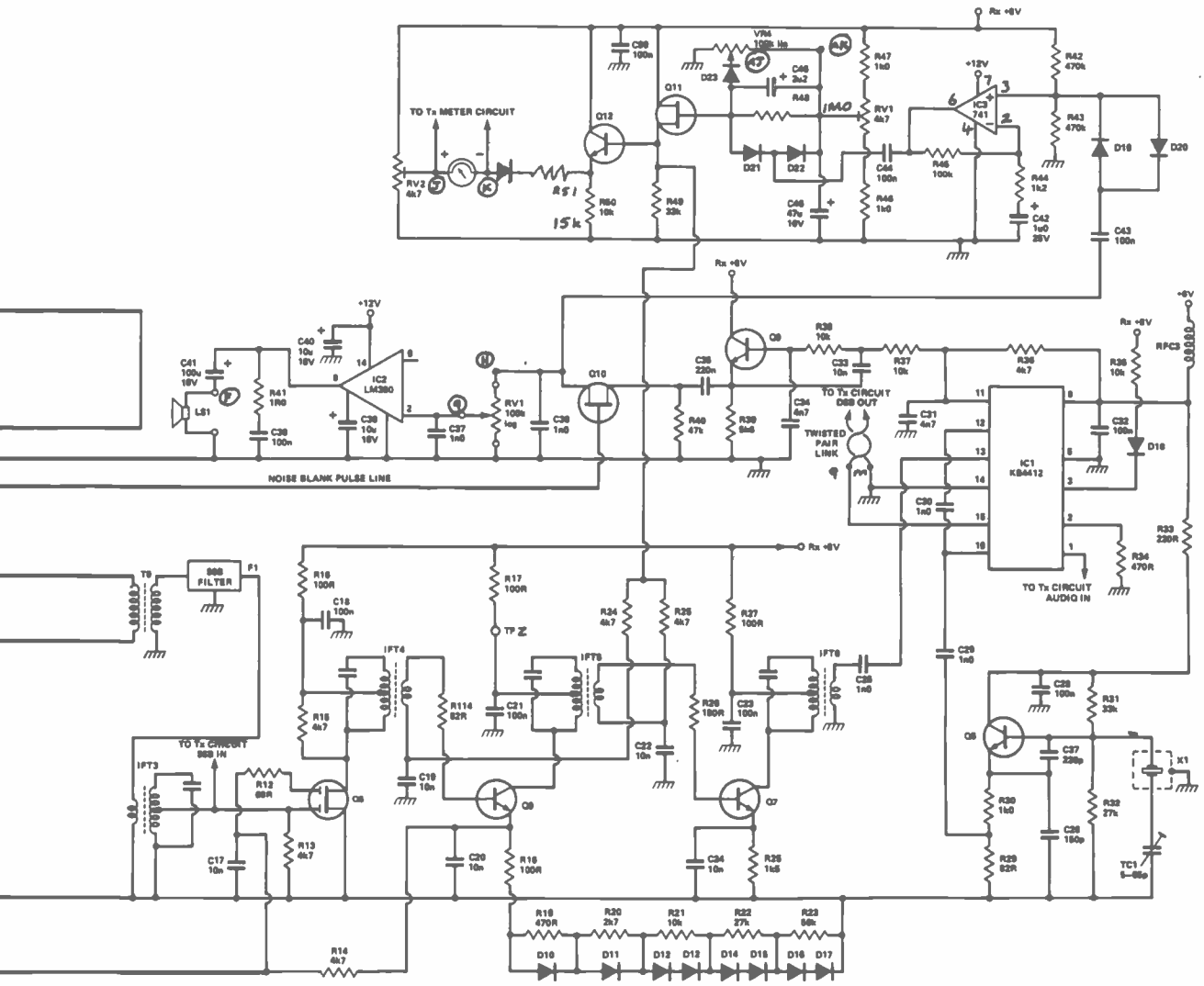
type of circuit, it is essential that frequencies outside the communications speech band are removed before application to the limiter. This filter function is provided by the second order filter ahead of the clipper, Q21. RV3 sets the level of processed audio going to the IC balanced mixer, IC3.

Double sideband taken from the output of this chip is fed through Q17 and Q18 PNP buffer stages to the crystal filter, where the unwanted sideband is stripped off. These transistors provide approximately unity gain in transmit but stop the carrier insertion signal from the sideband oscillator finding its way into the front of the IF strip, as outlined earlier. The resistor network surrounding these two transistors creates reversed biased conditions at their junctions in the receive mode ensuring the highest possible isolation.

From the filter, the SSB signal passes through the bi-directional amplifier picking up gain on the way before entering the power amplifier strip. Relays control this signal routing. MOSFET Q22 has front panel drive control connected to gate 2 to enable variation of transmitter output power anywhere from 2 to 50 W+ (on Top Band you will of course need to set the output power so that it does not exceed the 25 W or so permitted by your Licence!). This control is normally used to back-off the indicated meter output by a division from 'flatout' maximum. When the transmitter is used in this manner no splatter can result — even when shouting into the microphone!

The remaining sectors of the PA strip are all operated in push-pull to reduce the amount of second order harmonic products in the essentially broadband power stages. Power MOSFET transistors Q25 and Q26 bring the power level up to the 3W level for coupling into the output stage. The value of RFC5 is chosen to resonate with the input capacitance of these devices (about 30 pF gate-to-gate). A balanced output is taken from the bifilar transformer T6 into the power stage matching network.

Q27 and Q28 are a pair of audio power MOSFETs of the IRF120 variety, matched on both the inputs and outputs by transmission lines. This combination, the subject of a patent application, enables remote fixing of the power transistors (on an aluminium heatsink integral with the line of the custom case) while eliminating the effect of the package parasitics which make LF packaged MOSFETs unsuitable for use at RF. Essentially modern power



MOSFETs are *so* fast that the silicon dice which make up the transistor can operate up into the VHF range. However, the long bonding wires and header capacitances 'slugs' the operating speed at full power (or rather slew rate) to the very low MHz region.

Our new matching system gets over the problem. The result is that cheap MOSFETs offer better linearity, robustness and efficiency in RF output stages than any bipolar stage, cost for cost. The only appreciable drawback is that, having a higher input impedance, the broadband characteristics are inferior — about one and a half octaves. In single or dual band operation this is unimportant.

The power gain of the devices shown is around 15 dB at 14 MHz. The input power from the drivers is dissipated in the silicon gate resistance of the output transistor structures.

A simple Pi-section harmonic filter removes the comparatively small amount of rubbish generated by the PA strip. Power output is monitored by a simple diode rectifier arrangement feeding the 100uA meter.

Display

With the availability of the PCIM177 frequency counter at comparatively low prices, it seems futile to go to the considerable mechanical convolutions needed to produce a corded mechnical drive. The display offers a full LCD freqency counter with backlighting in a small package, but in its normal state only allows operation up to 4 MHz maximum. For this application, we want to use it to read the VCO frequency (either 25 or 12.5 MHz depending on band), and subtract the IF frequency of 10.7 MHz to get the actual frequency in use. The PCIM177 allows this internal subtraction (one of a number of preset IF frequencies programmed into it) as well as a programmable decimal point.

By dividing the VCO frequency by 10 in IC4 (after amplication and level shifting in Q16), the VCO frequency is brought into the counters range, and by suitable shifting of the decimal point, will now read the final frequency to a resolution of 1 kHz (ie 1.896 or 14.234 MHz).

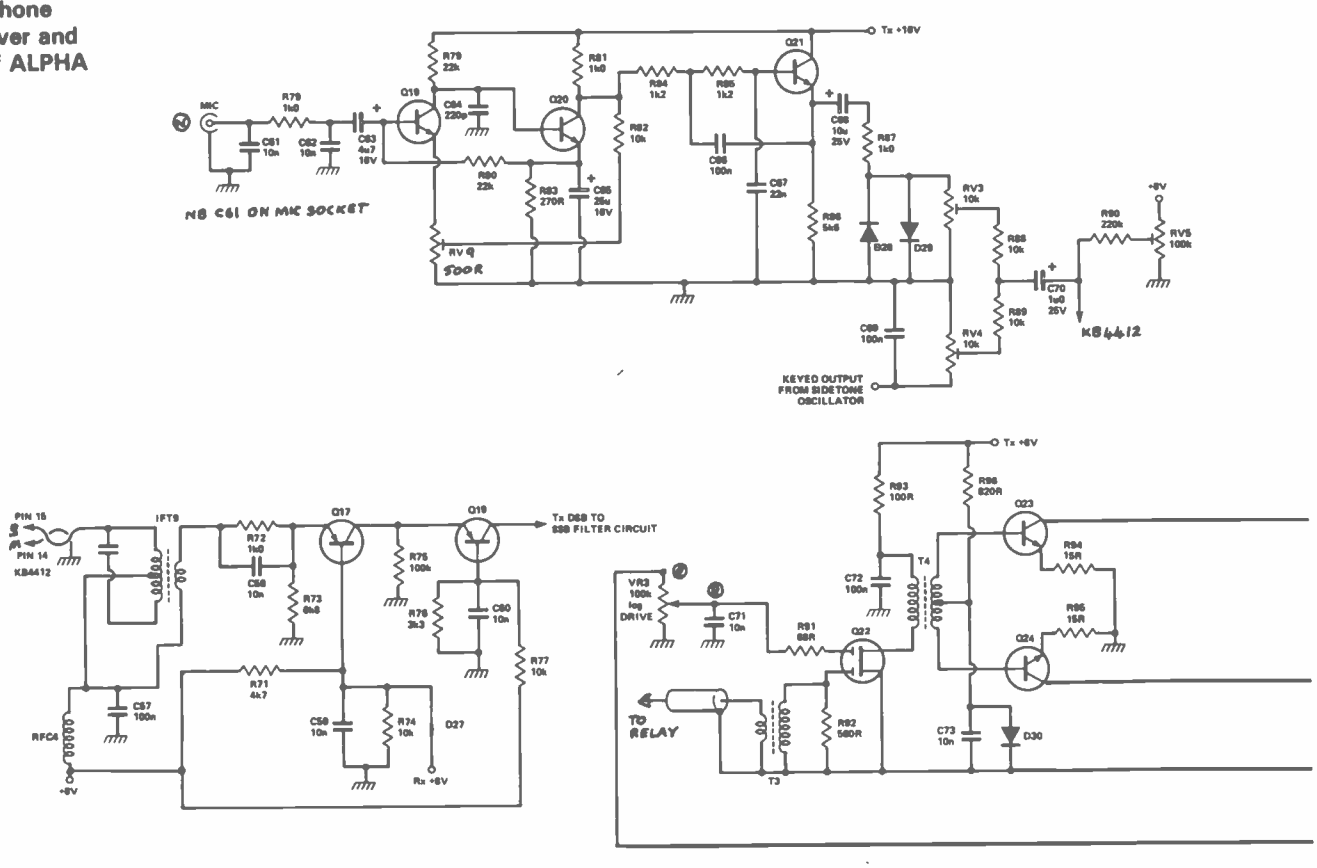
The display is mounted directly on the front panel of the case, and interconnected to the prescaler output via a short length of coaxial cable. The stabilised supply it needs is obtained from the simple zener arrangement of ZD1 on the main PCB.

VFO

The VFO used in ALPHA is nearly identical to that of the MINISYNTH PLL VFO published in the April 1984 issue of *HRT* as a separate design. This has been incorporated onto the same board as the rest of the Transceiver. The only differences are that the CW offset circuit is not used, and an air spaced VFO capacitor has been used to achieve ultimate stability, of the order of 50 Hz per hour when warmed up after a few minutes. The actual VFO drive uses a combination of 6/36:1 and 6:1 drives with the VFO capacitor to provide a very smooth, no backlash tuning action with fast and slow tuning.

The block diagram shows how the VFO works, as some people may be unfamiliar with the PLL design used. A fixed frequency crystal oscillator (Q29, BC239)

Fig.3 Microphone amplifier, driver and PA stages of ALPHA



mixes its output with a narrow band VCO (Q32, BC308) tuning only the amateur band required). A buffer transistor Q33 (2SK55) provides a +10 dBm output via T10 suitable for driving the Schottky ring mixer directly. Another portion of the VCO signal, tapped off of L8 mixes in Q31 (BC239) — the loop mixer, to produce a difference frequency between the crystal and the VCO.

This difference signal is filtered out by the low pass circuitry associated with RFC9, amplified by a series of CMOS buffers (IC6a,b & c) configured as an amplifier, and applied to the phase detector (pin 14) of a 4046 phase detector.

This is compared with a reference frequency derived from a free running, but very stable, low frequency LC oscillator configured from a further pair of CMOS buffers (IC6d,e). This output is then fed to the other terminal (pin 3) of the 4046 phase detector.

Any frequency or phase error appears as a DC voltage, after filtering by the loop filter components, at the varicap diode on the input to the VCO. This bring the oscillator back into perfect lock against the reference VFO. The control loop bandwidth is around 10 kHz, which is quite sufficient to 'clean up' the VCO output spectrum over the few critical kilohertz either side of the output frequency (there are some slight changes to the loop filter values against the original design).

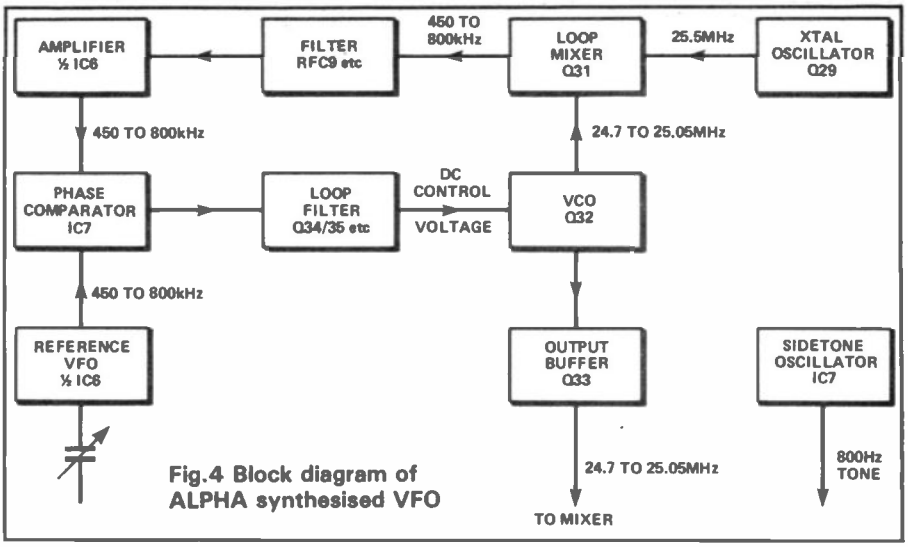
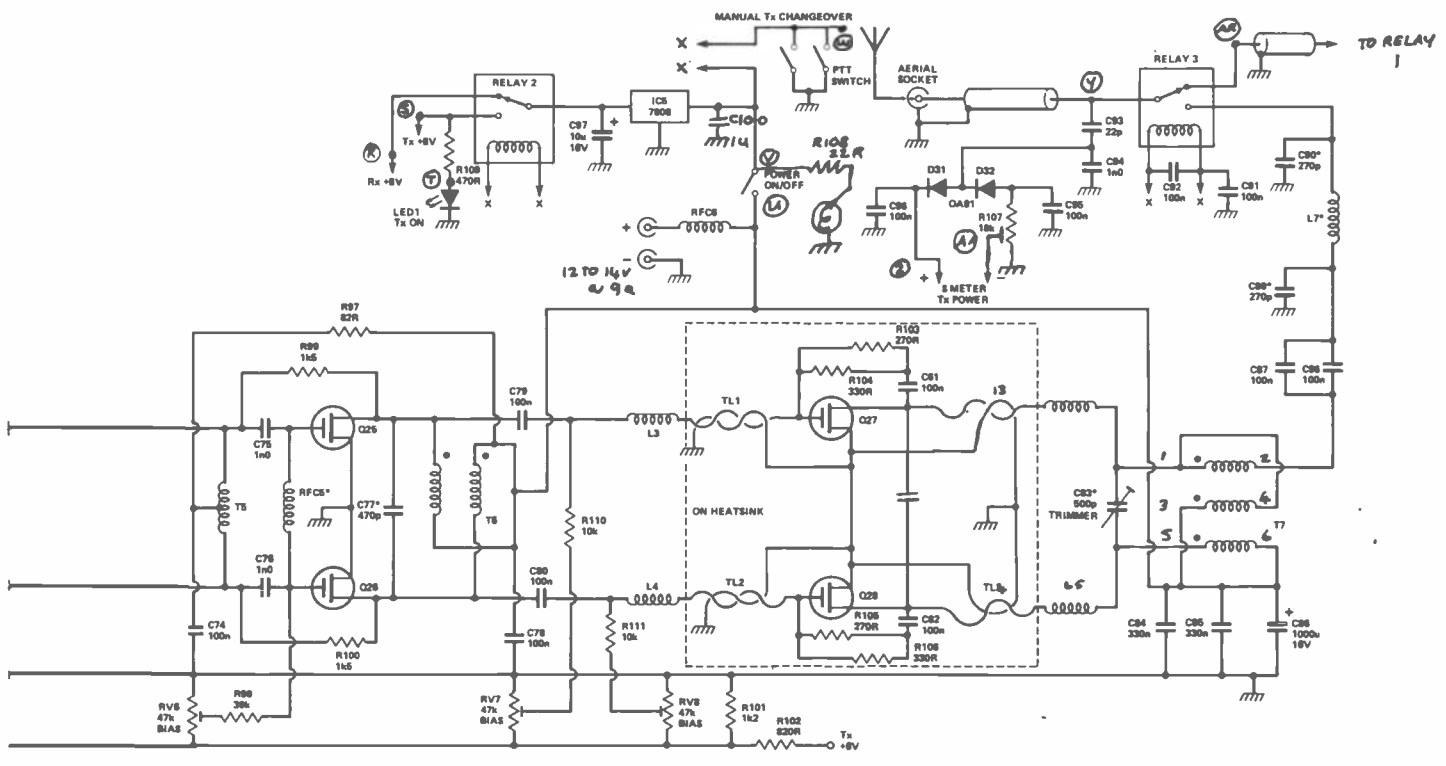


Fig.4 Block diagram of ALPHA synthesised VFO

Frequencies

For 160 m, which needs a 12.5-12.7 MHz VCO signal, the crystal oscillator uses a 13.4 MHz parallel resonant circuit, and a reference VFO running from 0.70-0.90 MHz (yes — we know Top Band is 1.81-2.0, not 1.8-2 MHz, but it makes the explanation easier!).

For 20 m, the VFO injection frequency is 24.7-25.05 MHz. This requires a series resonant 3rd overtone crystal at 25.5 MHz, in conjunction with a reference VFO at 0.45-0.8 MHz. Because of the



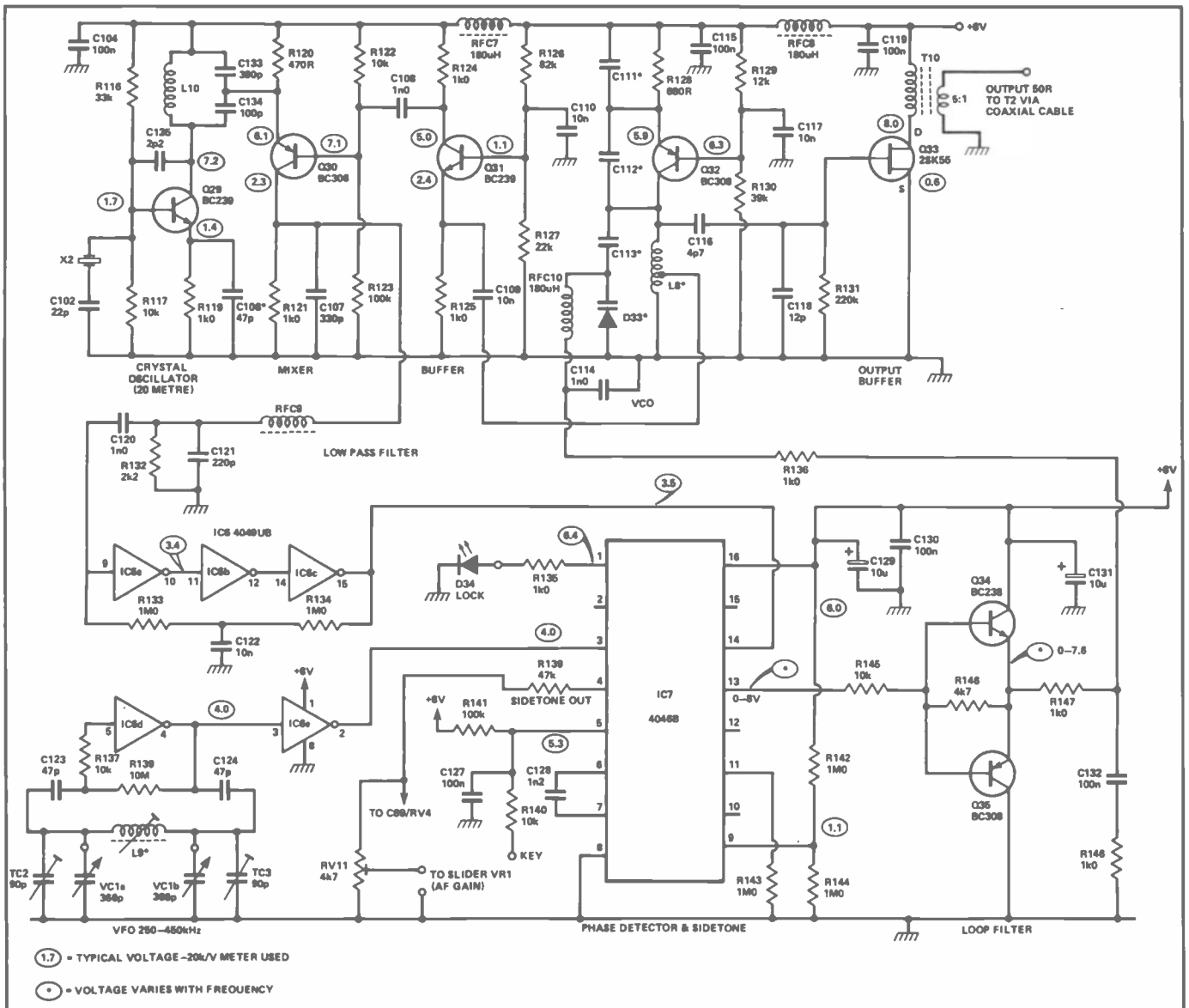


Fig.5 Circuit of ALPHA synthesised VFO

higher frequency crystal, the oscillator circuit for 20 m is different to that of 160 m. This is explained in detail on the circuit diagram, components list, and the assembly instructions.

Sidetone

For CW use, a sidetone circuit has been provided, which uses the voltage controlled oscillator of the 4046, otherwise unused in this application which only requires its phase comparator. R142,144 and C128 set the oscillator frequency, which will be around 800 Hz. Exact adjustment can be made by varying the value of R144. Earthing R140 switches the oscillator on, and the output from pin 5 goes to the slider of the volume control, RV1 via R139, and the level control RV11 (thus the setting of the main volume control does not affect the sidetone level). On transmit the sidetone signal is routed to the microphone amplifier section.

The ALPHA Case

While we were designing the main PCB, we decided that ALPHA would have a low-profile custom case which would be suitable for either fixed or mobile use. Full drawings will be given for this case, or you will be able to buy it in a completely finished state.

It is constructed from 16 gauge steel, and is therefore extremely rugged. In its commercial form, it comes with welded internal mounting studs for the PCB, speaker and heat sink, and is fully punched, painted and screen printed (much as in the photographs). The heatsink for the PA transistors is mounted underneath the lid, and in direct contact with it, giving an efficient solution to the problem of where to put a heatsink when you can't make one as part of an extrusion in the case, like the Japs do! With the use of the transmission lines to feed the PA devices, this means that just the transistors and a few components are mounted remote from the main PCB.

The front panel offers the following controls and other facilities: S Meter, Frequency Counter, Mic/PTT socket, AF gain/Power On/Off, IF Gain, Drive, Blanker Gain/Blanker On/Off, SSB/TUNE/CW, AF Filter OUT/Narrow/Wide, status LED's for the Blanker and Transmit, and the main VFO tuning control.

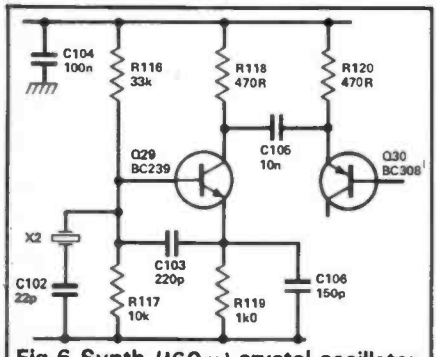


Fig.6 Synth (160m) crystal oscillator

The latter goes to two epicyclic reduction drives, one at 6:1 and another dual type at 6/36:1, connected in series mechanically. We played around a lot with this part of the design, as the VFO 'feel' is very important to most operators. Without resorting to expensive flywheel-type geared reduction drives it is difficult to produce a decent drive system, but we feel this is a very good answer. For several revolutions of the main tuning knob the tuning rate is very slow, with no trace whatsoever of backlash, then changing to a fast drive for tuning around the band. The transition between the two rates is almost imperceptible, and the torque needed to tune very low. The drives are mounted on two internal brackets in the case, welded as part of the case assembly (or screwed if you make it yourself).

A mobile mounting bracket is part of the design, and is capable of being fixed either over the lid or under the base of the main Transceiver.

Construction

Part Two of this article will describe in full the construction and alignment of ALPHA.

It has to be said now that ALPHA is not a project for the beginner! It involves close soldering work, and if you have not attempted anything like it before, you would be advised to try a few other simpler projects before tackling this. Despite this, the constructional details will be detailed, allowing almost anyone to tackle ALPHA with a high degree of confidence.

Kits

Kits of parts for this project will be available from WPO COMMUNICATIONS. Options available, for either the 160 m or 20 m version will be a complete PCB KIT, with all board mounted components, PCB, VFO capacitor, pots, wire and drilled heat sink for the PA, priced at £149.50 or a COMPLETE KIT with case (ready punched, painted and screened) plus mobile mounting bracket, and all switches, speaker, hardware etc (leaving only a microphone, key and PSU required) priced at £199.50 (all inclusive of VAT & Post).

Printed circuit boards alone (drilled and tinned) are priced at £22.45 inc.

Component Listing

R1,4,6,9,10,11, 13,14,15,24, 25,36,71,146	4k7
R2,7,12,57, 64,91	68R
R3,139	47k
R5,21,35,37, 38,50,68,74, 77,82,88,89, 110,111,117, 122,137,140, 145	10k
R8,40	47k
R16,17,18,27, 62,93	100R
R19,34,56,67, 109,118,120	470R
R20	2k7
R22,32	27k
R23	56k
R26,59,70	150R
R28,99,100, 115	1k5
R29,97,114	82R
R30,46,47,69, 72,78,81,87, 119,121,124,125 135,136,147,148	1k
R31,49,116	33k
R33,108	220R
R39,86	5k6
R41	1R0
R42,43	470k
R44,84,85,101	1K2
R45,66,75,123, 141	100k
R55,	2M2
R51	15k
R53,96,102	820R
R54,90,131	220k
R60,73	6k8
R61,79,80,127	22k
R63	3k9
R65,133,134, 142,143,144,48	1M0
R76	3k3
R83	270R
R92	560R
R94,95	15R
R98,130	39k
R103,105	270R 0.5W
R104,106	330R 0.5W
R112,113	180R
R126	82k
R128	680R
R129	12k
R132	2k2
R138	10M0

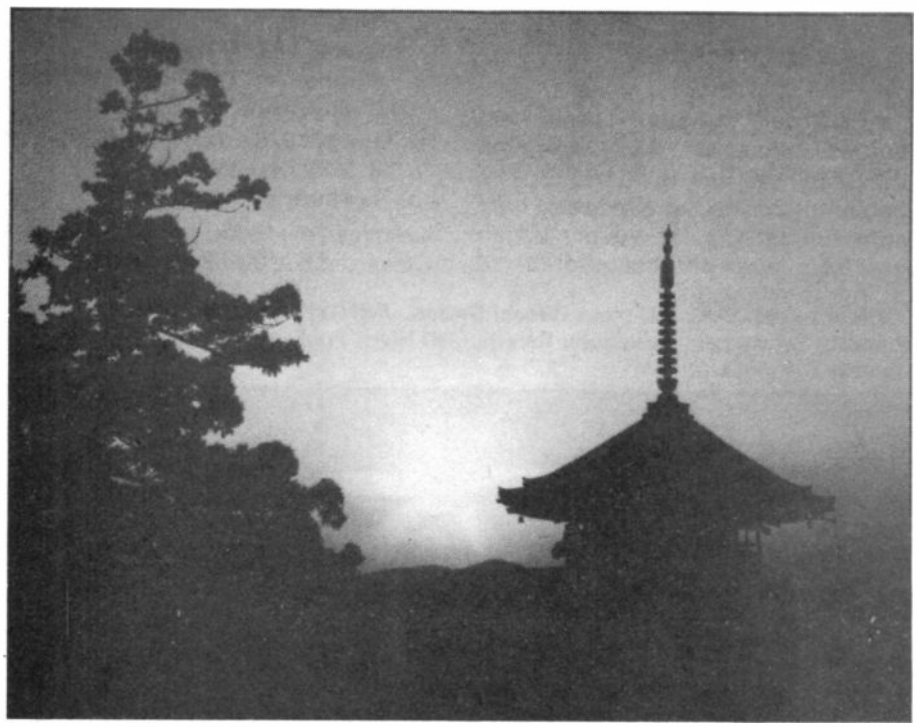
All resistors 0.25W 5% carbon film unless otherwise stated.

VR1	100k Alps Log pot with rotary switch
VR2	100k Alps log pot with push/pull switch
VR3	100k Alps Log pot
VR4	100k Alps Lin pot with push-pull switch
RV1,2,11	4k7 10mm hor preset
RV3,4	10k 10mm hor preset
RV5	47k 10mm vert preset
RV6,7,8,10	47k k10mm hor preset
RV9	470R 10mm hor preset
C1,2,10,18, 21,23,28,32, 39,43,44,49, 53,56,57,66, 69,72,74,78, 79,80,81,82, 87,88,91,92, 95,96,98,99, 104,115,119, 127,130,132	100n ceramic disc
C3,7	20m 1n ceramic plate 160m 10n ceramic disc
C4,6	20m 100p ceramic disc 160m 1n5 ceramic disc
C5	20m 3p3 ceramic disc 160m 120p ceramic disc
C8,11,12,14, 15,16,17,19, 20,22,24,33, 47,50,51,55, 58,59,60,61, 62,71,73,101, * 105 (* 160m only), 109,110,117, 122	10n ceramic disc
C9,13,48,123, 124	47p ceramic disc
C25,29,30,36, 37,54,75,76, 94,108,114, 120	1n ceramic disc
C26,136	150p ceramic disc
C27,64,* 103 (* 160m only), 121	220p ceramic disc
C31,34	4n7 mylar
C35	0.22uF 16v electro radial
C38,40,68,97, 129,131	10uF 16v radial electro
C41	100uF 16v radial electro
C42,70,100	1uF 16v radial electro
C45	47uF 16v sub-min radial electro
C46	2u2 16v+ tantalum bead
C52,93,102	22p ceramic disc
C63	4u7 16v radial electro
C65	22uF 16v radial electro
C67	22n ceramic disc
C77	20m 470p silver mica 160m not used
C83	20m 500p mica compression

	160m 4n7 silver mica	D8	BA244	T7	6 Trifilar turns (18t total) 1mm en Cu wire on two cores as RFC6
C84,85	470n polyester film	D31,32	OA91		
C86	1000uF 16v radial electro	D33	BB204B		
		LED1,2	3mm Red LED	T8	2t primary, 8t secondary as T1
C89,90	20m 270p silver mica	ZD1	4v7 400mW Zener		
	160 m 3n6	IC1	KB4412	T9	2t primary, 6t secondary as T1
C106	20m 47p ceramic disc	IC2	LM380N		
	160m 150p ceramic disc	IC3	741N	T10	10t primary 2t secondary on core as T1
		IC4	74LS90		
C107	33p ceramic disc	IC5	7808	L1,2	20m TOKO KANK 3335R
C111	20m 470p polystyrene	IC6	4049UB (must be UB)		
	160m 820p polystyrene	IC7	4046B		160m TOKO KANK 3334R
		F1	Uniden SSB Filter		
C112	20m 100p ceramic disc		10.7MHz 2.2.kHz type 10M02DS	L3,4	20m 5t 1mm en Cu wire on Amidon T68-6 core
	160m 220p ceramic disc	X1	20m 10.6985MHz		
			160m 10.7015MHz		160m 10uH axial choke
C113	20m 27p ceramic disc	X2	20m 25.500MHz 3rd ovt HC18/U.	L5,6	20m not used — link, see text
	160m 56p ceramic disc				
C116	4p7 ceramic disc		160m 13.400MHz 30pF par. res HC18/U		160m 5t 1mm en Cu wire on Amidon T50-2 core
C118	12p ceramic disc				
C128	1n2 polystyrene	RL1,2,3	Kam Ling KUIT-A or B. 12v SPCO Relay	L7	20m 10t 0.8mm en Cu wire on Amidon T68-6 core
C133(20m only)	390p ceramic disc	IFT2,3	TOKO KACS 3894A		
C134(20m only)	100p ceramic disc	IFT4-9	TOKO KALS 4520A		
C135(20m only)	2p2 ceramic disc	RFC1,3,4	10uH axial choke		160m 25t 0.8mm en Cu wire on Amidon T68-2 core (NB: −6 cores are Yellow −2 cores are Red)
C136	150p (20m only)	RFC5	20m 6.8uH axial choke		
CT1	60pF max 10mm trimmer		160m 3k9 resistor		
CT2,3	90pF max 10mm trimmer	RFC6	14t 1mm dia enamelled Cu wire on Fair-Rite Core type 59-61001101	L8	20m 7t 0.56mm en Cu wire tapped at 2t from earthy end on Amidon T50-6 core
VC1	Jackson Type 00 air variable. Twin gang 365+365pF.				
Q1,2,5,15,22	3SK45 or 3SK51	RFC7,8,9,10	180uH TOKO type 7BA or BS (marked 181)		160m 12t 0.56mm en Cu wire tapped at 3t from earthy end on Amidon T50-6 core
Q3,4,8,9, 12,19,20,21, 29,30,31,34	BC238 or BC239	T1	6t Primary, 6t CT secondary 0.2mm en Cu wire on Fair Rite Balun core type 28-43002402		
Q6,7,14,16,23 24	2N2369 or BSX20			L9	20m TOKO RWO6A7752EK
Q10,11,33	2SK55	T2	6t CT primary, 6t Secondary as T1		160m RW06A7752EK
Q13	J310	T3	2t primary, 6t secondary as T1	L10 (20m only)	TOKO 301KN 0700 (Violet)
Q17,18,32,35	BC308	T4	10t primary, 4t CT secondary as T1	TL1-TL4	twisted pair transmission lines at 5 t.p.i. using PTFE covered wire — see text for details
Q25,26	VN66AF (Siliconex)	T5	8t CT as T1		
Q27,28	IRF120 or IRF123 (ex International Rectifier) or VN64GA (Siliconex) (see text) with mounting kits	T6	10t Bifilar wound (20t total) 0.56mm en Cu wire on core as RFC6		
D1,2,10-30	1N4148			DISPLAY	PCIM177
D3,4,5,6	Schottky type				
D7,9	Not used				

Radio in the 'Rising Sun'

Much of today's Amateur Radio equipment comes from Japan, which also has the largest number of licenced amateurs in the world — well over 1 million! Tom King, VK2ATJ, packed his typewriter and went to investigate.



The next time 20 metres goes dead, ponder this fact about the most prolific users of the band. If all the radio amateurs in Japan were to stand with outstretched arms touching, the human chain formed would extend for over 1,700 km. (This is roughly the air distance between London/Naples, and about half the way from the cool climate of northern Hokkaido to the sub-tropical warmth of the Southern Okinawa Islands). That's quite a distance, but more importantly it's an astounding number of amateurs.... some 1,020,000.

By the time you've finished reading this, the odds are very good that the amateur population in Japan will have increased a bit. I'm sure that in the 10 hours it took me to fly from Sydney to Tokyo, the bands greeted a few more DXers and rag chewers. I was pondering the possibilities when I touched down at Narita International Airport; I had arrived in the Land of the Rising Sun.

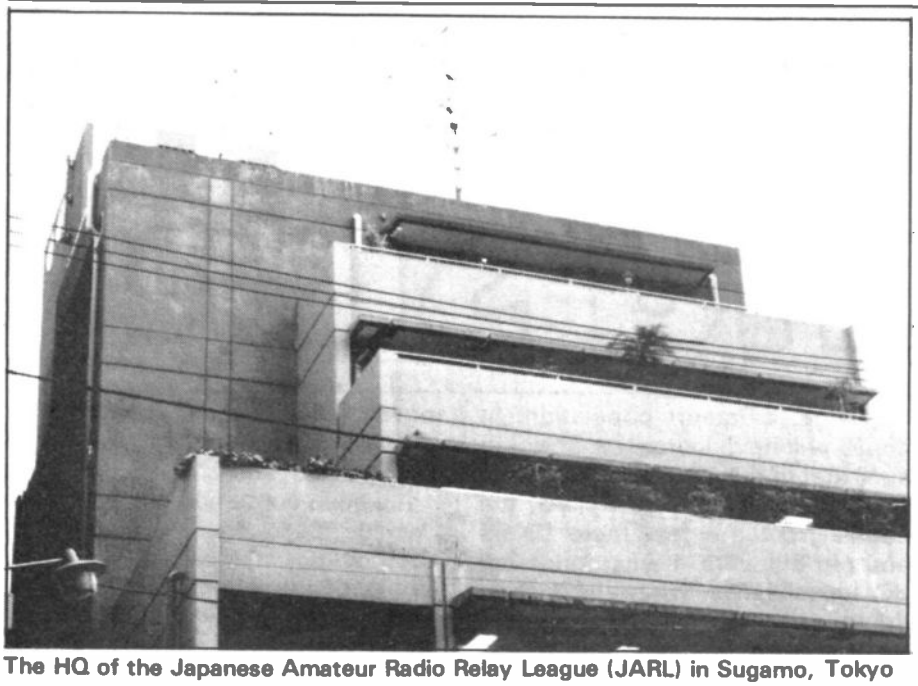
Ultra modern Narita must have received an award for being so far from Tokyo as it's 60 km between airport and capital, a distance which is covered in a little over an hour. (Fortunately, there are frequent coaches which offer white glove courtesy and a welcoming bow to each boarding passenger.)

As we sped towards Tokyo, all the passengers around me must have been contemplating how they would spend their few days of stop-over or their two week holiday in one of the world's largest cities. Most undoubtedly would opt for the initial buzz-around-town city tour to see somber Kasumigaseki where the government offices are located; the massive 400 year old Imperial Palace; the sophisticated and shop-lined Ginza; the 1,350 year old Asakusa Kannon Temple with its god of thunder guarding the entrance and the amusement and shopping area of Old Ueno, concluding with a leisurely cruise down the Sumida River and a traditional tea ceremony. None of these tourist activities for me — or at least not until I've finished my mission — I thought, as I spotted a bay of 44 440MHz yagis stop eight well guyed tower sections.

On the drive to Tokyo I heard exclamations from fellow passengers about "how modern all this is", and "gee, it sure is spread out." I only exclaimed about the number of yagis, quads and dishes I saw... but very quietly, as I didn't want anyone to know that I was planning a more interesting time than they would have!

Down To Business

At last we arrived in the heart of skyscraping Tokyo. I transferred my well travelled luggage to the boot of a spotless taxi and said, "Shinjuku," to the spotless white-gloved taxi driver. We located the Take-No-En Minshuku (a guest house-type lodging charging £13 including two meals) without much difficulty. The quiet surroundings and comfortable bed coupled with flight fatigue beckoned me to rest. The importance of my mission urg-



The HQ of the Japanese Amateur Radio Relay League (JARL) in Sugamo, Tokyo

ed me on however . . .

The Shinjuku railway station was not far from the minshuku so I walked the distance, hardly noticing the multitude of cinemas and restaurants sprouting from the suburb. I purchased a ticket for Sugamo station (6 stops north of Shinjuku on the Yamanote line), checked for the correct platform and waited for the next train. (All this, I must emphasise, was undertaken during off-peak hours, otherwise the commuter experience becomes a rib-bruising ordeal!)

Since railway stations are labelled in English as well as Japanese, it was easy to get off at my destination. "I've conquered Tokyo," I thought as I headed out of the station, hopefully armed with a tiny slip of paper containing just one address in Japanese.

I showed the address to a street corner policeman and he pointed to the other side of the station. Immediately to the left of the station I found a small circle of grass and a narrow street which ran parallel to the station. I followed the street for one block, then scanned the roof line for any telltale indications. It worked, as a few buildings from me was an assorted array of every imaginable type of antenna. It was on the doorstep of 14-2 Sugamo, 1-chome, Toshima-ku, the headquarters of the Japan Amateur Radio League. Fortunately, I had called ahead (03) 947.8221 so Mr. Hiroshi Onoda, Deputy Chief, JARL Publicity Section was awaiting my arrival. Mr. Onoda, JM1RYK, like Mr. Takenobu Kaieda, JH1HNH, Publicity Manager for the League, spoke excellent English and provided a fascinating look at JAs and the JARL.

A Bit Of History

'Official' amateur radio activities began in 1927 (although the JARL was set up in 1926). The beginning of the modern era of ham communications, however, began in 1952 with the resumption of amateur radio operations which had been suspended during World War II. The intervening 32 years has witnessed a virtual explosion of amateur interest and enthusiasm seen nowhere else in the world.

Thanks to the 600 training classes offered throughout the 147,200 square mile island nation of Japan, some 30,000 new amateurs are added to the ham ranks each year. (By the year 2000, according to current projections, Japan will have an estimated 1,500,000 licensed amateurs and somewhere around 750,000 equipped stations!)

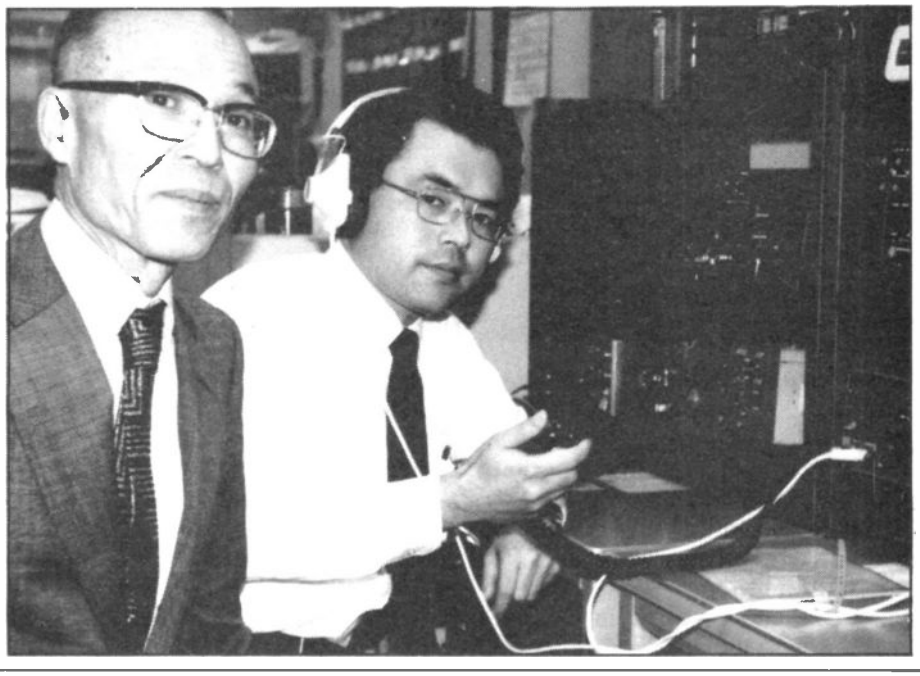
The JARL plays a unique role in the procedure to become an amateur as the organisation writes, gives and marks the exam and then sends the results to the Radio Regulatory Bureau for the issue of a call sign. The entire process from exam to call sign takes three to six months.

There are four grades of licence in Japan:

* 1st Class, all bands and all modes, 500W output.
* 2nd Class, all bands and all modes, 100W output.
* Phone, no 14MHz or 10 MHz, 10 W output.
* Telegraph, no 14 MHz or 10 MHz, 10 W output.

Testing charges for the four licenses are around £10.25, 1st Class; £8.80, 2nd Class and

Visitors to the JARL will meet Hiroshi Onoda, JM1RYK, Deputy Chief, Publicity Section and Takenobu Kareda, JH1HNH, Publicity Manager and can operate the JARL station



£5.85 for the two 10 watt licences. Exams are given twice a year for 1st and 2nd Class.

While some aspects of amateur activity and legislation in Japan are absolutely astounding for their progressiveness, other aspects are not as sophisticated as would normally be expected in a country with a million plus amateurs. For instance, third party traffic of any kind is forbidden. A reciprocal licensing agreement is in progress, however. Until 1982 repeaters were illegal, but, now, the "horizon extenders" are so popular that Japan's 70cm band of 430 MHz to 440 MHz is filled to capacity. Another UHF band is receiving overflow, with activity on 1.260-1.300 GHz gaining new operators every day. Commercial gear for this band is selling well in the half-a dozen equipment outlets in Akihabara (six railway stops beyond Sugamo on the Yamanote line).

The JARL, like amateur radio leagues in most other countries, is in constant negotiation with the government to allow increased privileges. This, however, is only a small part of its overall commitment to developing the art of amateur radio in Japan.

Highly Organized

Aside from its active involvement in the amateur exam and licensing process the JARL liaises with its more than 2,000 affiliated radio clubs. It does this by staffing a regional office in each of the 10 JA call areas. (In all, there are 130 staff members of the JARL.). Headquarters lend 16 mm films and video tapes and have staff who can present non-technical and technical lectures to widely diversified audiences. Additionally, HQ co-ordinates a TVI assistance program which involves 700 JARL members and TV and audio equipment manufacturers.

Within the JARL headquarters office in Tokyo is a state-of-the-art station setup (operational from 10am to 5pm) and a publications division which produces a call book (only in Japanese), a QSO manual (in seven languages), the monthly official journal, "JARL News" (which contains news — particularly awards and contests and information on activities of local clubs) and the International Amateur Radio Union "Region 3 News" magazine (a bi-annual publication). The Sugamo office also has another major task with the processing of 2 million QSL cards a month through the JARL QSL Bureau!

JA1 QCQ, Managing Editor of 'CQ Ham Radio', displays the world's largest ham radio magazine

Yearly membership in the JARL is around £14. This is hardly a financial burden to Japanese amateurs who live in Asia's most affluent country, yet JARL members number only about 130,000 or about 12 per cent of the total ham population in the country. Japan's largest selling independent amateur magazine "CQ Ham Radio" doesn't have a much greater share of the market with its 150,000 monthly sales figure.

The offices for "CQ Ham Radio" are conveniently located in the same building as those of JARL. Mr. Oneda of JARL's publicity section can usually arrange for a visit to the magazine for a look at how the world's largest amateur magazine is put together. (While it may not sell the most copies in the world, "CQ Ham Radio" consistently runs over 500 pages an issue).

Mr. Sumio Miyamoto, JA1QCQ, Editor-in-Chief, heads an editorial team of 20 journalists (*I've just gone green — Ed.*) and 6 advertising personnel. The issue he was involved in during my visit was shaping up to the 532 page mark which is a far cry from the 24 pages for the first issue which appeared in September, 1946. The biggest issue to date was December, 1980, which contained 596 pages of ads and articles. The economic situation in Japan has seen a drop in advertising by equipment manufacturers but *not* a drop in the number of articles "CQ Ham Radio" publishes every month.

Despite the availability of advanced commercial equipment, Mr. Miyamoto noted that Japanese amateurs are still interested in building at least some of their own gear. There's interest in amateur TV, RTTY, antennas, computers and microwave articles with 10,000 MHz now receiving much attention.

Mr. Miyamoto has noted a change in hams' interests since he's been editor-in-chief, with Japanese amateurs preferring more technical articles. "CQ Ham Radio" is now having to work harder to explain techniques, and explain them on different levels, as beginners are just as interested but their relative recent entry into amateur radio may mean their level of experience and understanding is somewhat limited.

Japanese amateurs not only like to work DX and exchange cards but they like to know who's worked what, when it was worked and how. Consequently, "CQ Ham Radio" carries much DX information. In the early days of the recent operation from China, the magazine dispatched staff to China with the result being a massive colour feature eagerly devoured by DX-hungry readers.

"What's the most difficult aspect of editing the world's largest amateur radio magazine," I asked Mr. Miyamoto. His answer was simple. As he handed me a copy of "CQ Ham Radio" he said, "judging what amateurs want to read and meeting those challenges in a country where the sun is just dawning in amateur radio."

Addendum

Iambic Keyer (June 1984)

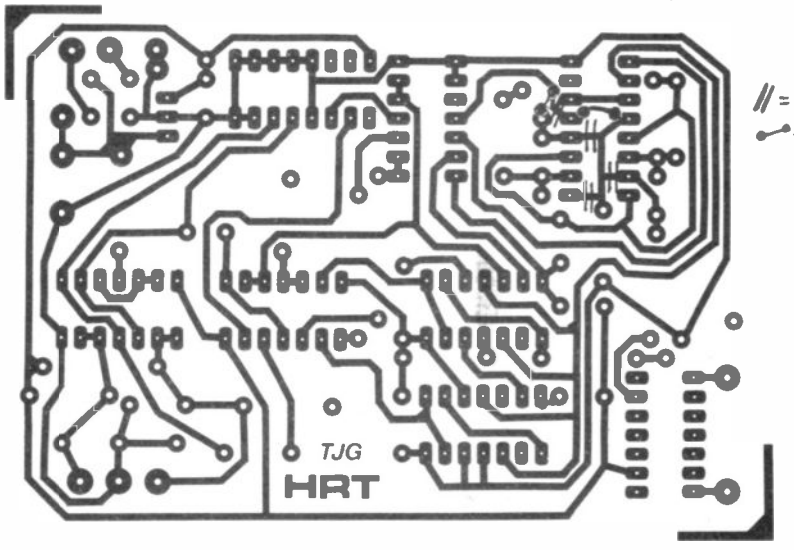
In the process of publication, a number of errors crept into this project, which we regret.

Circuit diagram, P60: The circuit of the keyer on page 60 is incorrect in that IC4 a and b pins 1 and 15 connect only to C3 and C4 respectively — not to earth as shown. There are a few labelling errors on the circuit which could serve to confuse. These are as follows:
IC4a pin 4 should be 'A' not 'B';
IC2b CLK pin 3 and S pin 6 should be pin numbers 11 and 8 respectively as in IC1b;
The arrow between R4 and R5 should be labelled +12V.

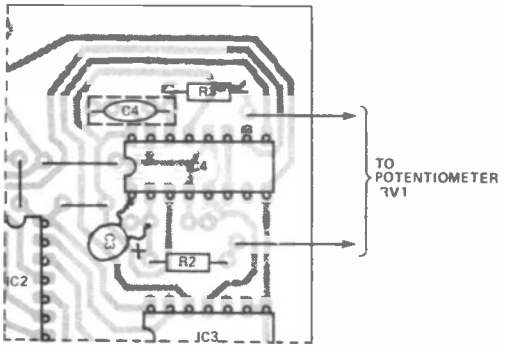
Overlay diagram, P61: Alterations are necessary to the PCB in the area of IC4. The corrected overlay diagram shows these in simple diagramatic form; for clarity, the pin connections of IC4 are given below;
Pin 1: remove earth connection, this pin should connect to C3 — only;
Pin 2: connects to C3 + and R3;
Pin 3: OK;
Pin 4: connects to IC3 pin 11;
Pin 5: connects to negative supply;
Pins 6 to 14: all OK;
Pin 15: remove earth connection, connects to C4 only;
Pin 16: OK.

A small piece of PCB track is missing between Pin 1 of IC1 and the adjacent wire link which should connect the positive 12 V supply to pin 1. Extend the wire link to pin 1 of IC1 to connect the positive 12 V to the IC.
On this diagram, the potentiometer should be labelled RV1 not R2;
R3 becomes R2;
R4 becomes R3
R5 is correct;
R6 becomes R4.

Finally, we would like to appologise to the author, David Silvester, for not only getting his project slightly less than perfect — but also for spelling his name wrong. Sorry, it was one of those months.



// = CUT
= LINK



A Fresh Look at the FT200

After Harry Leeming's excellent and highly popular series on up-dating the FT101, HRT received many requests for a similiar article on the FT200. Well, G3LLL got to work and here it is!

Lowe's of Matlock introduced the FT250 by Sommerkamp in 1969. The rig was manufactured in Japan by Yaesu for Sommerkamp; Yaesu directly marketing it themselves as the "Yaesu FT200". In the USA the same rig carried the Henry Radio label and was known as the "Temp One", all three rigs being identical apart from the name plates. The rig's success can be judged by the fact that it remained in production ten years, and during this time went through very few circuit changes, and the only way later production models can be easily identified is that in the last few years' of production the original grey cabinet was replaced by a black one.

The FT200 does not use the common double superhet arrangement as do most other rigs of its era, but it uses a pre-mixer arrangement. This system with a few alterations was later incorporated in the FT101ZD. The general block diagram of the FT200 is shown in **Fig.1**, and **Fig.2** shows how the pre-mixer system operates when the rig is tuned to the 15m amateur band. Pre-mixing avoids the cross modulation and noise problems caused by the usual need to use two mixers in a double superhet and without the complication of synthesisers or phase locked loops to provide the oscillator injection. With the FT200 the VFO operates over a fixed frequency range of 5-5.5MHz, so that frequency stability is not too much of a problem.

Looking at Fig. 1, one sees that apart from the VFO the FT200 is almost entirely non 'solid-state'. Mechanically, the complete Yaesu outfit consists of a fairly light weight transceiver, with a separate and heavier loudspeaker and power supply unit. All bands 80-10 metres are included with the exception of the new WARC bands. Full coverage of 28-30MHz is provided for in the switching, but only the 28.5-29MHz crystal was supplied as standard. Fitting the extra crystals needed to give full 10 metre coverage is simplicity itself, but I know of no simple way of incorporating 1.8MHz or the new 10, 18 and 24MHz bands on the FT200.

If you are considering buying a second hand FT200/250, Bill Lowe's original advert, reproduced here courtesy of Lowe Electronics, tells most of the plus points, and it only remains for me to point out the shortcomings in what, after all, is an economy rig.

The FT200 is full of valves. Nothing wrong with bottles, of course, they do have some advantages over solid state devices, but they don't last as well. Usually transistors have only three possible states: good, bad or 'noisy', and they do not gradually tail off in performance under normal cir-

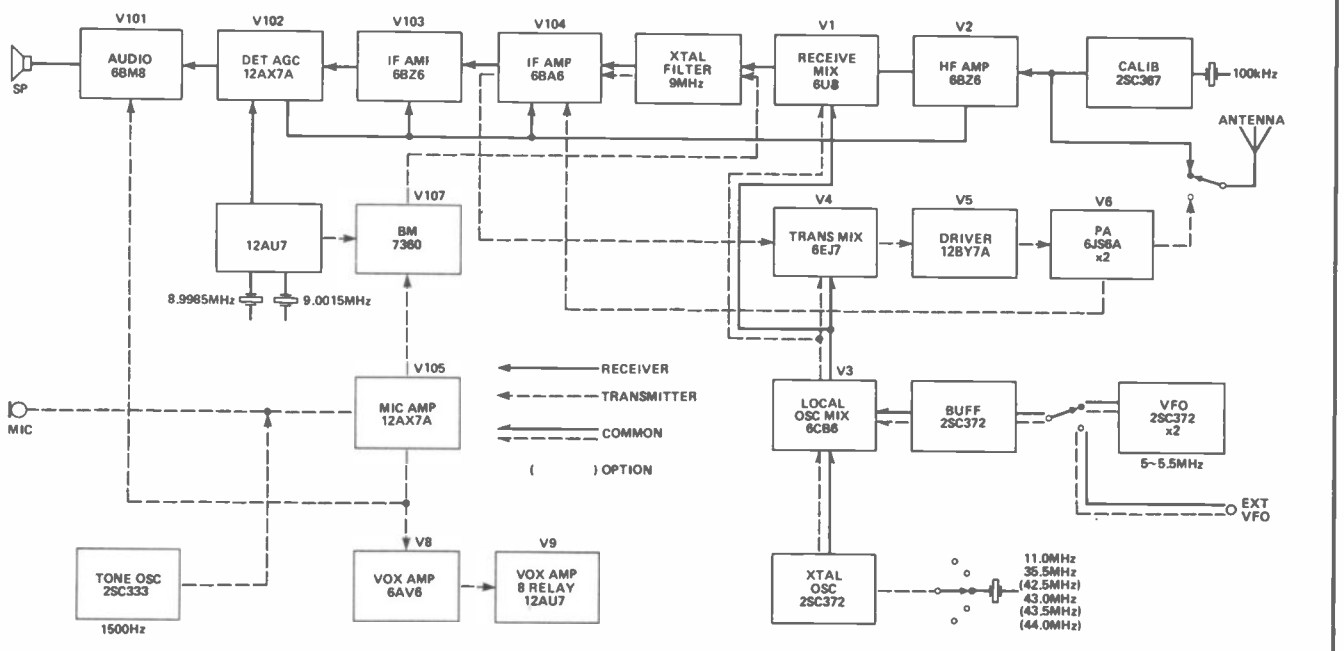


Fig. 1 Block diagram of the Yaesu FT200

cumstances. Valves do occasionally suffer from, ''catastrophic failure'' but more often than not they just gradually deteriorate. To bring an old and tired FT200 up to scratch can mean the purchase of over £50 worth of valves. Some of the valves are just not made any more by the original makers, and not all equivalents of other manufacturers work; some can even cause extensive damage if fitted — more about this later.

No provision is made for a CW filter on receive. Transmit wise, in particular, the FT200 will give good account of itself in the CW mode, and can be run at near the full legal limit. The best one can do for reception is to back-up the 2.3kHz wide SSB filter with a good active audio filter such as one of those made by Datong. *(The Editor would like to point out that he used an FT200 largely on CW for a number of years with no extra filtering — the SSB filter has very steep 'sides' and the rig is considerably better than, say, an FT101 without a CW filter).* The FT200 also has no noise blanker. On paper this is a disadvantage when compared with other rigs made at around the same time, but in practice it is just as good to have a rig without a noise blanker, than it is to have one with a noise blanker that doesn't work!! Unfortunately, this is about all most noise blankers on competitive rigs made at around the same time can offer!

The scale of the FT200 S-meter is marked logarithmically up to S9 plus 60, but the circuit which drives it seems to operate almost linearly. The result is that readings on signals below about S8 are insufficient whilst readings over S9 are too generous. Not too much to worry about once you learn to add a few S points to your DX signal reports, and to subtract 20-40dBs off your locals signals.

A Word Of Advice

An FT200 in good condition can be an excellent first buy when funds are somewhat tight; untried bargains can, however, prove to be expensive and so as the rig has been around for over fifteen years, condition and value for money can vary enormously. Faulty rigs can usually be repaired, but equipment that has been butchered or which has had unrecorded modifications carried out on it can prove to be a very expensive proposition, so that it is wise to have a good look inside and outside first. As with a car purchase there is little to beat a trial run, and if fed with a reasonable aerial system the rig should work well on all bands, but expect the S

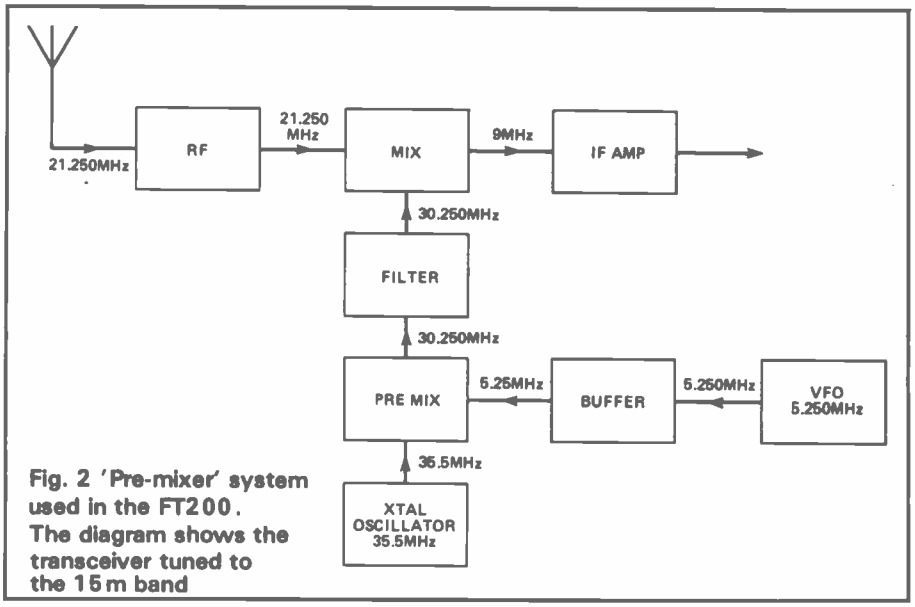
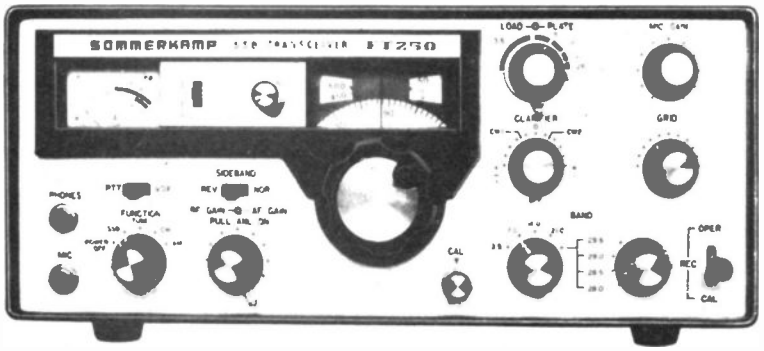


Fig. 2 'Pre-mixer' system used in the FT200. The diagram shows the transceiver tuned to the 15m band

LOWE ELECTRONICS 50/52, WELLINGTON STREET, MATLOCK, DERBYS. DE4 3GS
MATLOCK 2817 (2430 evenings)



SOMMERKAMP FT-250 TRANSCEIVER - £160.0.0.

240W p.e.p. 80 to 10 (4 segments of 10 if required with 3 extra crystals) Receiver sensitivity 0·3 microvolts for 10db S + N/N.
Selectivity: 2·1 kHz at 6dB, 3·4 kHz at 6dB. This is an incredible 1·62 shape factor.
Stability: plus or minus 100 cycles after warm-up.
Meter reads cathode current, relative power out, or ALC on transmit and acts as an " S " meter on receive.
Power required: 800-800vdc at 200mA average. 300vdc at 50mA; 150vdc at 150mA; —100vdc at 10mA and 12·6vac at 5A. This 5A may be obtained from two sources (2A and 3A) if preferred as there are two separate heater circuits (just another thoughtful touch!).
Size: 13½ in w × 5½ in h × 12 in overall depth. Weight: 18 lbs.
This latest addition to the Sommerkamp range is designed to compete with the lower cost equipment in price while at the same time outperforming it handsomely. It does this by leaving the construction of a power supply to the owner. This is no great hardship to most amateurs who can soon lash up a p.s.u. We can of course, supply a matching p.s.u. if you really want one, for £45.0.0 (but I'd much rather help you build your own!).
The high quality and thoughtful engineering associated with Sommerkamp has not been relaxed in the least and examining the FT-250 closely there are a few nice touches not usually found in this price range:—
1—The designer has avoided using the PA tank as the Rx input—he has used proper r.f. coils of optimum design. If you think about it, a PI net by itself makes a pretty poor Rx input.
2—VFO and heterodyne oscillator are pre-mixed before being injected into the Rx chain. Hence the great sensitivity and low noise performance.
3—Transistors are used where they are best suited, not just for the sake of using them. Where valves are superior, valves are used.
4—M derived band pass filter between the VFO and following mixer. Very nice touch, this.
5—Built in tone oscillator for tune-up and CW sidetone.
6—Amplified agc.
7—" S " meter sensitivity (as well as zero) pot. This will delight the " 60db over S9 OM " boys! !
8—All crystals have trimmers for extreme accuracy.
9—A very nice robust geared drive plus a ball drive for slow, slow tuning (15 KHz per turn).
The above points, Gentlemen, are nicetles the spec. sheet doesn't cover—nicetles which are unusual in low priced gear. Also, of course, you have a full complement of operating facilities which are built-in as standard and not optional extras —100 kHz calibrator, VOX, PTT, MOX, switchable sidebands, monitored ALC, R.I.T., extremely linear VFO with 1KHz calibration and a healthy long-life PA virtually identical with the FL-500 Tx.
All this adds up to a very fine rig at a rock bottom price and I for one, wouldn't blame you one little bit for wanting one!
Needless to say, it carries a 12 month guarantee.

73 de Bill, G3UBO/VE3DP

Original advertisement for the FT200 which neatly summarises the main advantages of the transceiver

meter to be mean and sensitivity a little down on 10 and 15 metres. RMS power output into a dummy load should be well over 100 watts on all bands below 15 metres, and around this figure on 10 and 15m. Check the grid tuning control; if the correct valves are fitted and alignment is OK the point of maximum sensitivity on receive should coincide near enough with maximum output on transmit. ALC action should be obtained on all bands except, perhaps, on 10 metres and the point of maximum output on the PA tune control should coincide with minimum dip if neutralization is OK and the correct PA valves are fitted.

Servicing The FT200

The original RF and IF valves in the FT200 were made by Toshiba and are difficult, if not impossible, to obtain now. Replacement of several of the receiver valves with less gainy substitutes does not help a receiver which initially was perhaps a little short of gain. One way of adding extra gain, recommended by the FT200 club in New Zealand, is to remove the 6BZ6 RF amplifier valve and its holder, and wire in a new holder to take an EF183. This is perhaps a move only recommended for the technically adventurerous, and Colin Wilson, G4AZM, (often seen surrounded by hundreds of valves at mobile rallies) recommends the 6DC6 as being a plug in replacement for the 6BZ6 with higher gain; this being an easy way to hot up the FT200. Other mention the 6EW6 as being another suitable substitute for the 6BZ6 when more gain is required.

The FT200 gets hot — very hot — and so despite some effort having been put in by Yaesu to ensure temperature compensation, a little long term frequency drift is inevitable. The same heat can also cook components and reduce their life — adding a fan to suck out the heat from the rear of the PA cage is a very worthwhile move and considerably increases stability and long term reliabilty.

The AGC System. As on most valve rigs the FT200 AGC line is of very high impedance, and is soon upset by any small 'leakage'. The most common trouble with the AGC system is that as the set warms up, the receive gain tends to drop and the zero on the S meter drifts up for the first hour or so. A couple of S points drift is normal but more than this indicates that one of the AGC control valves is flowing grid current and is gradually biasing off the AGC system. The most common culprit is V104, a 6BA6, and this should be replaced by its heavy duty equivalent the 6BA6W which, in most cases, will very considerably reduce the drift on the S meter.

The RF gain circuit functions by applying a controlled negative voltage to the AGC line. Sometimes, the high valve resistors

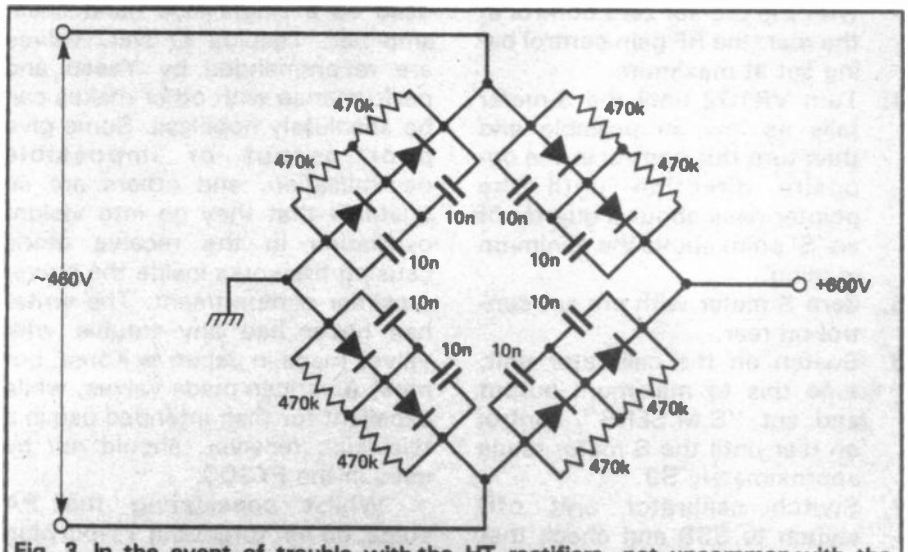


Fig. 3 In the event of trouble with the HT rectifiers, not uncommon with the FT200, they should be replaced by a bridge of 8 BY127 rectifiers as above

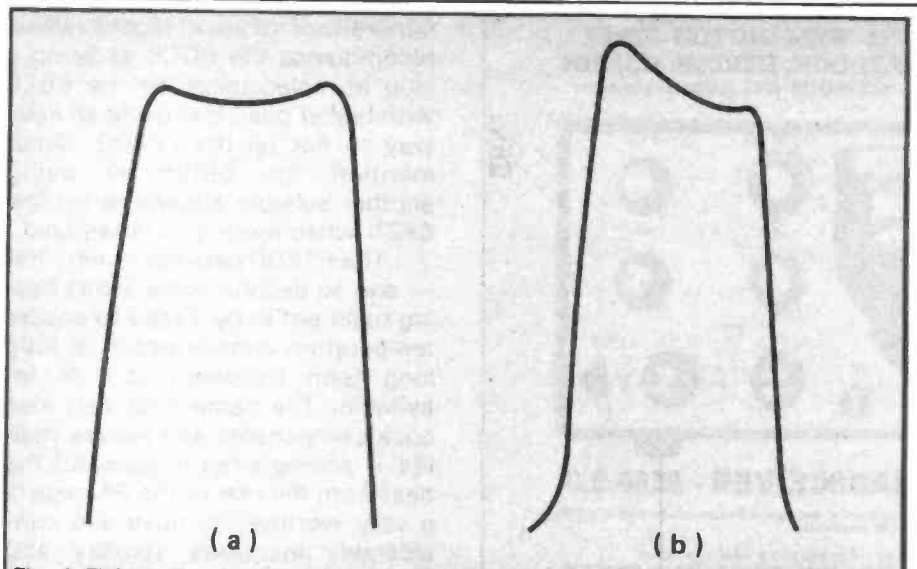


Fig. 4 FT200 Receiver response should be symmetrical — as in (a) *not as in (b)*

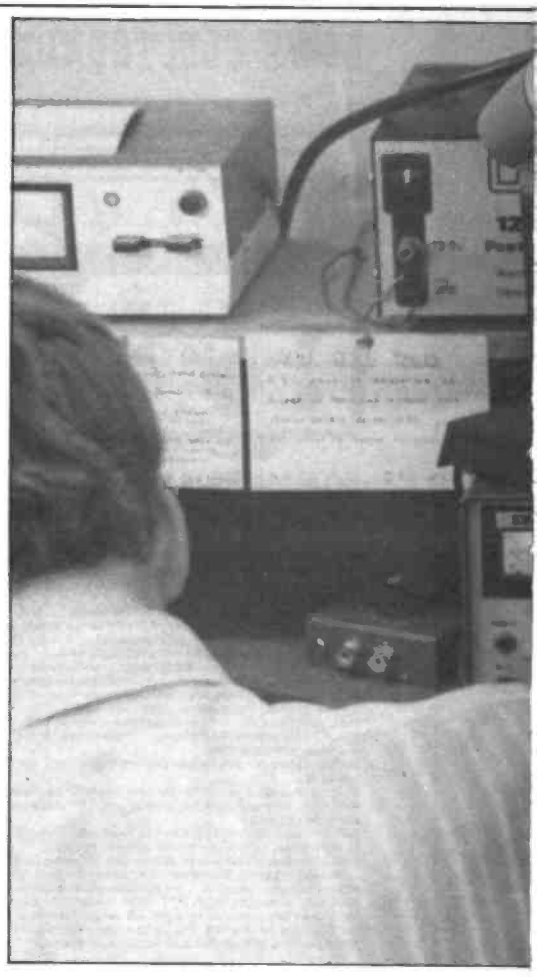
around V102B, and in the grid circuits of the AGC controlled valves, multiply in value or go open circuit. This gives distortion on strong signals, low receive gain, or incorrect operation of the RF gain control.

Setting up the AGC system. Presuming that there is no fault in the AGC circuitry, distortion on strong signals with attendant necessity of excessive backing-off of the RF gain control indicates that the AGC system is out of adjustment. To re-align this, proceed as follows:

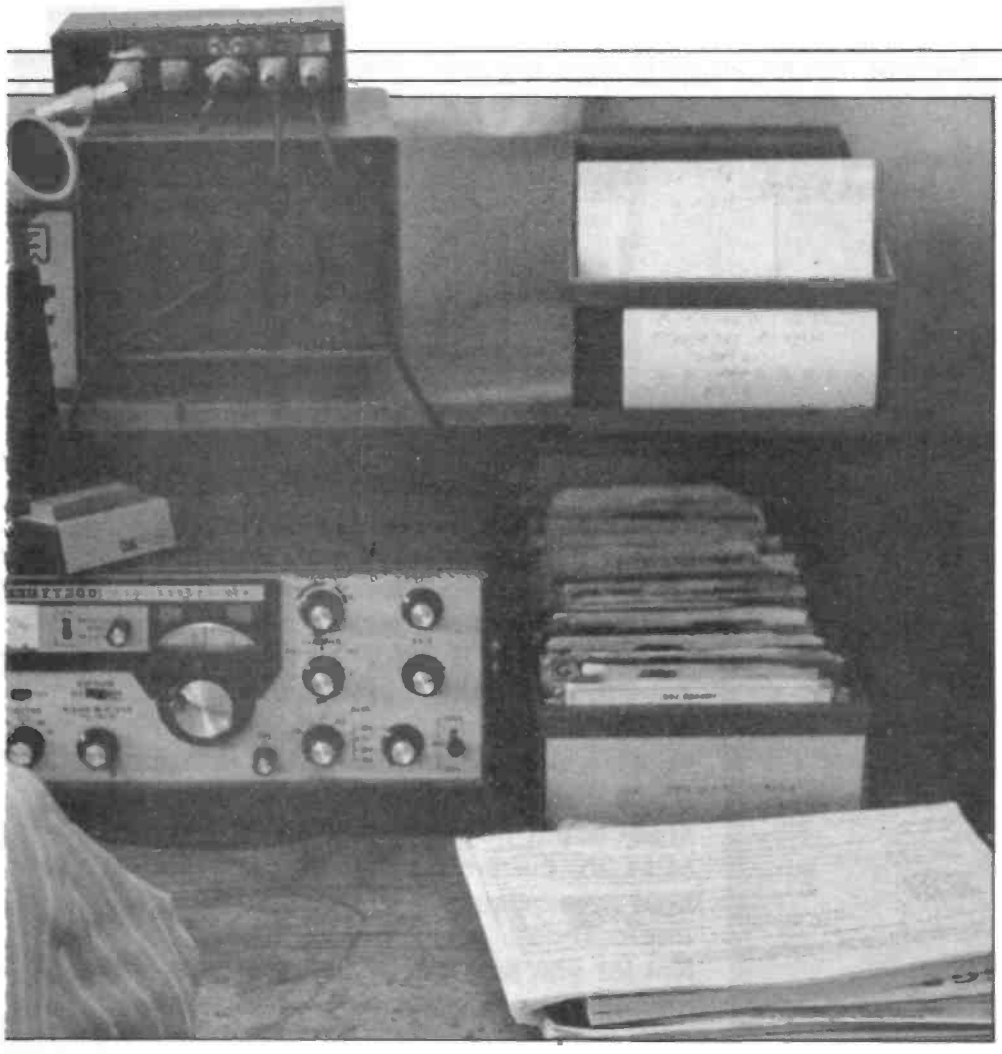
1. Remove case of FT200 and leave to warm up for about 20 minutes.
2. Remove aerial and tune to 3.8MHz in the AM receive mode.
3. Set the 'S-meter' to about S2 with the pre-set zero control at the rear; the RF gain control being set at maximum.
4. Turn VR102 until the S-meter falls as low as possible and then turn this control in the opposite direction until the pointer rises about a quarter of an 'S' point above the minimum reading.
5. Zero S meter with pre-set control on rear.
6. Switch on the calibrator unit; tune this to maximum output and set "S.M.SENS" control on rear until the S meter reads approximately S9.
7. Switch calibrator unit off; switch to SSB and check that zero on SSB is the same as on AM.
8. If zero rises above S1, reset capacitor (twisted wire under V102) until the reading falls.
9. If much adjustment was necessary repeat steps 3 to 8.

The PA Stage. This used originally a pair of 6JS6A valves; these being replaced in later production by the slightly higher rated 6JS6C. These valves, which preferably, should be in matched pairs are plug-in replacements for each other, although it is sometimes recommended that when using the former, the I/C current is set at 50mA, whereas, with the latter, setting the bias for 60mA is advised. It is important to note the 6JS6 is a television line output valve, and that its specification does not guarantee inter-electrode capacity or linearity when used as a single side band linear amplifier. Toshiba or NEC valves are recommended by Yaesu and performance with other makes can be absolutely hopeless. Some give poor output or impossible neutralisation, and others are so unstable that they go into violent oscillation in the receive mode causing fireworks inside the power amplifier compartment. The writer has never had any trouble with valves made in Japan or Korea, but most American made valves, while excellent for their intended use in a television receiver, should *not* be used in the FT200.

Whilst considering the PA stage, do not forget the 11-pin plug which must be inserted into the rear of the FT200. A link in this plug completes the PA heater circuit for the rig, and whilst it should be removed when driving a transverter, so as to disable the PA, the transceiver will not work in its normal mode without it.


Despite its age, the FT200 is still a popular rig for driving VHF/UHF transverters because of the readily accessible very low power output at the rear of the transceiver. The picture shows the 70cm station at G3AYC where an FT200 drives a Microwave Modules transverter.

Blown PA Valves. Before replacing faulty 6JS6 valves, it is wise to check that the new ones will not be immediately blown! With the valves removed, a high impedance voltmeter should be used to check the bias voltage on pins 5 of the valve bases. This should read around −50volts with the rig on SSB transmit with the mic gain at minimum, and about −90 when switched to receive. Lack of these negative voltages will result in the very quick destruction of any new valves fitted with, perhaps, damage to other components as well. A common 'bias' fault is the



failure of the coupling capacitor which runs from the anode of the driver valve to the grid of the PA (C55), and if the capacitor shows the slightest leakage it should be replaced — as it will couple the +300volt supply on to the bias network!

The Driver Stage. The 12BY7A once again is not a transmitter driver valve, but was developed for video amplifier use and so certain parameters will vary from one maker to another. Yaesu, like other Japanese manufacturers, designed their rig around Japanese valves and Toshiba or NEC valves should be used. The use of other makes usually results in either a shortage of drive, or Tx and Rx peaking at different points on the grid tune control. Whilst discussing the driver stage, note the choke L11. This is in the neutralisation circuit, and shorted turns on this component is a fairly common cause of low drive on the FT200. Its presence can be easily overlooked; if it is suspected it can be temporarily replaced by almost any shortwave RF choke if desired to prove as to whether or not it is the cause of trouble.

Carrier Balance. Listening to FT200s on the air one soon notices that carrier balance can be a problem, and quite a few have inadequate carrier rejection. Rejection of carrier on the FT200 relies on a correct balance in the 7360 balanced modulator valve *and* the correct positioning of the carrier frequency about 20db down the slope of the SSB filter. The latter can be checked by first tuning the receiver in the SSB mode for maximum S-meter reading on a crystal calibrator and then by re-tuning for zero beat. Zero beat should occur at a point of about 3-5 S-points below that obtained at maximum signal, and this test should be repeated on the reverse side-band. If the S-meter does not appear to fall much at zero beat on one side band, switch off the calibrator and compare the background hiss on each sideband. A carrier crystal which is too close into the pass band of the crystal filter will result in a deeper pitch of hiss, and the relevant crystal trimmer TC101 or TC102 should be adjusted until the pitch of hiss becomes higher and then the first test should be carried out again. Balance in the 7360 stage is adjusted by VR106 and this adjustment will be found to be less critical once the carrier frequency is correctly set. Carrier balance does vary slightly as the 7360 warms up, and can be very erratic as the valve gets older so that eventually replacement becomes essential. Be warned, however, that the 7360 valve is rather expensive and may cost as much as a pair of PA valves.

Blown Fuse. When using the recommended power supply, a common cause of trouble is the HT rectifiers. Yaesu's circuit shows 4 HT rectifiers in a bridge format but, as in the FT101, some power supplies are fitted with 8 as per **Fig.3**. When any trouble is experienced with HT rectifiers, the final cure is to fit 8 new BY127 TV type rectifiers, adding the necessary resistors and capacitors as shown.

Alignment. Full details for this are given in Yaesu's manual if it is really necessary. Alignment doesn't normally seem to be often needed in the RF driver and front end circuits, but the 9MHz IF transformers do drift a little. L101 and L102 should be peaked on receive whilst L103 and L104 are best first peaked for maximum drive on transmit. After peaking L103 and L104 on Tx, switch to receive and tune through the crystal calibrator on the 40m band, watching the S-meter. The response should be as per **Fig.4a** and not **Fig.4b**. Detune 103 and 104 the minimum amount possible so as to get the maximum possible Tx gain with a symmetrical receiver response. Finally, check that the receive response is assymmetrical without any tendency to oscillation on the 3.5 and 14MHz bands. Any problems, here, can be cleaned up by slightly retuning the trap coil L1.

On The Air. The FT200 does not match modern low-Z mics but has a 50Kohm input for the mics of the 1970s. Most of these were of Jap origin and were somewhat short of treble (a lot of Japanese mics still are). The FT200 is much better for working DX if used with a bright mic, and Shure's 444 Hi-Z or 444D dual impedance are recommended. If funds won't run to these, try a crystal insert or a CB high output crystal mic such as the "Pace" hand held — have fun with your FT200.

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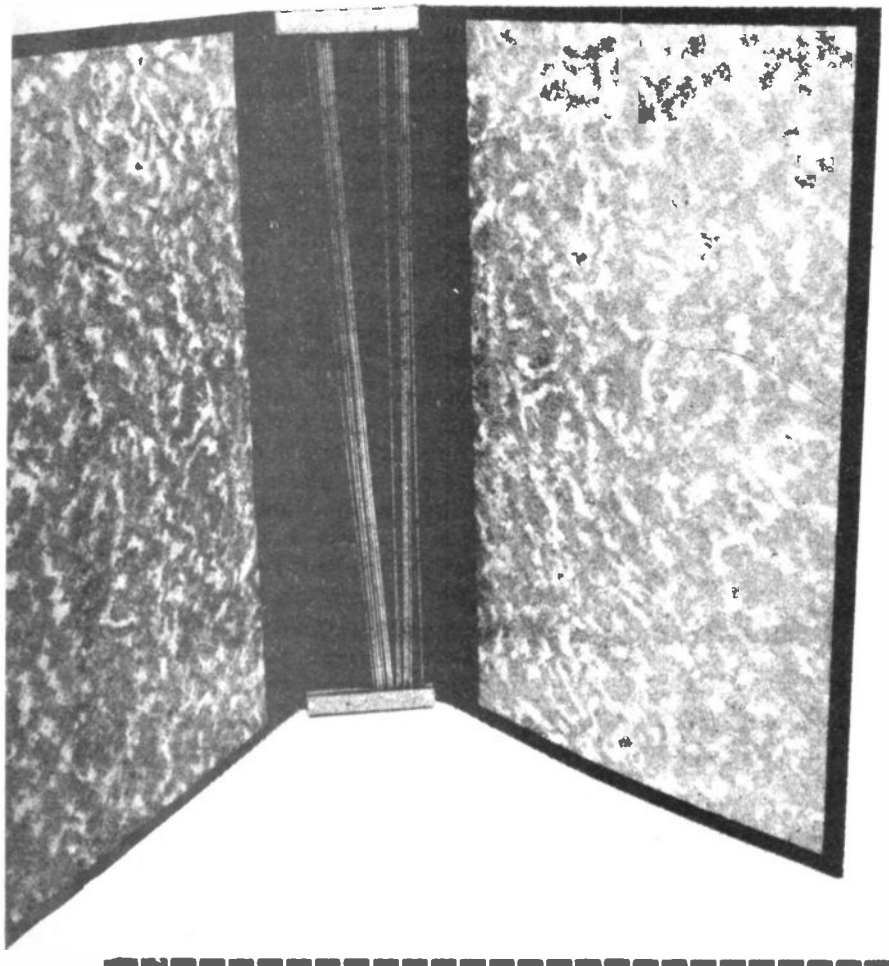

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BASICODE for Radio Amateurs

If you've got a micro in the shack and don't know about BASICODE you've been missing out on a computer 'esperanto' which has a unique application for amateur radio. Dave Bobbett, G4IRQ, keys in.

In the autumn of 1983 the BBC began their first broadcasts of computer programmes to accompany their new 'Chip Shop' series. The unique feature of those transmissions was that they were transmitted in BASICODE, a sort of 'computer esperanto' which enabled virtually all machines to make use of the broadcast. Here, I will give an outline of the BASICODE system, and suggest ways in which radio amateurs can make use of it to extend the scope of our hobby.

Amateur Radio And Computing

With the level of computer-ownership being amongst the highest in the world, it is hardly surprising that amateurs in this country are more 'computerate' than most. Satellite prediction, automatic log-keeping, morse sending and decoding, RTTY, antenna steering (and playing space invaders!) are just a few of the many uses for a computer in the shack. However, there has always been one major draw-back with all this technology — one brand of machine couldn't 'talk' to another. For whilst it is true to say that certain computers can be used as RTTY terminals, and there are commercial programs available to get them to do this, such systems are not suitable for the interchange of computer programs on a direct 'load and run' basis. *Up until now it was not possible to transmit a program directly to another station's computer where it could be used straight away, unless it happened to be of the same type.* The use of BASICODE has overcome this problem and should allow much greater application of computer techniques in amateur radio.

In this article, I will be generally talking about BASICODE with the idea of transmissions taking place on the VHF and UHF amateur bands using FM, so as to take advantage of both the inherently quieter nature of these frequencies and the 'capture effect' of FM.

The History Of BASICODE

Whilst in the UK there were one or two experiments with direct program transmission, initially using a Sinclair ZX81 in the BBC's 'Tomorrow's World' programme in 1982 and, more recently, using a BBC Micro in 'The Computer Programme', there was little activity in this area other than one or two computer 'shows' on Independent Local Radio, such as Radio West's in Bristol. These were all machine-specific, however, and of course for the ILR's, local! That was the state of play until the BBC launched its 'Chip Shop' programme in the Autumn of 1983 on Radio 4.

To complement the main programmes, there were the 'Chip Shop Takeaway' computer programme transmissions, which followed the shipping forecast on each Saturday, Sunday, Tuesday and Wednesday night. However, these noctural transmissions (which had an infuriating habit of not being broadcast at one specific time but whenever the shipping forecast had finished!) used the same system as the Dutch domestic service — NOS. They had been using BASICODE with considerable success, since January 1983 in the 'Hobbyscoop' programme, which went out every Sunday at 17:10 GMT (18:10 in the summer) on 747 kHz. This allowed a number of different computers to access the 'universal' program *via a BASICODE translation program,* which was specific to each machine.

There were three main problems with the 'Chip Shop' which gave BASICODE a somewhat inauspicious start in the UK; firstly, the demand for the translation program cassette was grossly underestimated which led to long delays; secondly, the program transmissions were far too late at night for most people; and thirdly, because the transmission times wandered about, it was impossible to use a timer to record the data if short C15 computer grade cassettes were used. Nevertheless, the series did serve to introduce BASICODE on a large scale and that in itself was worthwhile.

As for the origin of BASICODE itself, many technical advances have had their beginnings in the amateur radio world, and BASICODE is no exception. It's inventor was Klaas Robers, a Dutch radio amateur who was particularly interested in the possibility of exchanging and developing computer programs using a universal language which could be transmitted by radio. He formulated the original version with the help of a

group of computer enthusiasts in 1979, and this early version was later refined when Klaas got together with Jochem Herrman and produced BASICODE-2; this is the version which is currently in use.

What is BASICODE?

Before looking at BASICODE in more detail, it may be useful to briefly outline how computers record information on tape, and why compatibility problems exist. When computers store programs they do so by representing each character with a block of seven or eight 'bits' (we will use eight) — so for example the letter 'A' will be represented by '01000001', the letter 'B' by '01000010' and so on, with each character having it's own unique sequence according to 'The American Standard Code for Information Interchange' (ASCII). If you listen to the noise of a computer tape, you will notice that there are two tones present; one of them representing the '0' and the other representing the '1'. It is by this form of AFSK (Audio Frequency Shift Keying) that each character which goes to make up the complete program is recorded. So, if '0' is a low tone and '1' is a high tone the letter 'A, (which is '01000001' in binary) would be recorded as:
'low-HIGH-low-low-low-low-low-HIGH'.

One of the sources of the compatibility problems between micros is that the tones used can be different. There are also various speeds at which the information is stored on tape, and, in order to save time, various command words which are used frequently are often saved in a form of a 'short-hand' *which is specific to each computer.* In a few instances, the ASCII code is not followed *at all,* and in most cases the codes from '0' to '31' are used for the various special features which each micro offers.

Having dealt with the encoding side of the problem, there is also the question of language compatibility, for, although most micros use BASIC, there are numerous versions or dialects of this language, which are again *machine-specific.* At first sight it would seem to be an impossible task to accommodate all the variations available, but BASICODE has succeeded in doing just this.

Using A Standard Format

To get over these problems, Klaas Robers and Hochem Herrman decided upon a standard tone and speed format which computers could be programmed to accept — 1200 Hz for the low tone (binary 0) and 2400 Hz for the high tone (binary 1), with data being sent at a speed of 1200 Baud in ASCII — a good bit faster than 50 Baud RTTY! Each character would be sent in the following format; 1 start bit — 8 character bits — 2 stop bits. The start bit (a binary 0) would indicate to the computer that a character was about to follow, the 8 character bits would define the

character, and the two stop bits (both binary 1's) would indicate that the end of the information for that character had been reached. The whole sequence of 11 bits is known as a 'byte', and every character is represented by one 'byte'. In this way, a stream of 'bytes' can be built up to represent one line of text, such as a BASIC program line; and if there is a sequence of such lines then you have a whole program!

So the first task of the BASICODE translation programme is to set up the computer in such a way that it can decode the standardised data format.

Developing A Standard Language

Having persuaded the computer to accept the incoming program in its special format, the next job is to translate the program from BASICODE BASIC, into each computers version of BASIC — once this has been done, the universal program will be in a form which can be run immediately.

Fortunately, one thing which the vast majority of micro's have in common is that they use BASIC and so a large number of their commands, although executed in varying ways, have the same effect from one micro to another — for example, the command 'PRINT' varies little from one machine to the next. If each command is defined so as to fit the capabilities of the 'least able' micro, then a program using such commands is bound to work on all micro's in the group. Here the major advantage of BASICODE can be seen as also being its major deficiency, in that users are limited by the shortcomings of the less sophisticated machines. Given that computer capabilities are destined to dramatically improve with time, it follows that BASICODE will have to delete the more restricting micros from it repertoir so that the advantages of more advanced machines are not lost. However this is a difficult issue and depends upon exactly what applications are suitable for the 'Esperanto' approach to programming. Certainly, from the point of view of distributing the type of 'universal' programs which would be used in amateur radio, such restrictions are far outweighed by the obvious advantages of BASICODE.

Apart from the features which are common ground, there are also a number of commands which are non-standard but which must be used, such as 'clearing the screen' for example. BASICODE gets over this problem by setting aside all line numbers below 1000 to accommodate a series of subroutines, which have the same overall effect on all machines. For example, the command to 'clear the screen and return the cursor to the top left-hand corner' (simply CLS on a BBC micro) is achieved by writing 'GOSUB 100' in BASICODE. The sub-routine at line 100 then contains whatever commands are needed by that particular micro to clear the screen and home the cursor. There are twelve of these sub-routines in all and can be used by calling the appropriate

'GOSUB xxx' — further details of these routines can be found in the manual which accompanies the BASICODE cassette. From the users point of view, it is very easy; just remember to use the simpler options with most commands, and to use the GOSUB routines to replace the twelve non-standard commands.

Which Computers Can Use It?

Like all good inventions, BASICODE is a simple idea — the computer is first loaded with the appropriate 'translation program' (so that it is set up ready to convert any incoming program into a format acceptable to the machine), and then the 'universal program' can be received, translated and used. As a result, all that is needed is the right 'translation programme' for your machine and any BASICODE program is accessible. Because this process takes place at high speed, there is very little delay before a program is 'up and running'. Currently, the following machines have translation programs available for them:

Apple I & IIE
Colour Genie
Commodore 3000, 4000, & 8000
Vic 20
Sinclair ZX-81
BBC Models A & B
Commodore 64
Pet 2001
Sharp MZ80A & MZ80K
TRS-80 /Videogenie

In addition to those listed, the Sinclair Spectrum should be supported by now, and I have also heard 'Hobbyscoop' transmitting a translation program for the Newbrain AD. For those machines which are not supported yet, there is an outline of the BASICODE protocol in the manual which should give the more 'computerate' amongst us enough information for them to write their own translation programs.

Why Use BASICODE?

Apart from the sheer fun element of experimenting with something a little different (we are supposed to be indulging in 'self-training' after all!), BASICODE allows radio amateurs to transmit 'live' information in the sense that a program will DO something when it is received, unlike other forms of data transmission which effectivley just 'sit there' on the paper. As well as being of direct interest to the stations involved, there are usually numerous people tuning around who would welcome the chance to experiment with what may almost be called a new mode — and for no outlay at all, assuming that they have a computer and a cassette machine handy.

On an individual basis, it would be quite easy to write a program to generate an animated QSL card with moving messages; not exactly pushing back the frontiers of human knowledge I admit, but at least it is a bit of a change from the inevitable 'you-are-five-and-nine-how's-the-weather' type of QSO! And on a more serious/sensible note, it would be ideal for RSGB newscasts which have to transmit data concerning satellite orbital parameters, special event callsigns and various other complex data. Wouldn't it be nice, for instance, to be able to look up propagation predictions which are clearly written down and only a day or two old? For that matter, it would be a perfectly feasible proposition for club newsletters to be transmitted direct to many members — five minutes of repeater time would reach a lot of people, providing that the powers that be could be persuaded that such transmissions were a good thing, of course! In addition, it would be a new field of interest for a group which I think we tend to forget about, the Short Wave Listeners; a radio-related on-air computer forum with programs being transmitted to and fro would undoubtedly attract considerable interest, and I can see no reason why programs developed by SWL's could not be transmitted for them.

Get Typing!

As with conventional computing, the diversity of applications for BASICODE is only limited by the ingenuity of the users. Regulations (and propagation) permitting, it occurs to me that 10 Metres FM with its trans-Atlantic capabilities may offer further room for experimentation in the future. Whilst at first sight, SSB operation using data at 1200 Baud may seem out of the question, it could be interesting to see if a data SSB mode was viable. Given the stability of modern equipment this may not be such an impossible task.

As for the software used in BASICODE transmissions,a proram's originator should always be acknowledged out of courtesy, unless otherwise requested. BASICODE was produced to encourage program exchange and development and so contributors are usually willing for their work to be used by all.

Although it should hardly need mentioning — amateur bands are (hopefully!) very public parts of the radio spectrum and commercial computer software manufacturers would be extremely 'unchuffed' to find that their latest pride and joy was gracing the airwaves as a 'test-program' from a ham station!

CQ Micro Net?

Next month's issue of HRT will see the launch of a brand new bi-monthly column which will be specifically aimed at those of us who are deviant enough to be interested in both radio **and** computing! The column, which will be called '**Micro Net**', will be unique (as far as we know) in that most programs will be in BASICODE *so that they can be used by the vast majority of computer users.* In the meantime, if you are already a BASICODE user, we would be very interested in publishing not only details of any regular times that you are on-the-air if you are licensed, but also any other information which may help others to get started. The column will be *strictly* radio orientated. We think there is considerable interest in a column of this kind — let the Editor have your views. Oh yes, and please *don't deluge him with programs*!

The BASICODE kit, containing a cassette of both translation and demonstration programs with an instruction manual detailing the BASICODE protocols, is available for £3.95p from: Broadcasting Support Services, PO Box 7, London W3 6XJ.

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Belcom LS202E
2m FM/SSB Handheld – a realistic proposition?

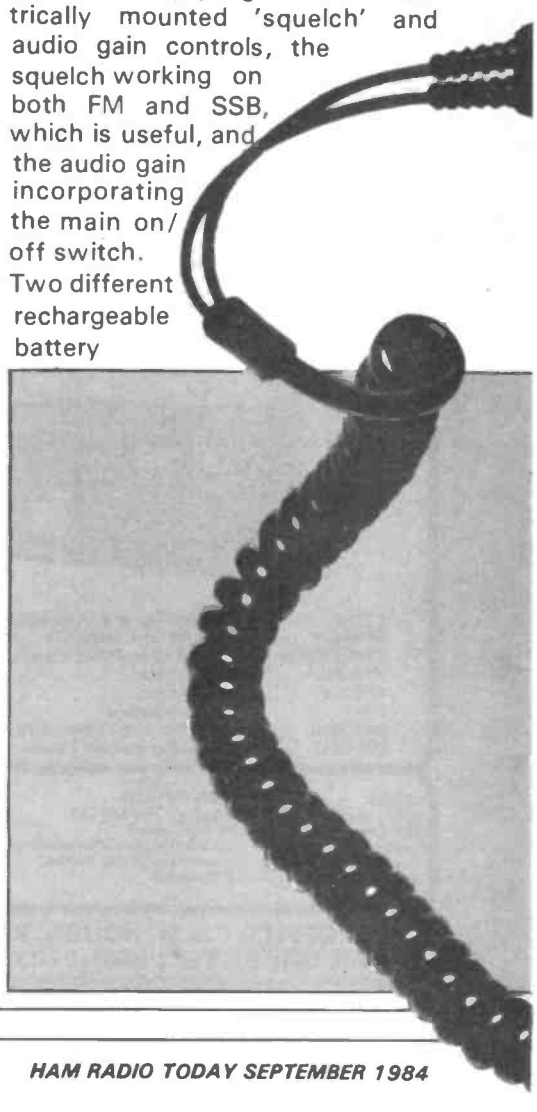
The Belcom 2m FM/SSB handheld offers facilities previously unavailable in a rig of its size. A brave effort undoubtably, but would the RF performance hold water? Angus McKenzie, G3OSS, took one into his shack...

Although many amateurs are quite content with FM only 'handy talkies' such as the Icom ICO2E, the Yaesu FT203 and the Trio TR2500, there is undoubtedly a case for having a rig which also incorporates an SSB facility. Up to recent times, only Standard and Yaesu have offered 2m multimode portables with this facility, and both these rigs are definitely portables rather than handhelds. The Belcom LS202E would seem to be the first truly handheld multimode available and I was extremely keen to put the rig through its paces to see if it would be a useful asset. Before delving into its performance characteristics which, frankly, are rather depressing, let us have a look at its facilities and ergonomics.

The size, 165 × 62 × 40mm, and weighing about 500 grams, is typical of its FM only competition. The front panel is completely blank other than the loudspeaker/microphone at its top. The left side cheek includes a PTT lever, which was rather stiff and intermittent unless you held it down very firmly, 1750Hz tone on/off, high/low power switch and repeater shift, which is 600kHz up or down on transmit. There is also a small push button which controls a light inside the S meter so that it can be more easily read. At the bottom of this side cheek is the charging hole for interconnection with the charging adaptor. Underneath the rig are holes for locating and interfacing the rig into a stand incorporated into an accessory mobile linear. The right side cheek is blank, whilst on the back is a special clamp for a belt clip. And now I have to come to the first drawback – the most crowded and cramped top panel I have yet encountered on a handle-talkie. A BNC socket is provided for connecting the supplied rubber duck antenna or for feeding external aerials. This BNC socket unfortunately does not stand up proud enough from the panel to allow some types of BNC plug to lock in position. We tried a standard BNC to N adaptor and this was incredibly tight on the socket.

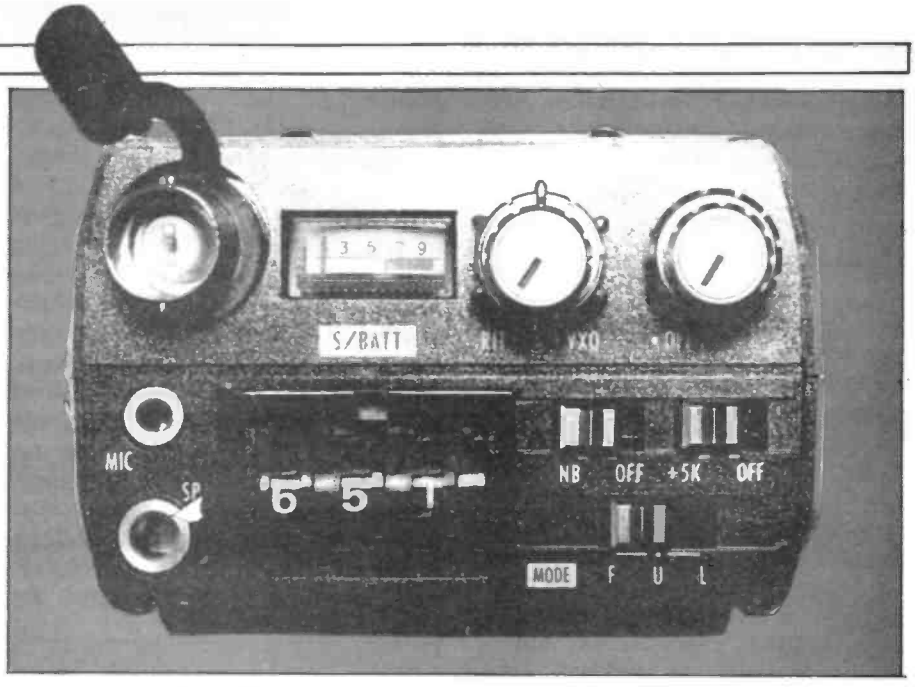
In front of this socket are two miniature jacks for interconnecting an external speaker/mic. A little rubber cover is fitted with blobs that can push into these holes for protection from dirt.

Along the front are three deeply recessed thumb wheel switches which I found extremely awkward to use, particularly if you have stubby fingers like me! I found these so awkward that it took a considerable time to change frequency by a reasonable amount, and thus virtually impossible to use them for scanning rapidly across the band because of the deep recessing. To the right are three slide switches including the mode switch; this switch selecting either FM, USB or LSB. The second switch activates a noise blanker, whilst the third gives a 5kHz 'up' shift on both modes. The thumb wheels select MHz, hundreds of kHz and tens of kHz. Across the top, to the right of the BNC socket, is the rather cramped S meter, scaled in odd numbers only, which doubles as a battery indicator on transmit, and two concentrically-mounted pairs of controls. The first pair includes, on the bottom, a centre-indented receiver incremental tuning rotary adjustment which adjusts up to +/−1kHz. Above this is the VXO control which changes the transmit and receive frequencies by up to +/−5kHz. These two controls operate on SSB only. At the top right are concentrically mounted 'squelch' and audio gain controls, the squelch working on both FM and SSB, which is useful, and the audio gain incorporating the main on/off switch. Two different rechargeable battery



packs are available, the review sample being fitted with the quick-charging 7.2V version type NP6, a 10.8V rechargeable type NP9 also being available, which enable the LS02E to give a higher RF power (3.5W output is claimed with this). Four chargers are available, two types for each different voltage battery pack, allowing batteries to be charged from either mains or car battery. A speaker mic was supplied, type SH1, sensibly having separate sizes of jack for the PTT line and audio, which thus makes it impossible to fit them in the wrong way round. This unit had a belt clip on its back and was found easy to use, the quality being better than that from both the rig's internal speaker and microphone. The PTT lever was also much easier to use, having a longer throw than that on the LS202E itself and requiring ony light pressure to engage it.

Other optional accessories available include a soft case, a headset with



Top panel of the LS202E

built in VOX, a quarter wave whip, a mobile console with front speaker and mobile mount, and a 25W 2m linear amplifier.

The rig is amazingly compact and I consider it a great shame that some of the top panel functions were not positioned on the right side cheek, or the back, in order to facilitate simpler frequency changing. It was easy to hold and seemed fairly well made although perhaps rather 'plasticky'.

The received signal from the antenna passes through a low pass filter and is then amplified at RF before being fed through a band pass filter, a 3SK114Y dual gate FET being the amplifying device. The signal then mixes in a single transistor type 2SC2786L to the first IF of 10.695MHz, which incorporates a switchable crystal filter. The first IF is mixed down by the crystal controlled second local oscillator in an integrated circuit mixer to the second IF of 455kHz. The signal passes into two filters and then onto a limiter and quadrature detector, incorporating active filtering and the squelch circuit. For SSB, the 10.695MHz IF is fed through a crystal filter, and, after amplification, is fed to a conventional product detector working at this higher IF frequency. The audio output circuit is a simple IC, giving an audio output power claimed to be more than 400mW into 8 ohms for 10% distortion.

The microphone circuit output is split into two paths: SSB and FM. There appears to be no internal SSB mic gain preset (which explains some of the problems I encountered and which will be explained shortly) whilst, on FM, there only appears to be a deviation preset. This results in the microphone gain being completely fixed which is not a good thing.

The SSB audio signal feeds into an integrated circuit double-balanced modulator followed by a crystal filter which eliminates the unwanted side band. This signal is mixed up to the final frequency fairly conventionally and then amplified by several stages. Frequency modulation is achieved by modulating the VCO. The phase-lock-loop synthesiser is too complex to describe here and includes a 10.24 MHz reference crystal with

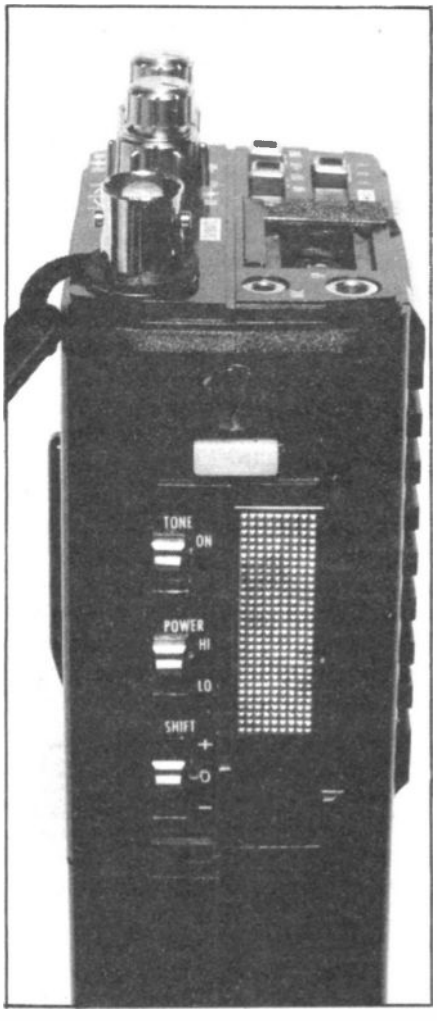
division, multiplying up again with phase locking, and mixing in with the VCO, and thence up to final frequency.

Subjective Performance

I first tried out this rig on FM and found the sensitivity to be rather poorer than I might have expected. This was briefly checked in the lab to be −120dBm (0.22uV) pd for 13dB sinad. This is around 4dB deafer than most of the competition. I have already had a moan about the poor tuning ergonomics but after sorting this out, the first problem I encountered was the very limited reproduced audio output available on receive. This clipped very severely if it was turned up slightly too much. I cannot see how this rig could, say, be used sensibly in a car where the background noise can be quite high. If used at a rally, or for Raynet exercises, the lack of reproduced volume could be a severe handicap, although in an average quiet shack it might be just about adequate. The selectivity seemed adequate and the squelch worked very well. We found it possible to receive frequencies right across the band from 140 to 150MHz, which was a little surprising. It was a pity that the VXO facility had not been designed to permit adequate tuning in of adjacent 12.5kHz spaced stations.

When I first used the transmitter on FM on the local North London Raynet channel, a station came up saying "QRZ, your modulation is very distorted, please try again!" Somewhat taken aback by this, I retreated away from the rig about 12 inches and tried again, to be told that that was much better but rather thin and poor. At least I had achieved readability 5, but accompanied by the reverberation in my shack which could clearly be heard due to excessive and non-variable gain. Several stations reported that if I went closer than 6 inches or so, the modulation quality deteriorated badly. The quality was thought to be worse than that of any other handie-talkie that I had tried in the last year or so.

Giving up FM, I switched to SSB and tried calling on the calling channel for a considerable time. Eventually a station came back and stated that whoever it was calling was unreadable, but whose 'voice' bore slight characteristics which might be attributed to G3OSS! I tried again, only to receive a report of readability 3 and strength 9. At this point, I thought it a good idea to read the instruction book, which explained clearly that the recommended speaking distance was around 4 inches. I had been using around 2 inches, so I backed off and QSY'd. Stations then gave me just about readability 5, although everyone said that the modulation was of the type that I am always grumbling about when other stations produce it on the band. By



Sideways on

now, I was getting rather embarrassed, so I tried backing off to around 8 inches, which gave considerably improved results. The modulation was then rather thin but fully readable and the distortion was acceptable. The quality, though, was way short of any reasonable SSB rig, and very far short of a model such as the IC202S, or FT290 (provided the latter was fitted with the PA mod which increases the standing current).

When receiving SSB I was struck by the deafness of the RF input and the lack of IF gain. As the available maximum audio output power was severely limited, I had to bring the audio gain control up and down almost like a yoyo in between different stations' overs in a net — in order to avoid overloading when a strong signal was received, as compared with almost inaudibility for a weak signal. The AGC also appeared to be rather poor, and there seemed to be a complete lack of any punch in the reproduced audio. It was found practically impossible to use the rig for tuning up and down the SSB section, for this took an age. The VXO facility on SSB was useful in getting the voice pitch correct on receive. The rig excludes any CW facility, which is a pity, for this would not have cost much to put in.

We did take just a few lab measurements, although the Editor agreed that extensive ones were not really justified in this particular case as the rig was somewhat disappointing. On FM, the output power was 2W high, and 125mW low power. We had a quick look on the spectrum analyser, and could see no second or third harmonic outputs above the noise floor at −65dB. We did not note any spurii, but did not really have much time to look close in. The FM deviation peaked at just under 5kHz which is about right, but this was reached all too readily, confirming that the microphone was too sensitive. We checked the audio output power for 10% total harmonic distortion, and the rig only achieved 370mW into 8 ohms.

The rig was able to transmit from 144 to 148 MHz and, in passing, thus conflicts unfortunately with the new British Telecomm's Act requirements. To end this section on a high note, the transmitted frequency accuracy was phenominally good.

Final Thoughts

Belcom's concept in this rig is clearly an excellent one, but what seems to have gone badly wrong is the extra touches in design required

for the rig to give good transmitted and receive quality. I have to criticise very severely the lack of any SSB internal mic gain pre-set, but, perhaps the problem could be partly due to a lack of adequate carrier level into the double balanced modulator, which could then cope with a wide variation of audio levels from the mic amp. If the AGC characteristics had been good at IF, then varying speech levels into the microphone could have been accommodated without the severe distortion problem. On FM the same lack of a mic gain control means that the rig will pick up a lot of the noise that may be present in the vicinity of the user. This could affect readability in noisy environments. Apart from this, the inefficient loudspeaker, (the speaker mic also suffers in this respect), must be criticised, for 370mW should give a louder sound than this rig gives. Perhaps the most awkward feature of the LS202E, however, is the recessed thumb wheel frequency switches. On balance, it is only fair to point out that the rig is very reasonably priced, and if you are attracted to it because of its facilities, I consider it essential for you to try one out first and then make your mind up. Perhaps another manufacturer will bring out a better model soon; I think it is worth waiting to see what competition occurs. Otherwise, my advice would be to look again at the FT 290 and the Standard alternatives, and only consider the Belcom if these are too bulky for you.

Finally, I would like to thank Lowe Electronics for supplying the rig for review, and especially for the helpful way in which they listened to my criticisms which were acknowledged fairly and with complete integrity. This rig had so much promise in advance, and it is such a shame that I have been so disappointed with it, but such is life. Maybe some users will get a lot of fun out of it, but I hope they will remember to keep well back when they are talking into it.

Since the writing of this review, Lowe Electronics have informed HRT that at their instigation, the SSB transmit gain of the LS202E has been reduced so that talking into the transceiver from a distance of 1/2 inches produces full audio *without distortion,* thus rectifying one of Angus's main criticisms. Try one if you are interested and see what you think. **G3ZZD**

VHF CONTESTING

John Ridd, G8BQX, a successful participant in VHF contests with the Hastings ERC since the early seventies, looks keenly at the requirements of VHF contesting today.

The Editor has asked me to write an exposition on the running of a VHF contest station. He was kind enough to say that he thought I was well qualified to do this, on the strength of a talk I gave many years ago to the radio club he belonged to.

For my part, I feel the only qualification I have to write such an article is that I have twisted the odd arm, and otherwise conned some of Hastings locals into a VHF contest group, and we have participated, mainly on 2 metres, since 1969. We have had the occasional success, and there are several certificates on the wall of the club shack. We won the RSGB 2m September contest one year when for some inexplicable reason, the conditions favoured us to the exclusion of the rest of the UK.

I did, for my pains, organise a contest, at very short notice, last year, to compensate for the strange omission of a regular 2 metre event, after it had previously been advertised! However, this was the exception that proves the rule that I hold dear, to the effect that the RSGB is the sole body in the UK that has the cause and the authority to run contests *(Hmm — Editor)*. The one I organised was to indicate that there was a need for this particular contest. This has been recognised, and the event has been reinstated this year. So, I am saying nothing about how to run a VHF contest, and will concentrate solely on organising an entry.

I would also like to emphasise at this point that the ideas I am putting forward are by no means unique or original, and only represent my way of doing things. I would not presume to dictate how to do it, and will merely suggest a framework that seems to give some chance of an effective contest entry. Apologies in advance are given for any failures or inconsistencies, for this is the first article that I have written for a national periodical. Apologies are also rendered for my (occasional) execrable misuse of the English language. You may find a certain bluntness in my prose, to the point perhaps of being obnoxious, when you come to my particular 'hobby horses', but there are some detrimental things that I feel need to be said about VHF contesting today.

Many of the points about "improving the breed" refer equally to non-contest VHF operation, and it is to be hoped that these points will assist in the improvement of technical and operating standards in general.

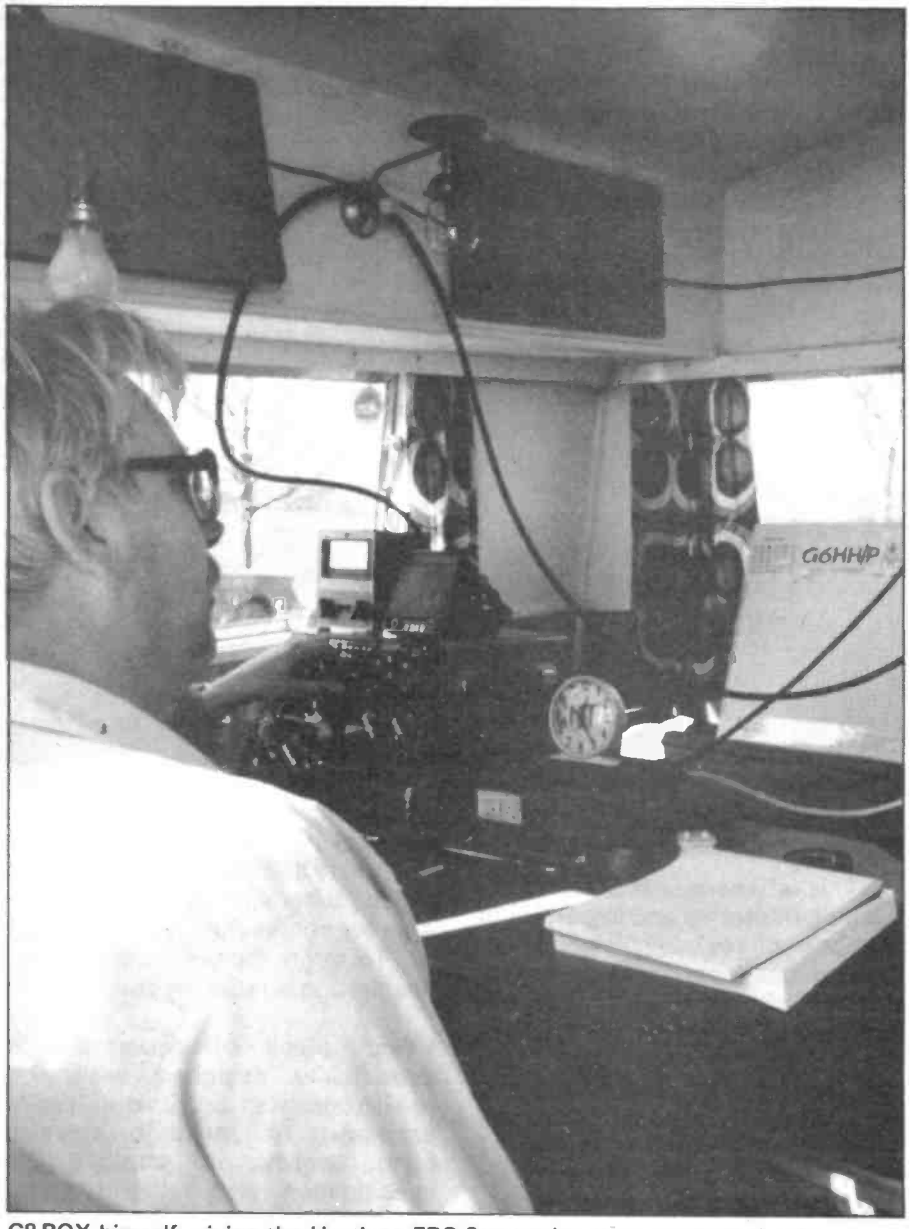
So, for a start, **why contests??**

a. To test the abilty of a group or an individual to make effective communication.
b. To "improve the breed." Contest operation, in the pouring rain (or sunshine) brings people together under conditions of adversity — variable food supply, a lack of soft beds and a minimum of equipment sorts out the men and women from the boys and girls.
c. To enable a contestant to measure his effectiveness against the rest.
d. To demonstrate to Authority that there is an occasional full use of the limited bandspace afforded to the Amateur Radio Movement.
e. To assist non-contestants in not-so-good locations in contacting stations in some rare locations — which are normally out of their range due to the scarcity of well-placed fixed operation in those locations.
f. It's fun!
g. To do well is good for the ego!

What are the necessary qualities required to do well?

a. Technical ability.
b. Organising ability.
c. Operating skill.
d. Application.
e. Persistence in maintaining the aim.

So much for that. Now read the rules of the contest you wish to enter. Now read them again. They are, in my view, often unnecessarily complex. However, make sure *exactly* what is meant, then you



G8 BQX himself, giving the Hastings ERC 2 m station a pre-contest checkover

can start planning your effort on a sound basis. Don't forget to write away for the LSVHF log sheets, the 427 forms, and the 4422 forms for RSGB contests.

Technical Ability

Equipment ought to be first class, especially if the contest site is near to a centre of high activity. The transmitter must give as 'clean' a signal as possible, of as high a power as possible, within the permitted level. The only reason for using high power is to keep up with the general contest rat-race. The contest group I'm involved with had just about got it together with 25 watts of AM when the opposition went SSB. That was no problem for us. A VFO of sufficient stability enabled us to keep up and mix it with the SSB gang, the majority of whom did not cotton on that we were using AM. The average distance of the contacts we made was no worse than now. We finally had to go SSB when the trend was more and more power, when techniques, in the opinion of some, came secondary to brute force. Certainly, we get more contacts now, but the number of participating stations has also increased considerably. As has the level of unwanted rubbish — due to the high power run by people with untameable equipment. It is to be hoped that my effusions here will result in stations like G3 (expletive deleted) and that noncompeep G8(ouch!) getting their equipment sorted out! Preferably with a 14 lb. hammer (or the metric equivalent.)

Even so, there is every reason for a new station embarking on a contest career to have a go with modest power for a start. Progressive improvement towards the top of the list is the thing to *aim* for.

The receiver used must be able to work efficiently in the presence of many strong signals. Superb rejection of unwanted signals is even more important than absolute maximum sensitivity. As an illustration, try putting half a dozen preamplifiers in series in your aerial lead. You will get super sensitivity. You will be able to (metaphorically) hear a chap striking a match a hundred miles away, but, with strong local signals on the band, your receiver will be completely blocked with mixtures of all the signals around — 'wall to wall' as they say on the HF bands.

Strong Signals!

Signal levels as high as 100 millivolts can be present at the aerial socket of your receiver from just one line-of-sight station. Such a signal strength is enough to make an in-line power meter indicate when you are receiving! 100 millivolts in 50 ohms corresponds to an S meter reading of S9 + 63dB. 100 dB down on this is about S2. So, with a receiver with 100 dB spurious rejection, spurious S2 signals will be found *all over the band*. Even more spurii will be found when there are several strong but clean transmissions in progress. With transmissions of this order of strength 'clean' only down to 100 dB there will be a lot more spurii apparent on your receiver. Imagine trying to work a really weak S1 signal in a constant spurious level which can approach S3 to S4 on a busy band.

Ideally, transmitter and receiver spurii should be 120 dB down, practically impossible, but an ideal to be aimed at. The local oscillator of an unmodified FT225 is only 'clean' down to about 90 dB. Changing the mixer to a double balanced passive mixer results in some improvement since the oscillator noise sidebands tend to balance out, and the intercept point is adequate, but, even so, the oscillator cleanliness still really needs improving, especially since

that same oscillator is used for transmission!

A professional spectrum analyser costing about 5 kiloquid is only quoted as having oscillator noise sidebands of – 70 dB, so you can see that serious contest gear must be several orders better than professional VHF gear! Especially so, since we use high power and high gain aerials, with signals close together, whereas professionals use relatively low gain aerials, low power, and a wide frequency spacing between adjacent transmissions. Life is difficult! However, we do get some assistance from the (hopefully) good back-to-front ratios and sidelobe nulls of our aerials, but, if there is a high powered station situated in the direction you want to point — you have problems!

'Clean' Gear Is Essential

It behoves us all to get our gear as clean as possible. No wonder most contest reports are S9!

Now, what about the isolated VHFer, living in an isolated valley far from normal centres of high VHF activity. He has naturally specialised in getting very high RF gain so that he can hear the distant stations. Along comes a contest station, on the local hilltop, running the full permitted power, and line-of-sight to our chap. He switches on, hoping to work a few new ones, and finds his receiver absolutely full of funny noise every time the contest station sends. He is aggrieved, naturally. Bang goes his chance of working a few new 'Squares'. But whose fault is it?? Suppose the contest station halves his power. The received level is 3 dB down, but the effect of this on the swamped receiver is minimal. The contest station halves his power again. The received level is now 6 dB down. 1 S point! The contest station now reduces power again — now 25 W p.e.p. — result 2 'S' points down. And the poor old receiver is still swamped, because a transmit power reduction of 12 dB can do nothing much to help a receiver with up to 30 dB of pre-mixer gain. With an active mixer, as found in most bog-standard VHF transceiver front-ends, there is *no* chance of much improvement, due to an unsatisfactory intercept point (see *Radio Communication*, March 1984).

HERC in contest action. From LHS, G4 KNU, G4 KNU, G4 FET, G4 RIT

Could Do Better!

This is where I take issue with the manufacturers and importers of 'bamboo boxes', available at inflated prices (cost as much here in numbers of pounds as they cost in numbers of dollars in the States!) For the last ten years I feel there has been no basic improvement in transceiver front-ends. We still have the very unsound line-up of FET RF amp. into FET active mixer. One rig even has the temerity to include *an extra preamp!* This must be about the potentially worst possible line-up for spurious responses there is. Everytime I see new 'improved' transceivers advertised, I find it funny how the adverts only deal with what are essentially ancillaries, but keep a graveyard hush about the RF things that really matter! More bells and whistles on the front panel (and the back, as well, for some completely anti-ergonomic reason.) Memories, multi VFOs — every possible lily-gilding accessory you can think of. The important part — the communication line-up, there seems essentially no improvement in whatsoever. An active mixer means far too much RF gain is necessary in order to drown the mixer noise.

And now we have the ultimate lunacy. You have an 'improved' imported transceiver, which has to be modified to include a proper front-end (bully for muTek) *at your expense*, before it is any good RF wise for contesting. Words fail me!

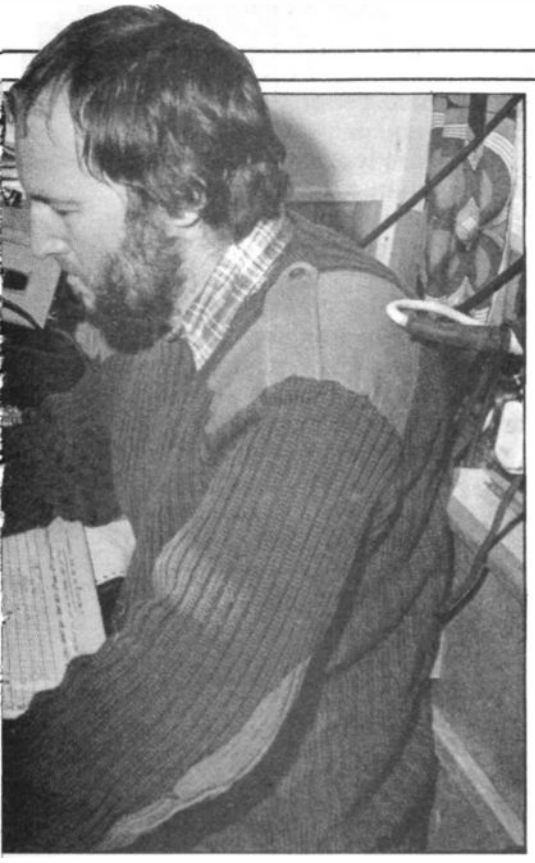
To quote from a recent advertisement in a radio magazine.

"Each piece of equipment is specifically designed with the requirements of.....the radio amateur in mind.....always been.....policy.....to improve the specification and reliability.....by listening to the valuable comments of radio amateurs....."

Right, Honourable Sirs, listen to this. If you can produce a transceiver with a proper double balanced passive receive mixer, with an adequate intercept point, an oscillator chain with noise sidebands down below 110 dB, and similarly, transmitter spurii down 110 dB, I will definitely consider acquiring one. You can reduce the number of noise-inducing digital displays, and the various auxiliary bells and whistles, to pay for it, by all means!

Plenty of Iron

The aerial should be the largest attainable. The best and most linear amplifier, both up and down, is the ironwork in the sky. Four big yagis,



in a square, at optimum spacing, will give about 18 dBd. After this, the next step, 8 yagis(!), will give theoretically another 3 dB making 21 dB in total. The law of diminishing returns comes in, because another 3 dB gain will require 16 yagis, which is definitely a bit much! And don't forget the array should have good front-to-back ratio and minimum sidelobes, for the ability to null out the unwanted is probably just as important as the forward gain. The next step the Hasting's Contest Group is contemplating is to have another medium gain aerial, switched by a footswitch controlled relay and set at 90 degrees azimuth to the main array, to cater for the types who will call from middle distances just after we have swung the beam!

Aerial height depends ultimately on the local terrain. Clearance of nearby surrounding objects (including hills!) is the important factor. Heights above 100 ft start showing a diminishing return because of feeder losses (and cost!)

Adequate Power!

The power supply for the station must be adequate. Ideally, there should be enough reserve current capacity to ensure that the voltage available does not 'droop' under send conditions, for serious variation can lead to distortion in power amplifiers, which will adversely affect signal quality. Illumination may be needed at the generator, for fuel refilling in the dark. A card should be displayed at the operating position, setting out definite times for refuelling — with space for the signature of the person who refills. Woe betide the one who neglects! Re-priming a diesel can be a swine!

A little tip to assist refuelling. An electric petrol pump plus float chamber (ex-Mini, perhaps) with a supply pipe into the bottom of the existing fuel tank, will enable the genny automatically to be topped up from a larger container, jerrican or similar, will obviate the danger of letting the 'genny' run dry — and will also keep the operators dry if the weather is inclement. Don't feed the electric pump straight into the carburettor — the float needle of a gravity feed machine won't cope with the fuel pressure and the machine will flood.

Getting A Contest Site

Local landowners, particularly local authorities, will be found to be most accommodating once you have sold them the idea of harmless VHF Contesting. It isn't necessary to travel miles to a contest site. There are usually quite adequate locations available almost everywhere and a good height above sea level is not everything. It takes a little reconnaisance to find sites but they are there often close at hand. My own group's site is in the adjacent small QTH square to our headquarters and the next best site locally is less than a kilometre from the clubroom. Our usual site is only 174 metres ASL but is superb for VHF propagation.

Equipment Finale

Above all, *all* the equipment must be *reliable*, and capable of going for 24 hours without failure. In saying this, I realise I am asking a lot but this is vital. Strict attention and consideration of correct engineering method, particularly in-interconnections between equipment, is all important. No twisted wires and tapes joints are to be contemplated. All must be secure, with proper lockable plugs and sockets between items.

Last, but not least, think on the accommodation for operators. I well remember visiting one 'contest station'. The operators were sitting on the ground inside a tent. A frying pan of congealed bacon was sitting on top of the rig. The torch battery had failed. Blankets and other clutter all over the place. A leaking 12 V battery was on a sleeping bag. The irony was that these lads had organised a £10,000 public liabilty insurance, at the landowner's behest, and had travelled some sixty miles to their site! The operating techniques were as jaded as the operators looked!

Separate sleeping accommodation, *way out of earshot of the operations,* is the first requirement. Comfort for the duty operators is the next. Then, reliable lighting, and warmth, for resting and duty operators, in the winter. A proper table and chairs. All equipment "to hand." Food (cooked somewhere away from the operating position. Booze — for voice lubrication only. No distraction for the operators. And so on. All this may *seem* obvious but needs thought beforehand.

And a final word, the contest group I mentioned earlier were using a Liner 2 — *unmodified*. They never went out contesting again; the aforementioned facilities to one side, it is easy to understand why. They were giving a nearby high power station some trouble with spurious transmission from their Liner 2. But they were getting it back in spades — 100 dB stronger. The poor fellows didn't need to tune the rig — that same station was everywhere round the dial. Unfortunately, they had neglected to try out their rig with a good aerial near strong activity at their home location .

Forethought. Rigorous testing. Planning. That's what's required. Which leads to the next consideration:

Organising Ability

Any club has the ability to assemble an adequate contest station. HF is probably easier than VHF in this regard, but, even so, it must be rare to find a group who cannot get together a workable VHF station. And the more remote

a group, the less worried they have to be about spurious responses in Rx and Tx; providing their contest venue is not frequented by one of the 'tiger' groups on contest day, gear can be that much more elementary and bog-standard 'off-the-shelf'. Any group *must,* if they put themselves to a little trouble, be able to scape together a Tx/Rx, a pair of 8 ele yagis plus a combining unit, a 30-40 ft mast and a power source, either 250 V AC generator, or some 12 V accumulators plus a means of floating them with a generator. This latter can consist of an old lawn-mower engine, belt driving a car dynamo plus control box, or else a car alternator. Accommodation requirements are a couple of tents, one for kipping in and one for operating, a table, a couple of chairs, and some reliable lighting. Don't forget a clock — not one relying upon 50 Hz for accuracy!

What is *not* required is a transceiver over-driving a cheap transistor linear amplifier and 'whiskering' up the band in an area well-populated with contest stations. This situation is, to a certain extent, self-limiting, since a bad rig operating in the home location in a well-populated area will soon be sorted out by a self-respecting owner, with the assistance of his concerned(!) locals. There is a wealth of assistance available around, especially at your local club — use it! However, if a chap has no self-respect in this regard, and persists in wallowing in his own self-inflicted electronic grottiness there is no way will others assist him — on contests or otherwise!

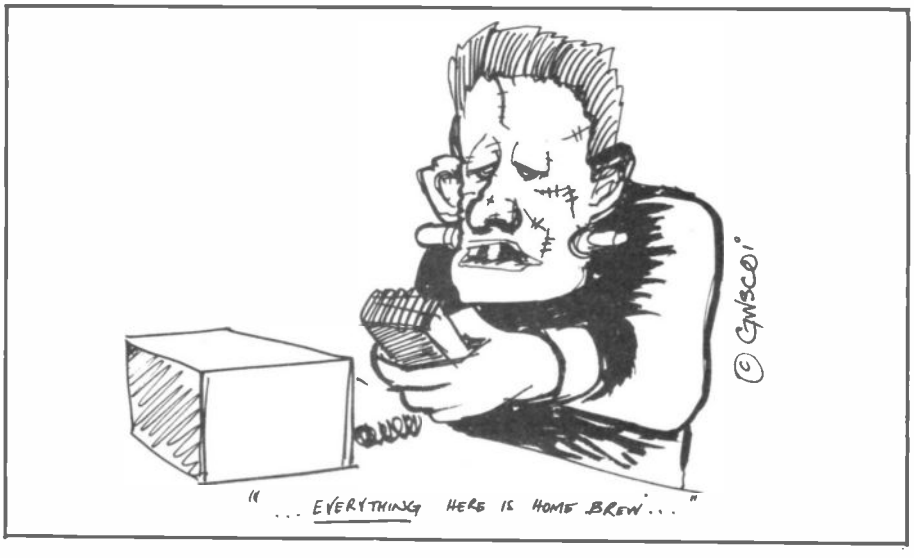
The organiser should assemble together all the gear to be used at some convenient time a few weeks before the contest, and the whole lot should be rigorously tested under simulated contest conditions for as many hours as possible. Efficiency is not the only fact to to be checked: reliability and endurance are of paramount importance. One would expect to choose one source for the Tx/Rx plus linear amplifier (if any), for problems can occur 'marrying up' different combinations, in particular with regard to drive levels between transceivers and amplifiers. Just because the specification in the transceiver handbook says "ten watts out," and the label on the amplifier says "ten watts in for 100 watts out" does *not* mean they may be connected together with any guarantee of the right output of the right cleanliness. You must test things out and see. Very often you will find that 4 watts in is enough for the amplifier! A linear amplifier should not be 'driven', it is gently led! The assistance of local fixed stations, who can assess the quality of the signal from the station, is very helpful to finally check things out.

The ability of the prime mover power source to supply the station *reliably* requires to be tested. Nothing more frustrating than a 'genny' which packs up after six hours, and will not start when hot! It happens!

The location for the tests need not be the contest site; all that is needed is some small patch of ground which is line-of-sight with the co-operating fixed stations. The aerial installation needs a certain amount of checking to ensure that all the necessary guys are there, that the aerials match the feeder, that the top end preamp is reliable under strong signals, and that all know how to put the thing up, for the aerial arrangements usually take the most time to set up on contest day. As the generator is to be sited as far as possible from the operating and sleeping tents, check that there is no unacceptable voltage drop in the supply leads to the gear. For safety, an earth leakage trip, preferably of the unbalance detector type, should be used with a 250 V AC system of power generation.

The best way of organising is to nominate a supremo (if I can't be captain, you can't use my football!) If the load is too heavy, put one person in charge of the equipment, and another in charge of the operating rota. People to choose are those who can inspire confidence (or can thump the hardest — the table or anything or someone as required.) They must remember an old military maxim — "delegation is the art of command."

Prepare lists: check off each item as it is to hand. Another military maxim: "time spent in reconnaisance is seldom wasted."



Similarly time and care in preparation pay dividends in efficacy of the final result.

Operating Skill

What makes a good operator??

a. The ability to write and talk into a microphone at the same time.
b. The ability to identify the really valuable weak distant station from among all the importunate middle-distancers.
c. The ability to instill good order and discipline on a frequency when faced with a multiplicity of callers, some of whom will, either through cussedness or through interference at the wrong moment, insist on calling whilst a contact is in progress.
d. The knack of reading weak stations *underneath* the noise: I sometimes think this is inborn rather than learnt. In connexion with this, I believe the over-frequent use of the FM mode is the kiss-of-death when it comes to reading weak SSB.

Too many newcomers seem to adhere to the FM channels instead of getting in there with weak SSB contacts and thus training themselves to comprehend low level distorted speech in high noise levels — which is essential for contest operation!

e. The ability to exude confidence and the feeling that a contact with your station is a good thing towards the often diffident people hearing your calls. (As a local once said, "You *WILL* contact us....it's good for you !!) This is connected with....

f. The ability to transmit good feeling, fellowship, and good humour towards correspondents, even when the going is tough. In other words, to be *positive* in a contact, and *not* giving the impression it's a bore!

g. The ability to pronounce and project one's voice properly — none of this diffident muttering so redolent of the FM channels. Proper pronunciation obviates the use of "speech processors" — properly called "speech distorters" — we don't use such foul devices. The old Service mnemonic for speech transmitting RSVP — RHYTHM, SPEED, VOLUME, PITCH, is much better than a processor when applied well.

Which would YOU prefer to work, given equal contact value? The mutterer? The mumbler?? The one who pronounces clearly??? Actually, *all* of them; we want to work the station who is just casually tuning around on the off-chance, as well as all the other contesters. And I am sure that the casual tuner would rather work the positive, clear, easily read, forthright, *interesting sounding* station rather than the wishy-washy, diffident, apparently back-of-the-mike, offhand, unconfident type of caller.

h. The ability to be patient, helpful, kindly, and of assistance to the new operator when in contact. It is most putting-off to the new licensee if his correspondent appears to be contemptuous, down-putting, hurried, and off-hand, just because the new chap isn't that far away and is obviously new to the game. Any of my operators who behaved in such a fashion would soon get a fat ear'ole! Paul M. Segal's "The Amateurs Code" is required reading for all contest operators for guidance in all the aforementioned aspects.

i. To have stamina — to be able to press on with the traffic right to the end of one's stay on the mike.

Application

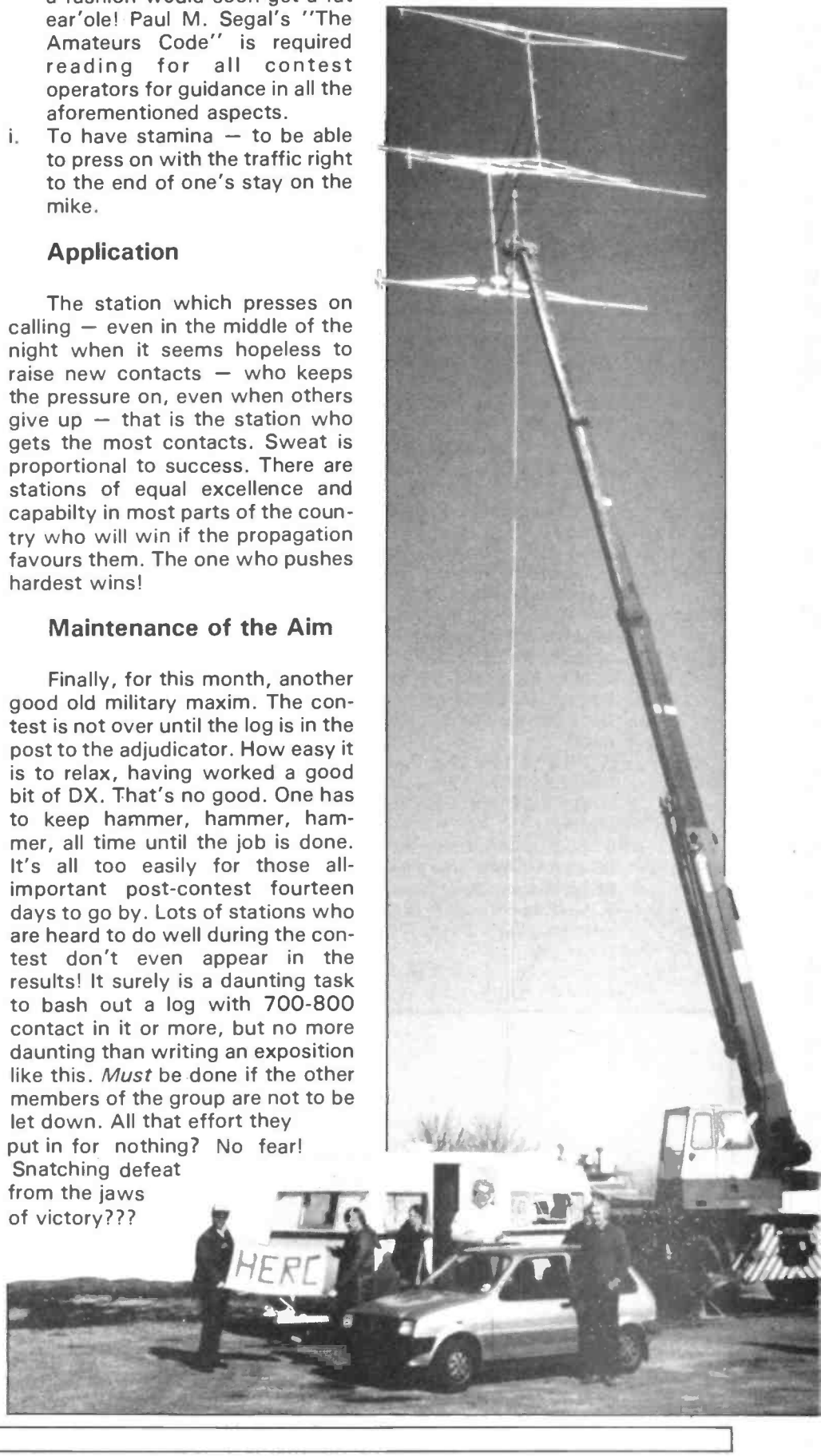
The station which presses on calling — even in the middle of the night when it seems hopeless to raise new contacts — who keeps the pressure on, even when others give up — that is the station who gets the most contacts. Sweat is proportional to success. There are stations of equal excellence and capabilty in most parts of the country who will win if the propagation favours them. The one who pushes hardest wins!

Maintenance of the Aim

Finally, for this month, another good old military maxim. The contest is not over until the log is in the post to the adjudicator. How easy it is to relax, having worked a good bit of DX. That's no good. One has to keep hammer, hammer, hammer, all time until the job is done. It's all too easily for those all-important post-contest fourteen days to go by. Lots of stations who are heard to do well during the contest don't even appear in the results! It surely is a daunting task to bash out a log with 700-800 contact in it or more, but no more daunting than writing an exposition like this. *Must* be done if the other members of the group are not to be let down. All that effort they put in for nothing? No fear! Snatching defeat from the jaws of victory???

Next month — the practicalities and actualities

Hastings ERC and their Contest set-up — including the 90' jib crane!



RADIO Tomorrow

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

1 Aug
Wirral DARC: D & W
S. Bristol ARC: Lecture — ring PRO for details
Wirral ARS: ring PRO for details
Lincoln SWC: RAE
Stockton DARG: ring PRO
Worthing ARC have changed their venue to Lancing Parish Hall, South Street, Lancing, W. Sussex. Info Eric Sandaver 0903 766318
Nene Valley RC: Natter Nite

2 Aug
Horsham ARC: *Automated Noise Figure Measurement by G4EJG*

3 Aug
Axe Vale ARC: 2m Foxhunt
Haverhill DARS: *Mobile Suppression*
Medway ARTS: *Satellite Working by G8XLH*
S. Manchester RC: 160m DF Contest
Harrow RS: G2UV Memorial Quiz
Dunstable Downs RC: *Computers in Amateur Radio*

4 Aug
RSGB 432 MHz Low Power and SWL
GB4FES/GB8FES at Festival '84, a Christian Family Festival at the County Showground, Stafford
GB2EGL at the Welsh Eisteddfod

5 Aug
RSGB 144 MHz Low Power and SWL
RSGB Woburn Rally
S. Manchester RSGB 160m DF Qualifier

6 Aug
Horndean DRC: *Car Ignition Suppression by Lucas Eng.*
Leighton Linslade RC: ring PRO
Braintree DARS: 'Live' Operating Evening
Southdown ARS: ring PRO
Stowmarket ARS: *Metrewave Awards by Jack Hum, G5UM*
Thornton Cleveleys ARS: *Switch Mode PSUs by G4KPY*

7 Aug
Wakefield DRS now meet at the Ossett Community Centre, Prospect Road, Ossett at 8pm
S. Lakeland ARS: 2m Foxhunt
Chichester DARC: ring PRO

8 Aug
S. Bristol ARC: Pocket Phone Rally with G4SDR
Farnborough DRS: to be arranged
Lincoln SWC: On-air
Stockton DARS: ring PRO
Nene Valley RC: *Solar Data by G8AFN*
Cheshunt DARS: Natter Nite

9 Aug
Southgate ARC: Demonstration of Equipment and Social Evening
Stowmarket ARS: 2nd DF Hunt

10 Aug
S. Manchester RC: *QRO Miscellany by G2HW*
Harrow RS: Informal and Practical

12 Aug
Wirral DARC: DF Hunt

13 Aug
Exeter ARS: Construction Evening
Sutton and Cheam RS: Inter-Club Quiz with Coulsdon ATS at St Swithins Hall, Purley
Thornton Cleveleys ARS: Brush Up Your Morse with G3ZRZ

14 Aug
Mid-Warwickshire ARS: Town and Country Festival Planning
Bury RS: Fox Hunt

	Basingstoke RS: Contact G4OAC for details
15 Aug	Wirral DARC: D & W
	S. Bristol ARC: VHF CW Night with G4OPQ
	Wirral ARS: ring PRO
	Lincoln SWC: RAE/Hamfest meeting
	Stockton DARS: ring PRO
	Nene Valley RC: *SSTV — in Colour and B/W by G4ENB*
	Cheshunt DARS: Equipment Evening
16 Aug	S. Lakeland ARS: ring PRO
	Chichester DARC: ring PRO
17 Aug	Medway ARTS: Demonstration of Satellite Working by G8XLH
	S. Manchester RC: to be arranged
	Harrow RS: Informal and Practical
	Haverhill DARS: Interference
	Dunstable Downs RC: Df Hunt on 160 and 2m
19 Aug	Glenrothes DARC: Forward Planning Discussion
	RSGB 1296 MHz Contest
	RAIBC/FRARS Hamfest at Flight Refuelling Social Club, Merley, Wimbourne, Dorset. Parking, Trade Stands, Camping and Caravanning facilities. Fun for all the family, including model railway rides and barbeque refreshment. Bring and Buy. RSGB Stall. Talk-in. Open 1100-1700. Fund raising event for the Radio Amateurs Invalid and Bedfast Club. Info Bob Burrows 0202 762828.
	East Kent ARS regret that their mobile rally is cancelled. All booking fees will be refunded.
20 Aug	Braintree DARS: *Computers and Amateur Radio by G8NPF and G6CHJ*
	Thornton Cleveleys ARS: contact PRO for details
21 Aug	Biggin Hill ARC: *Construction Techniques by G4VTD*
	Wakefield DRS: Pitch and Putt Competition
	Halifax DARS: *Radio Calderdale by David Keitch*
	Midland ARS: Discussion Night
	Fylde ARS: Natter Nite and Morse Class
22 Aug	Wirral DARC: Junk Sale
	S. Bristol ARC: End of Club VHF Contest
	Farnborough RS: to be arranged
	Lincoln SWC: Homebrewing with G8ZCD
	Stockton DARS: ring PRO
	Nene Valley RC: Natter Nite
	Cheshunt DARC: Natter Nite
23 Aug	Edgeware DARS: SSB FD Briefing
24 Aug	S.Manchester RC: ring PRO
	Harrow RS: Informal and Practical
26 Aug	RSGB ROPOCCO 2
	Preston Mobile Rally at Lancaster University. Free Parking. Admission 50p plus free prize draw. Cafe and Bar. Trade stands plus RSGB bookstall and Grand Bring and Buy. Rally starts at 1100. Talk-in S22 and 70cm. Info G3DWQ 0772 53810
	British Amateur Teleprinter Group Rally at Sandown Park Racecourse, Esher, Surrey. Trade stands galore, BARTG kits and publications stall, demonstrations, refreshments and a Car Boot Sale. Close to A3, M3 and M4. Open 1030-1700. Talk-in S22. Free parking. Info Ted Batt 01 549 8253
27 Aug	Southgate ARC: Trent Park DF Hunt and Social Extravaganza.
28 Aug	Mid-Warwickshire ARS: HF on-air night
29 Aug	Wirral DARC: D & W
	S. Bristol ARC: QRO Activity Night
	Lincoln SWC: RAE
	Stockton DARG: ring PRO
	Nene Valley RC: *The Six Metre Band by G4BAO*
	Cheshunt DARC: 2m Portable on Baas Hill Common
31 Aug	Medway ARTS: Talk and Demonstration by KW Communications Ltd
	S. Manchester RC: ring PRO
	Harrow RS: Informal and Practical
	Haverhill DARS: Lightning Protection
	Dunstable Downs RC: *Microwaves by G3BNL*
1-2 Sep	**RSGB 144 MHz Trophy and SWL Contest**
	RSGB SSB Field Day
3 Sep	Stourbridge ARS: "Your Construction Project" (a forum)
	Leighton Linslade RC: AGM
	Braintree DARS: Test Gear and Operating Aids
	Southdown ARS: ring PRO for details
	Stowmarket ARS: A Visit to Suffolk Police HQ
	Thornton Cleveleys ARS: *Japanese Morse by G3CSG*
4 Sep	Wakefield DRS: to be arranged
	Fylde ARS: Aerial Circus with G6CJ (video)
	Vale of White Horse ARS: Talk by G3RZP of Plessey
	Chichester DARC: Visit by the Sussex Repeater Group
5 Sep	Fareham DARC: Satellite Communications
	Wirral ARS: Debate on "CW is a dying art?"
	S. Bristol ARC: AGM
	Wirral DARC: D & W
	S. Lincoln SWC: CW/RAE/Hamfest
	Stockton DARG: ring PRO
	Nene Valley RC: Natter Nite
	Cheshunt DARC: Natter Nite
6 Sep	Horsham ARC: Junk Sale
7 Sep	**World Association of Christian Radio Amateurs and Listeners Conference Weekend at the London Bible College, Northwood, Info G3AGX 0482 822276**
	Axe Vale ARC: *The RSGB by G3XC*
8-9 Sep	**Cray Valley RS SWL Contest. 1800-1800 Sun. Up to 18h of logging to be done. Arguably the best SWL contest there is! Log sheets and rules from Owen Cross, 28 Garden Avenue, Bexley Heath, Kent DA7 4LF**
8 Sep	**Scottish Amateur Radio Convention at Cardonald College, Glasgow (short distance from the M8). Trade Stands, demonstrations, RSGB bookstall and guest lecturers, including George Dobbs of the G-QRP Club and Chris Bartram of muTek. Parking and refreshments readily available. Open 1100-1700. Admission £1. Talk-in on S22.**
9 Sep	Wirral DARC: 5th and Final DF Hunt.
	Telford Amateur Radio Rally at Telford Town Centre, (junction 10A off M6) Telford, Shropshire. Displays, over 80 trade stands, Flea Market and the rally is nearby the town park. Talk-in and refreshments (Ansells Bitter!) Info G8DIR 0743 64273
	Chichester DARC: G2NM Commemorative Station at Chalk Pits Radio Museum.
10 Sep	Exeter ARS: to be arranged.
	Milton Keynes DARS: ring PRO
	Thornton Cleveleys ARS: Morse Class
11 Sep	Mid-Warwickshire ARS: *Metal Bashing*
	Bury RS: *Video Vs Photography by G4OAC*
12 Sep	Fareham DARC: On-air/natter night
	Wirral DARC: Equipment demonstration by

	Lowe Electronics
	Farnborough DRS: Pre-AGM discussion
	S. Bristol ARC: VHF/UHF Activity Night — *all beams west, folks.*
	Lincoln SWC: *VHF Aerials by G3FDW*
	Stockton DARG: ring PRO
	Cheshunt DARC: Junk Sale
13 Sep	Southgate ARC: "Birds Nest" Night
	Edgeware DARS: Informal
14 Sep	Haverhill DARS: Open Evening
	Dunstable Downs RC: *RTTY, AMTOR and Packet Radio by G3NRW*
16 Sep	RSGB 70MHz Trophy and SWL
	Vange Amateur Radio Society Mobile Rally at Nicholas School, Basildon 1000-1700. Info Mrs. D. Thompson 0268 552606
17 Sep	Stourbridge ARS: ring PRO for details
	Leighton Linslade RC: ring PRO
	Braintree DARS: *Clay Pigeon Shooting*
	Thornton Cleveleys ARS: to be arranged
18 Sep	Biggin Hill ARC: *Antennas by Louis Varney, G5RV*
	Wakefield DRS: t.b.a.
	Halifax DARS: AGM
	Fylde ARS: Informal and Morse Class
19 Sep	Fareham DARC: *Multi-band HF Antennas*
	Wirral DARC: D & W
	S. Bristol ARC: ATV Activity Night
	Wirral ARS: Air Your (radio) Problems Night
	Midland ARS: Homebrew Evening
	Lincoln SWC: CW/RAE/Hamfest
	Stockton DARG: ring PRO
	Cheshunt DARC: Natter Nite
20 Sep	Chichester DARC: ring PRO
23 Sep	**Lincoln Hamfest. Trade Stands, Bring and Buy, fairground attractions and model aircraft display. Food, picnic area, parking and Talk-in. Located at Lincolnshire Showground (4m N of Lincoln A15)**
	Dunstable Downs Car Boot Sale at The Shuttleworth Collection, Old Warden.
24 Sep	Thornton Cleveleys ARS: Club Project and Construction Evening.
25 Sep	Mid-Warwickshire ARS: Junk Sale
26 Sep	Fareham DARC: on-air/natter night
	Wirral DARC: Inter Club Quiz Night with Chester at Irby
	Farnborough (Hants) DRS: Annual Construction Contest
	S. Bristol ARC: SWL Activity Night with Ron Gardner
	Stockton DARG: ring PRO
	Cheshunt DARC: Club Project Discussion with G4OAA
	Edgeware DARS: Quiz with G3PSP as MC
28 Sep	Haverhill DARS: HF Operating Procedures
	Dunstable Downs RC: *Colour Offset Printing by G4WYO*
30 Sep	**Welsh Convention at Oakdale Community Centre, Blackwood.**

Will Club Secretaries please note that the deadline for the November segment of Radio Tomorrow (covering radio activities from 1st October — 1st December '84 is 26th August).

Contacts

Axe Vale ARC	Roger Jones	Upottery 468
Barking RES	R. Woodberry	01 594 4009
Braintree RS	Alan Moore	0304 822738
Bury RS	Bryan Tydesley	0282 24254
Cheshunt DARC	Roger Frisby	0992 464975
Chichester DARC	C. Bryan	0243 789587
Cambridge DARC	David Wilcock	0954 50597
Dunstable Downs RC	Phill Morris	Dunstable 607623
Exeter ARS	Roger Tipper	0392 68065
East Kent RS	Stuart Alexander	0227 68913
Edgeware DARS	John Cobley	30 64342
Fylde RS	PRO	Lytham 737680
Halifax DARS	DL Moss	0422 202306
Harrow RS	Dave Atkins	0923 779942
Hastings ERC	Dave Shirley	0424 420608
Haverhill DARS	Rob Proctor	0787 281359
Hornsea ARC	Norman Bedford	0262 73635
Horsham ARC	Pete Head	0403 64580
Leighton Linslade RC	Pete Brazier	052 523 270
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Medway ARTS	Andy Wallis	0634 363960
Mid Ulster ARC	DF Campbell	0762 42620
Preston ARS	George Earnshaw	0772 718175
S. Bristol ARS	Len Baker	0272 834282
S. Lakeland ARS	Dave Warburton	Ulverston 54982
S. Manchester ARC	Dave Holland	061 973 1837
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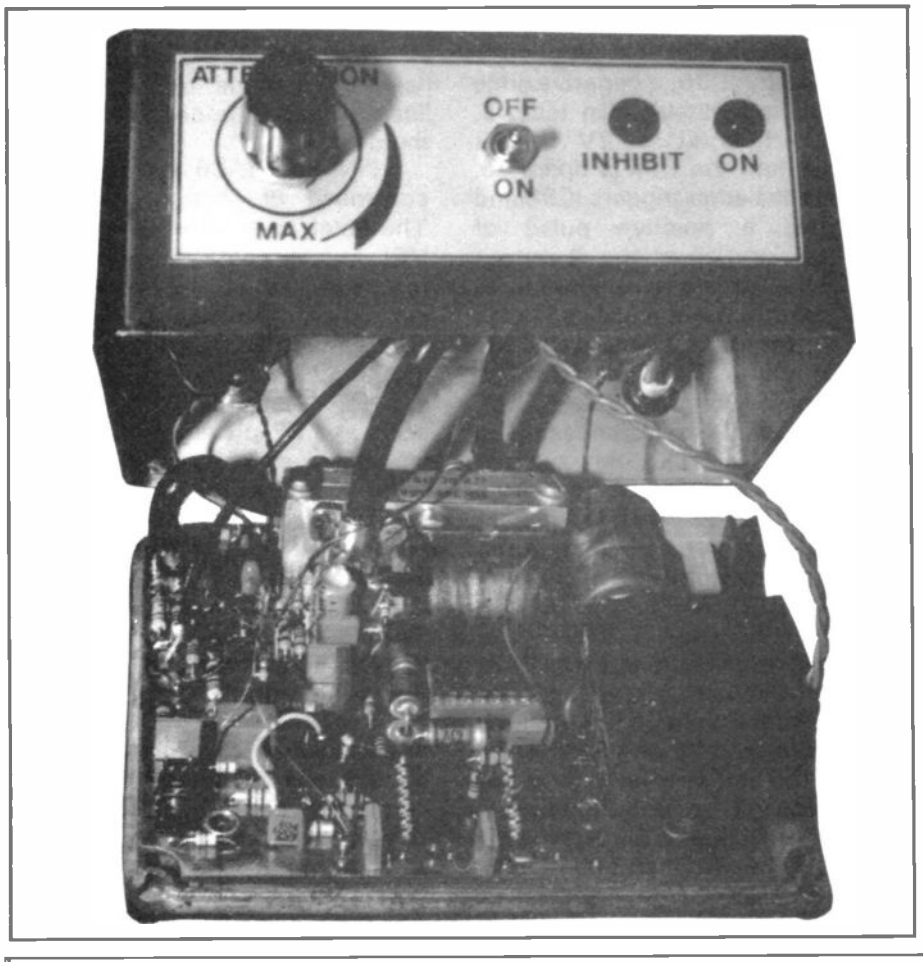
Wirral ARS	Cedric, G4KPY	625 7311
Wirral DARC	Gerry Scott	051 630 1393
Worthing DARC	Jim Hicks	0903 690415
308 ARC (Surbiton)	Dave Davis	01 399 5487

CONTROL UNITS for a 2m GaAsFET pre-amp

My article in last month's *HRT* described a GaAsFET masthead pre-amplifier for the 2m band, and made reference to a suitable control until which would be published in a later issue.

Remember our high performance 2m pre-amplifier last month? Here are two remote control units, capable of handling 350W and 40W of RF respectively, to suit a variety of station requirements. By John Matthews, G3WZT.

The unit described here fulfills the requirements previously mentioned, allowing great flexibility for various installations and user requirements. Hard switched changeover is used and fed to the masthead via the receive signal co-axial cable. Two levels for PTT operation may be internally selected; either +9/12V or earthed on transmit. A separate PTT output is provided for control of a linear amplifier, allowing correct sequencing of the co-axial relay at the masthead. The unit has a built-in mains driven power supply and a user-adjustable PIN diode attenuator in the receive line with a range of 30dB. It is housed in a standard diecast box and all components are mounted on a double-sided PCB with plated-through holes.



Circuit Description

PTT INPUT (**Fig.1**). The PTT line is fed into SK1 from the transceiver. Two levels are catered for, either earthed on transmit or plus 9/12V. These are selected in the control unit by means of a link on the PCB (C to E for earth, C to P for +V). Q5 is a simple DC controlled switch which earths the internal PTT line when the appropriate input is present on SK1.

SEQUENTIAL SWITCHING. (BREAK). IC3 is a dual monostable multi-vibrator. IC3a delays the pre-amp switching when going from transmit to receive; IC3b delays the PTT out to the external PA when going from receive to transmit. IC3a is a positive edge triggered monostable and provides a positive going pulse at the Q output when pin 4 changes from a low to a high level (ie when the PTT is released). The duration of the Q pulse is set by C3,R4 (T = approx. 0.5 C3 × R4). With the values indicated the pulse duration is around 100 mS.

IC1a,b are used as buffer/inverter gates with the output (pin 4) driving relay driver transistor Q1. On transmit Q1 is off and RL1 de-energised; when the PTT is released, the negative pulse at Q1 base holds RL1 'off' for a further 100 mS. This allows ample time for the RF to decay before DC is ap-

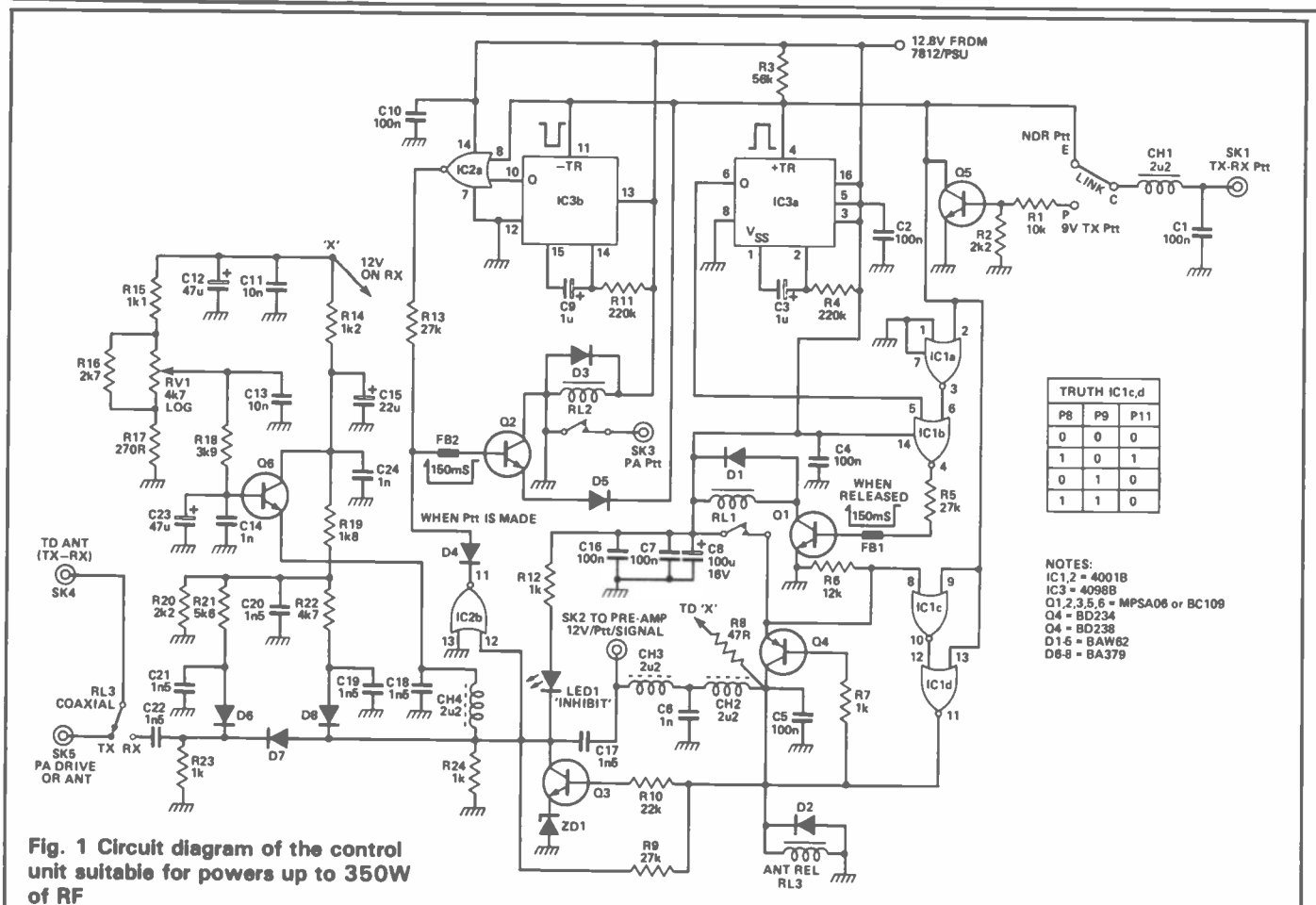


Fig. 1 Circuit diagram of the control unit suitable for powers up to 350W of RF

plied to the masthead pre-amp, and to co-ax relay RL3. The contacts of RL1 supply +12V to the series-switching-and-inhibit transistor Q4. IC1c and d perform an IMP-NOT function (Q = pin 8 AND NOT pin 9). Q being true is not a valid combination of PTT functions because it implies that the masthead unit is being supplied with 12V and the transmitter is also being keyed. As this condition must constitute an internal failure, Q4 is turned off, removing the masthead supply at SK2. Under the above conditions, the output of IC2b (pin11) goes low and prevents the power amplifier PTT line from operating by inhibiting Q2. Transistor Q3 is turned on and illuminates a front-panel LED to indicate that an inhibit condition exists.

SEQUENTIAL SWITCHING (MAKE). When the transmitter is keyed, it is most important to ensure that the masthead co-axial relay is in the de-energised position before RF power is applied to it. This is ensured by delaying the power amplifier PTT line at SK3. The sequencing for this function is controlled by IC3b, a negative edge triggered monostable. On receive, pin11 is held at +12V by R3 (56K). When the PTT is operated, the negative edge triggers IC3b and generates a positive pulse of 100 mS duration at the Q output (pin 10). IC2a is a NOR gate buffer which inverts the Q pulse and holds Q2/RL2 off for 100 mS after the PTT switch has been pressed. The emitter of Q2 is returned to the PTT line as a precautionary measure to ensure that RL2 can only operate when on transmit. D5 prevents reverse V_{BE} of Q2 when in transmit mode. Sequential switching functions are shown in **Fig.2**.

PIN DIODE ATTENUATOR. On receive the signal from the masthead amplifier is fed into SK2. Isolation between signal and the 12V operating voltage fed via SK2 is provided by C17 and CH2,3. To control the signal level fed to the main receiver, a PIN diode attenuator is included between SK2 and RL3. The attenuator configuration is similar to other published designs, and no originality is claimed. However, some modifications have been made to improve the linearity and gain control range of the device.

PIN diodes, D6,7,8 form a DC controlled PI section attenuator. The level of attenuation is set by VR1, which controls the base current into Q6. Components associated with the output side of Q6 are arranged so that with minimum attenuation set, D6 and D8 present a high impedance path to signal earth and D7 presents a near short circuit in series with the signal path. The reverse is true when maximum attenuation is set by means of VR1. Insertion loss of the attenuator at 145 MHz is 2.5 dB and could be reduced at the cost of passing additional current into the PIN diodes and reducing reliability. However, with the high gain available from the masthead unit, this small loss is insignificant.

Interconnections for installation of the control unit pre-amplifier combination are shown in **Fig.3** with separate diagrams to show use with or without a power amplifier. Although some doubt

may be cast on the use of diodes in the receive path from the point of giving rise to unwanted intermodulation products, there is no cause for concern. The third order products are well below those of the pre-amplifier and are suppressed by more than 70 dB with respect to an output level of 0 dBm (each tone) giving a 3rd order intercept point of +35 dBm. (see **Fig.4**). At these signal levels, pre-amplifier and attenuator performance are of little concern as most receivers will be grossly overloaded when signals of this magnitude are applied to the input. Co-axial relay RL3 switches the common Tx and Rx (aerial input) sockets of a transceiver between the pre-amplifier output on receive, and the aerial or power amplifier input on Tx. If separate units are used for Tx and Rx, the features of this control unit may still be used to full advantage. In order to maintain sequential relay switching when moderate power levels are used (50W) with a separate transmitter, the PTT will need to be modified so that its Tx/Rx switching is controlled from SK3. In its simplest form, the microphone PTT must be separated from the Tx and fed to SK1 on the control unit, with the output PTT at SK3 used to control the Tx/Rx changeover functions. Under these circumstances the Rx is fed from SK4; the Tx output goes to the original aerial feeder, leaving SK5 unused. If separate units are used with a low power transmitter, existing PTT facilities may be used as the problems associated with switching high power levels do not exist.

When using a separate high power amplifier in conjunction with individual transmitter/receivers, the interconnections are as shown in **Fig.3a**, except that the receiver is connected to SK4 and the transmitter to the PA drive socket.

Construction

Construction of the unit is straightforward, all components are mounted on a double sided PCB with plated through holes. Component layout is shown in **Fig.5**. The mains driven power supply unit and regulator are integral and mounted on the same PCB as the control circuitry. The completed unit is housed in a standard diecast box (114 × 89 × 55 mm) with the PCB mounted on the lid. Co-axial sockets and PTT input and output phono-sockets are mounted on the rear of the unit with the attenuator control, power 'ON', 'INHIBIT' LED and mains switch mounted on the front. Mains is fed through the rear of the unit and secured with a nylon strain relief bush.

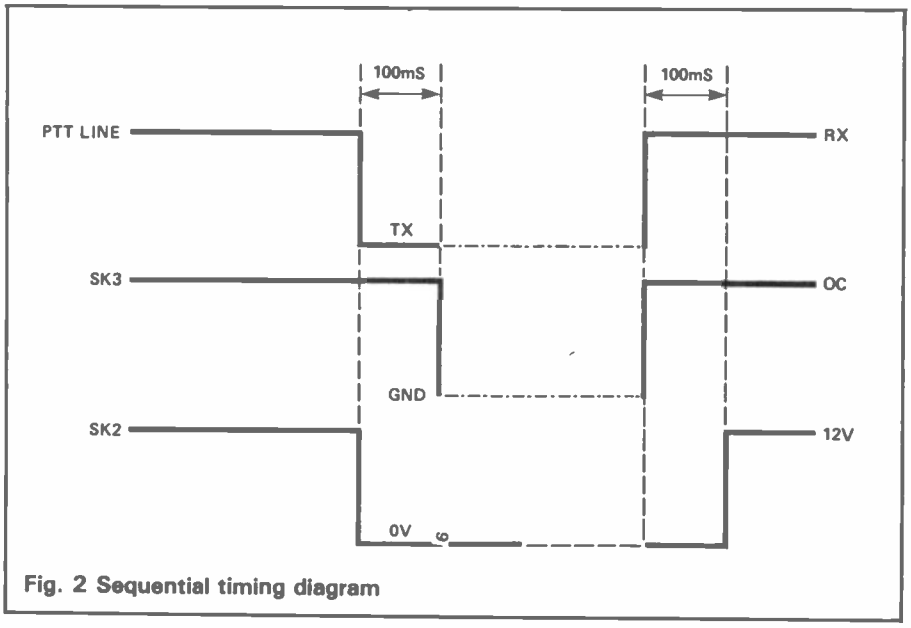


Fig. 2 Sequential timing diagram

Begin by soldering the chip capacitors (C17-C22) in position. These are very small, and care should be taken to ensure that a minimum of heat and solder are used consistent with good joints. Holders may be used for IC1,2,3 if preferred, but be sure to use modern types as reliability will be reduced if old or second-hand types are used. All other components may be fitted in any order, but be sure to observe the polarity of all diodes and electrolytic capacitors. Chokes in the bases of Q1 and Q2 are formed using a wire linked with a ferrite bead passed over the link. Where connections from the board to controls and sockets on the enclosure are required, leads may be soldered directly into the holes on the PCB or to pins previously soldered into those holes.

When all components are soldered to the board, make up and fit 3 six-inch lengths of UR43 to the co-axial relay. The cable braid clamps allow the cables to be

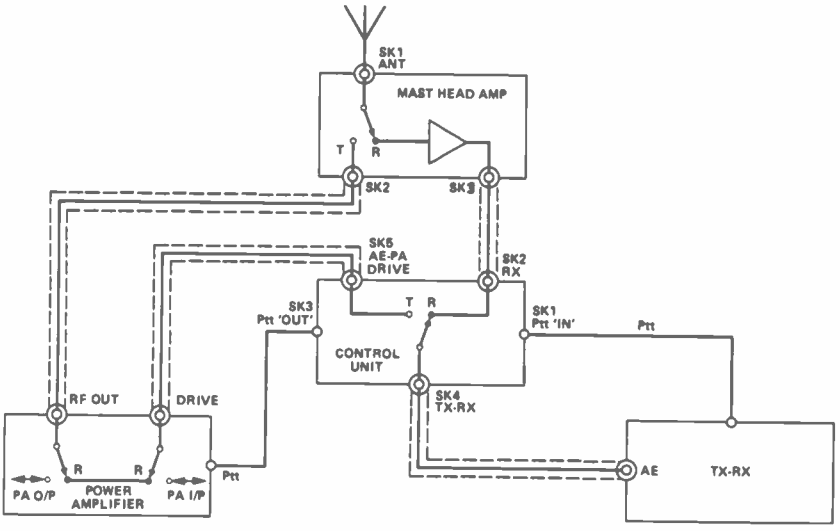


Fig. 3a Interconnections for use with a power amplifier

brought out from the relay in several configurations. To ensure correct fitting, proceed as follows. Place the relay in front of you with the energising coil towards you, and the coil connections on the left-hand side. The co-ax connection on the front of the relay adjacent to the coil should be made up to feed out vertically and at right angles to the body of the relay. This connects to SK5. The rear right co-ax is fed out in exactly the same way, and goes to SK4. The remaining co-ax lead is arranged to feed from the left-hand side along the axis of the relay body. This connects to the pad provided at one end of C22. A short piece of 28 SWG copper wire is used to connect the braid to the earth plane. Mount the relay, using M3 screws, with the coil facing towards the centre of the PCB and the coil terminals adjacent to C8. Solder one side of the coil to the earth plane, and the other side to the two points shown on **Fig.5**.

The completed circuit board is secured to the lid of the control box by means of 4 × 3 mm clinch nuts fitted to the underside of the PCB. These provide a 6 mm spacing between the underside of the PCB and the base of the unit. The drilling diagram for the front and rear of the enclosure (**Fig.6**) is correct for the components used on the two prototypes. Changes may be needed to accommodate components used by the individual constructor.

All cables should be earthed to the appropriate sockets using short pigtails soldered to earth tags. SK2 is connected by a length of 50 ohm co-ax to the point shown in Fig.5. Mains input is fed via a miniature DPDT switch to the pads provided adjacent to the mains transformer.

PTT Selection

As mentioned earlier, 2 levels of PTT are catered for, earthed on transmit or +9V - +12V. Selection is made by a wire link on the PCB. For transceivers giving a +ve voltage on transmit, link C to P; for those giving ground on transmit, link C to E.

Testing

After thoroughly checking component values and orientation, examine the board for solder splashes and poor joints. If plated-through holes are not used on the PCB, *make sure that components are soldered on both sides of the board and that vacant holes are pinned through.* If all looks well, switch on and check that 11 to 12 volts is present at the Rx/12V co-ax socket (SK2). The 'POWER ON' LED should be illuminated. Monitor

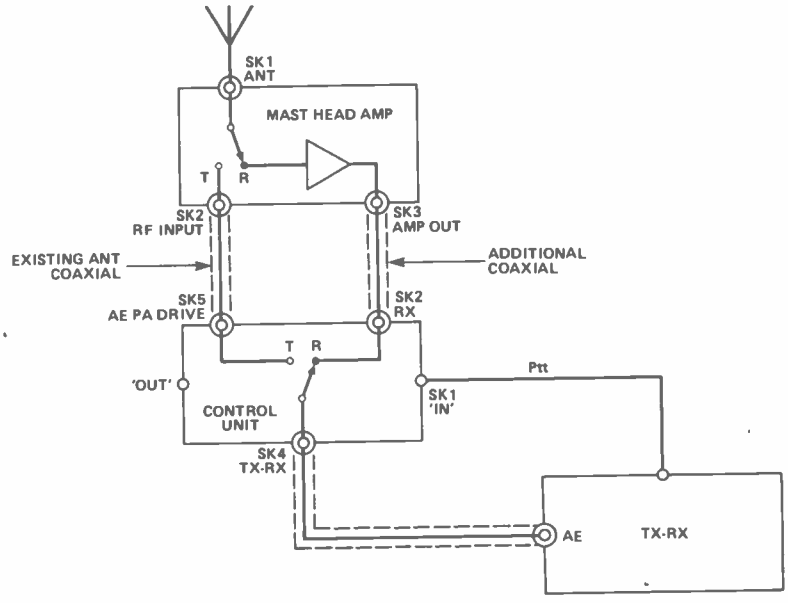


Fig. 3b Interconnections for use without a power amplifier

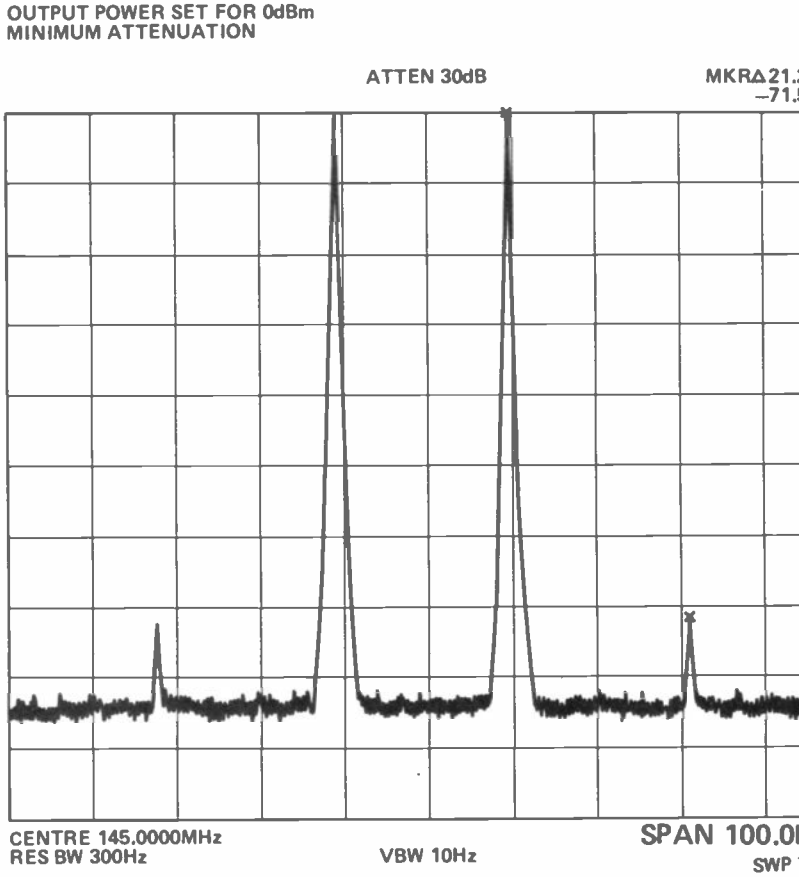


Fig. 4 PIN attenuator intermodulation

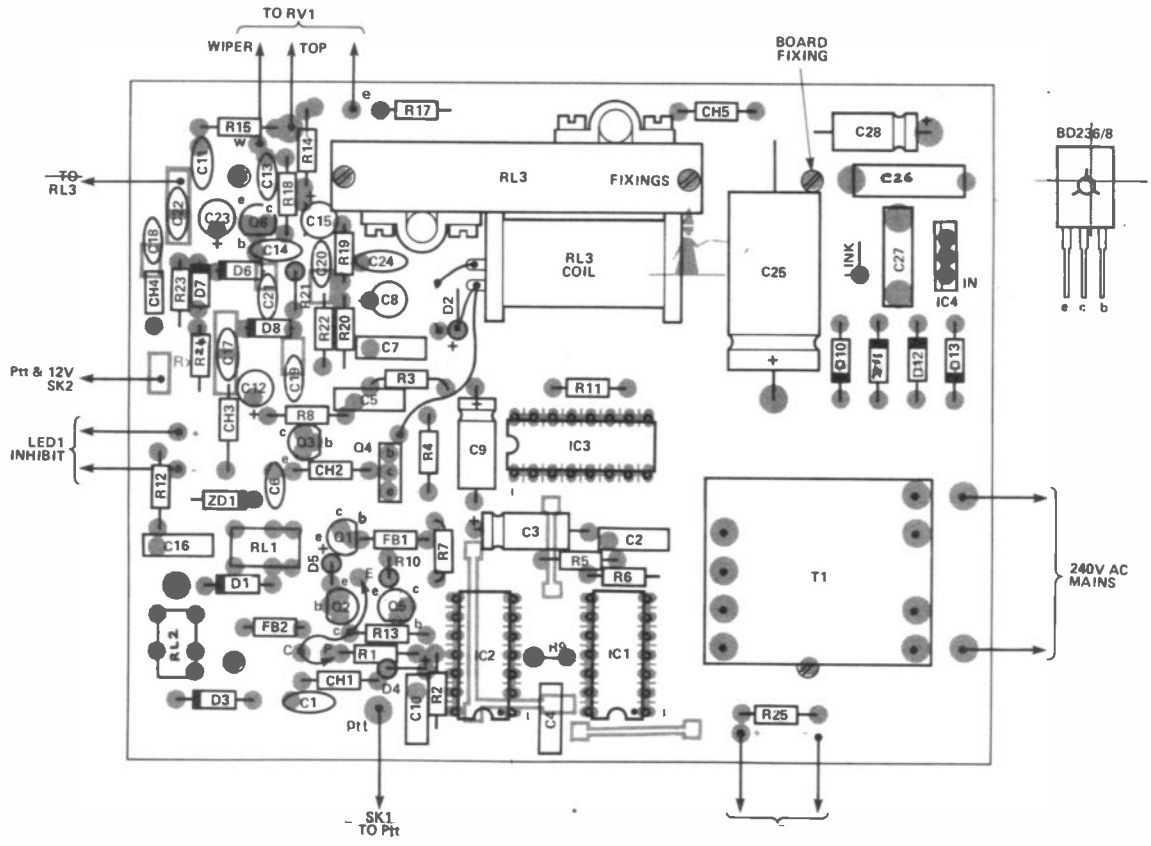


Fig. 5 Overlay diagram for the control unit suitable for 350W

the voltage at SK2 and operate the PTT by applying a ground of +9V - +12V at SK1 (depending on the link selected). The voltage at SK2 should return to zero immediately. Remove the PTT from SK1 and check that the DC level at SK2 returns after a short delay (approx. 100 mS). If this is satisfactory the sequential switching of the pre-amplifier is working.

Place the ohmmeter across SK3 and check that the contacts on RL2 are open. Operate the PTT at SK1 and check that a short delay occurs (approx. 100 mS) before the ohmmeter shows short-circuit. This ensure that the PTT out to a linear amplifier is delayed enough to allow the co-axial relays in the mast head amplifier and control unit to de-energise before RF power is applied to them. To check the inhibit circuit, place a temporary short between pins 8 and 14 of IC1. Switch the control unit on and operate the PTT at SK1. The 'INHIBIT' LED should illuminate and RL2 de-energise, removing the 'PTT out' from SK3.

The variable attenuator is most easily checked in a complete system. Connect the pre-amp and control unit combination as shown in Fig.3. Rotation of the attenuator potentiometer should alter the received signal level by approximately 30 dB.

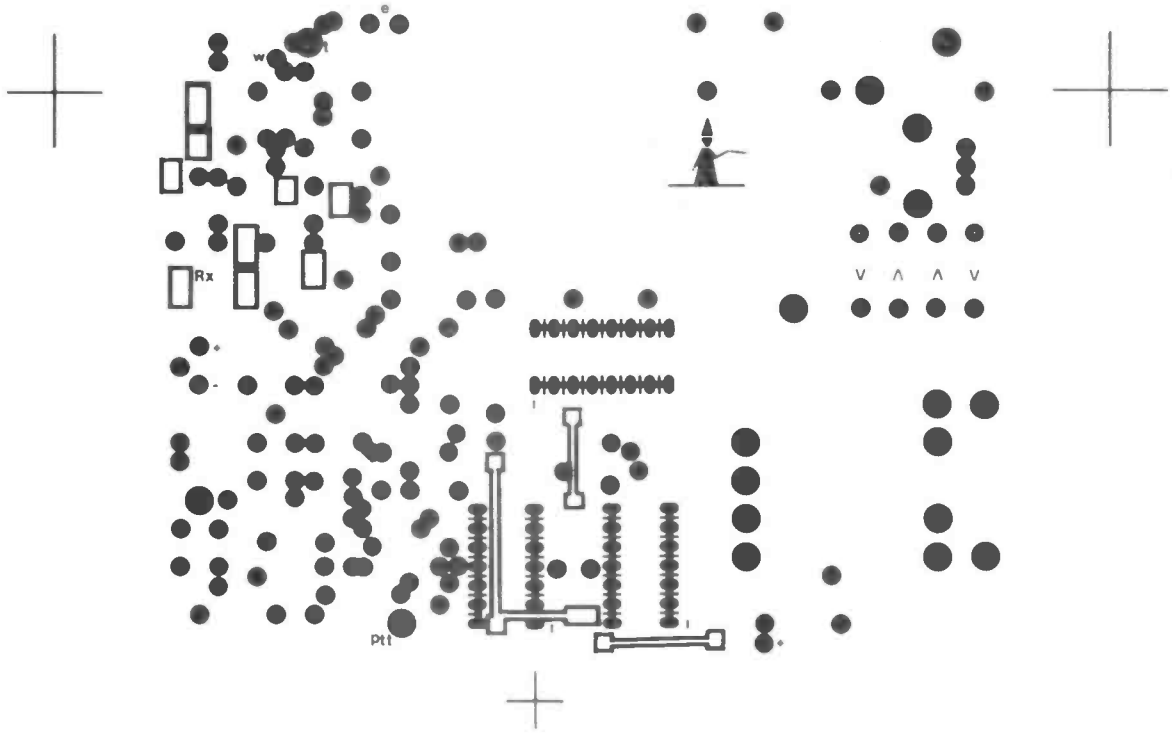
Use Of Attenuator

The amount of attenuation required will vary according to individual installations and user requirements. Sufficient gain is available from the pre-amplifier to cater for long runs of inexpensive co-ax between the pre-amplifier output and the control unit. Users with runs of average length will have the ability to adjust the gain at will to suit band occupancy and conditions at the time. The attenuator can sometimes have a dramatic effect. During a contest, for example, the band often contains a number of very strong signals (all of which seem a bit "wide") and the spaces between the strong signals are filled by a 'spitchy' noise. Tune to a space between strong signals and slowly back off the attenuator. Suddenly the noise decreases dramatically! If you now tune the band, you find that the spaces between the strong

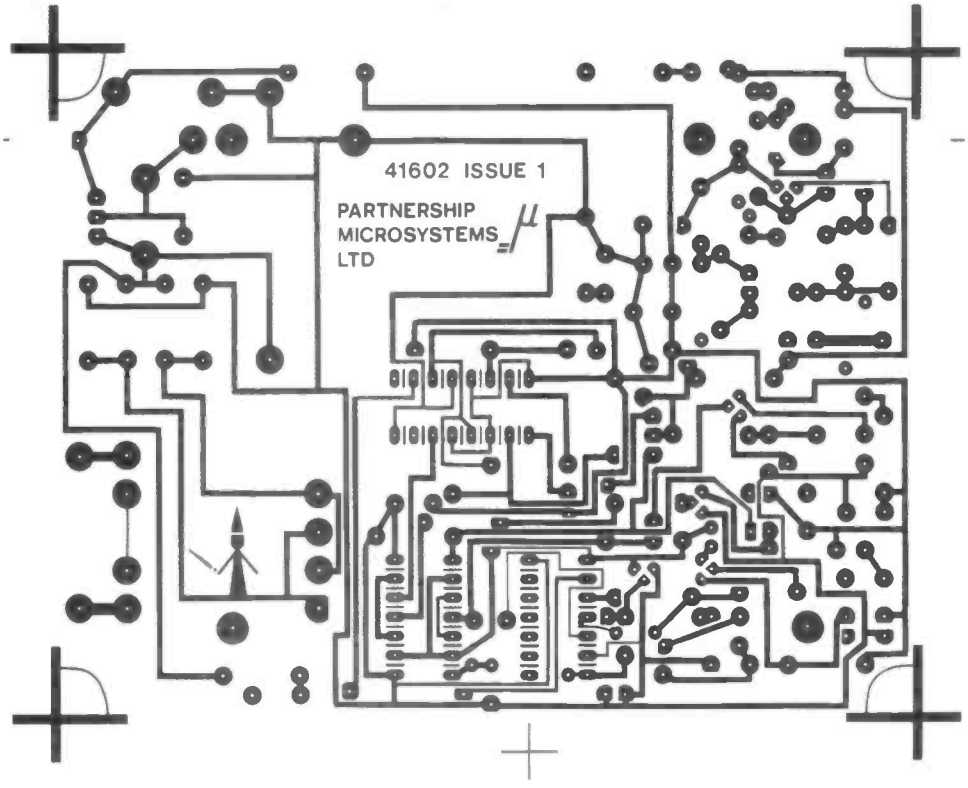
Component Listing

Resistors

R1	10K
R2,20	2K2
R3	56K
R4,11	220K
R5,9,13	27K
R6	12K
R7,12,23,24	1K0
R8	47R
R10	22K
R14,25	1K2
R15	1K1
R16	2K7
R17	270R
R18	3K9



Top foil of 350W control unit. WILL CONSTRUCTORS PLEASE NOTE THAT ETCHED AREAS ARE SHOWN IN BLACK



Botton foil of 350W control unit. In this, the TRACK areas are shown in BLACK!

R19	1K8		
R21	5K6		
R22	4K7		
VR1	Min. 4K7 log		

All resistors are ¼W, carbon film, Style TR4

Capacitors

C1,2,4,5, 7,10,16	100n ceramic monobloc (PM)
C3,9	1uF 25V tubular electrolytic (axial)
C6,14,24	In ceramic monobloc
C8	100uF 16V elect. (radial) RS 103-339
C11,13	10n ceramic monobloc
C12,23	47uF 16V sub min radial elect. RS 103-979
C15	22uF 16V bead tantalum RS 101-838
C17-22	1n5 chip (PM)
C25	1000uF 25V axial elect (AM 05-10810)
C26	470n polyester RS 113-926
C27	220n polyester RS 113-910
C28	2.2uF 63V Electrolytic (axial)

Semiconductors

ZD1	3V3 400mW Zener
D1-5	BAW62 or 1N4148
D6-8	BA379 PIN diode
D10-13	1N4001
LD1,2	Red LED with panel mounting RS586-835
Q1,2,3, 5,6	MPSA06 or BC108 plastic (AM 58-00238)
Q4	BD236 or BD238
Regulator	7812
IC1,2	4001B
IC3	4098B

Miscellaneous

IC Skts (if required) 2 × 14 pin dil, 1 × 16 pin dil

RL1,2	12V min dil type OUC (AM 46-70040)
RL3	12V co-axial RS 349-686
CH1-4	2.2uH min moulded RF choke
CH5	4.7uH min moulded RF choke
FB1,2	FX1242 ferite bead
SK2,4,5	BNC skt. single hole fixing with earth tag RS 455-674 & 456-469
SK1,3	Phono skt. single hole fixing RS 478-093
T1	15-0-15V 3VA RS 207-841
SW1	Min DPDT toggle switch 250VAC RS 316-989 or AM 53-00201

Strain relief bush RS 607-774; PCB See text (PM 41602) and die cast box Eddystone 6908P

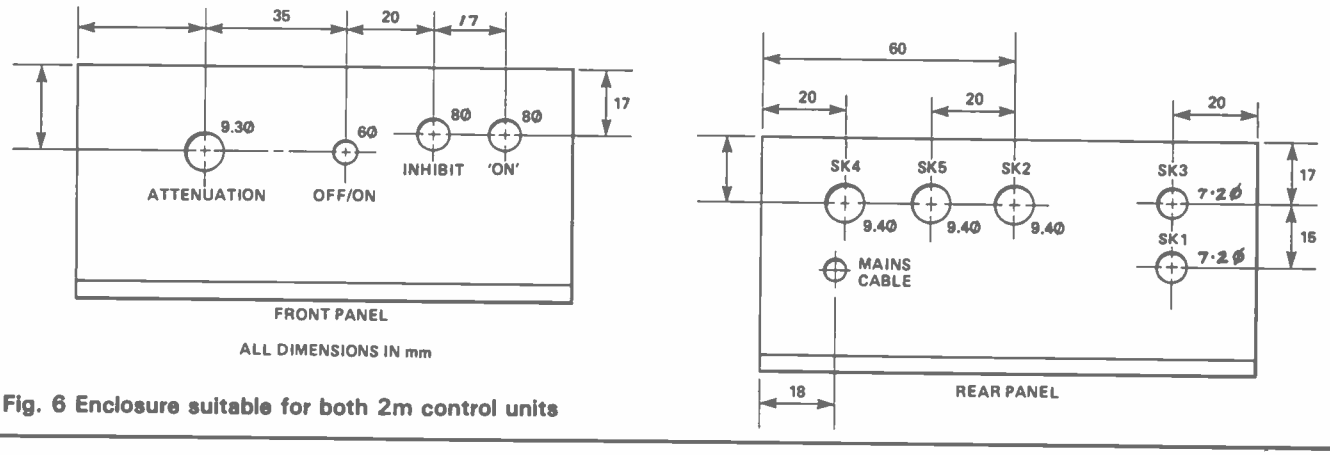


Fig. 6 Enclosure suitable for both 2m control units

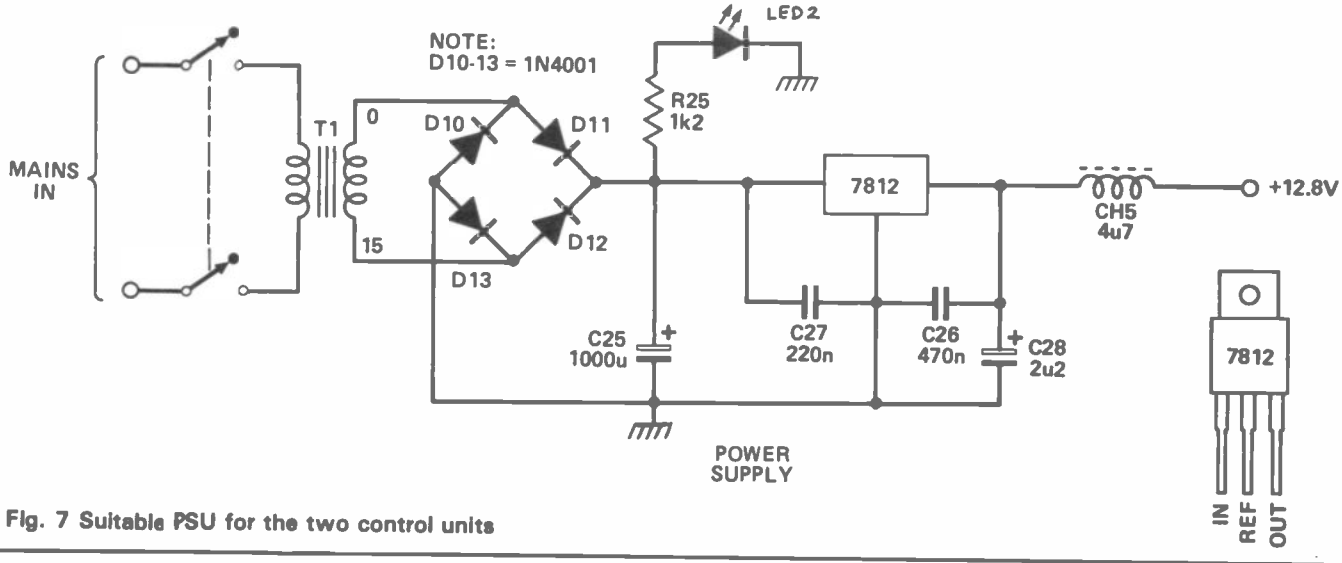


Fig. 7 Suitable PSU for the two control units

signals contain numerous weak (but readable) signals. You also notice that most of the strong signals no longer spread across the band. The stations that still spread are those that really DO have transmitter intermodulation problems!

Alternative Low Power, Low Cost Control Unit

This is a lower cost design, with a reduced specification. A DIL reed relay is used for RF switching, switching is not sequential, and there is no provision for control of a linear amplifier. Transmit power is limited to 40W maximum. RF sensing is used to switch to transmit mode; hard switching can be used (and is preferable) if the rig has a PTT output. A 6 dB fixed resistive attenuator is included to reduce the pre-amplifier output. The attenuation may be changed to suite individual needs by changing the values of three fixed resistors. The unit is powered from an external 12V DC supply.

Circuit Description

RF power is sampled at SK1 via C1 and detected in the diode voltage doubler D1,D2. Decoupling is provided by C2 and the rectified voltage clamped at this point by ZD2. The hang-time of the RF VOX is set by C3. To maintain a high input impedance (preventing excessive loading of the detector) the rectified RF sample is fed to a NAND Schmitt trigger IC1a. The output at pin 3 goes low when the input threshold has been reached. The threshold level is to some extent dependant upon the supply voltage, and will increase as V_{DD} is increased. At +9V the RF VOX will require around 0.5W to operate

As some form of buffering is required between IC1a and the relay driver transistor Q1, the remaining gates are used to form an RS flip-flop. The output at pin 10 goes low when RF is present at SK1, turning Q1 off and de-energising RL. Hard-switched changeover can be selected by taking the centre pin of SK1 to pin A for ground on transmit or pin B for +9V - +12V on transmit. When hard switching is selected, RF sensing is not disabled. This provides a built in safety function should a failure occur on the PTT line. Q2 is a DC switch which supplies DC via SK3 to the mast head amplifier. When no RF is present at SK1, Q1c is at 0V and Q2 is switched hard on, giving +12V at SK3. CH1,2 and C8,9 provide isolation between DC supply and signal.

Input from the mast head amplifier at SK3 is fed to the attenuator R1,2,3 via isolating capacitor C10. The values of R1,2,3 given in the component list provide 6 dB attenuation. For different levels of attenuation, see **Table 1**.

ZD1, in conjunction with the input fuse, provides protection

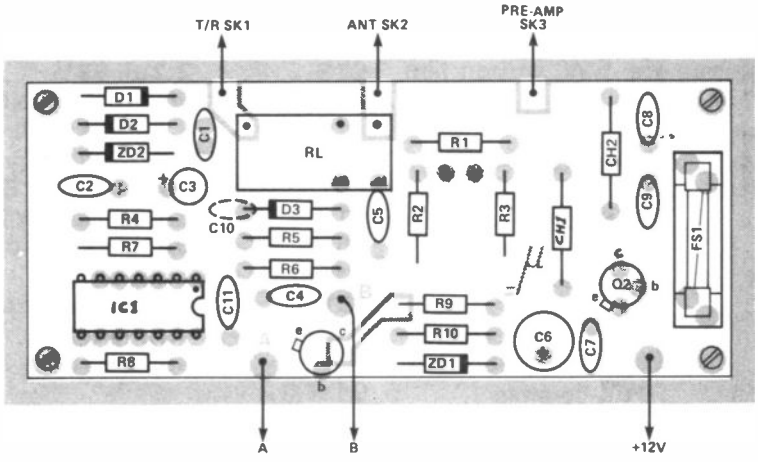


Fig. 8 Overlay diagram for the control suitable for 40W RF

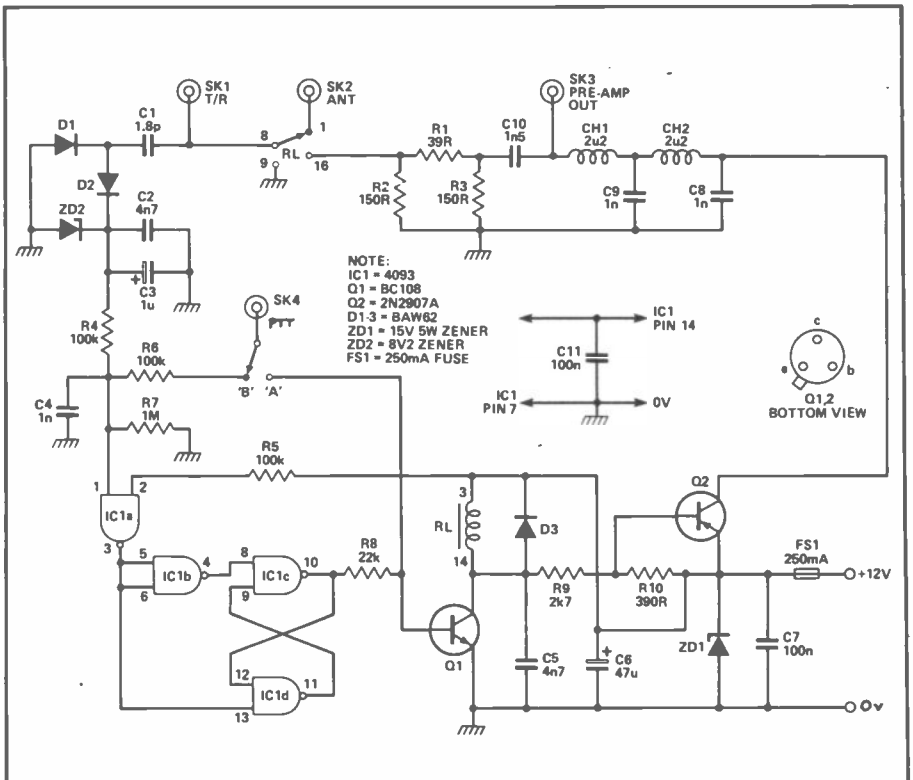
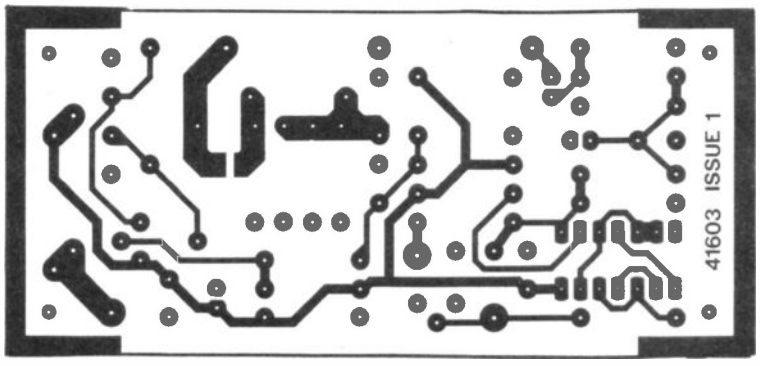
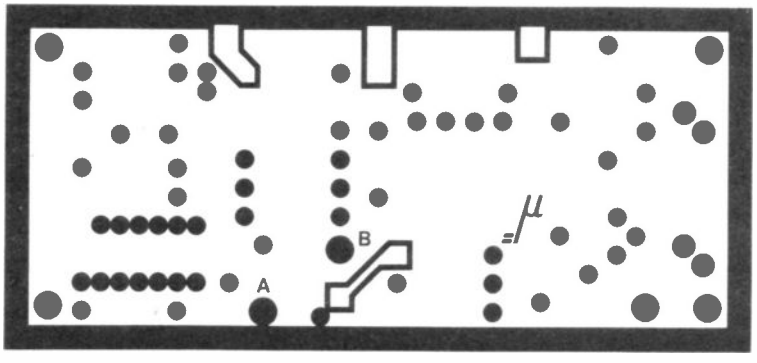


Fig. 9 Circuit of the control unit suitable for 40W



Bottom foil of 40W unit. TRACK areas are shown in BLACK



Top foil of 40W unit. ETCHED areas are shown in BLACK

against excessive or reversed supply voltage.

Construction

The unit is constructed on a double-sided PCB with plated through holes and housed in a small standard diecast box. Construction is very straightforward. All components are mounted on the top (earth plane) side of the board except C10. This is a chip capacitor, and is soldered to the underside of the board across the gap in the 50 ohm strip-line leading to SK3. When fitting the fuse-holder clips, take care to stand them off the earth plane. Component layout is shown in **Fig. 8.** The completed unit is mounted in a 110 × 6 × 28 mm die cast box, by means of 4 × M3 screws. SK2 is fitted to the exact centre of the rear edge of the box, with SK1,3 spaced 20 mm either side. This allows the inners of the BNC sockets to be soldered directly to the pads provided on the PCB. A phono socket is mounted on the front edge of the box for PTT input. 12V DC enters via two PTFE feed through insulators.

John would like to thank John Cooper, G8NGO, for "translations from the Sussex dialect into English".

ATTN db's	R1	R2/3
3	18	292
4	24	220
5	30	178
6	37	150
7	45	130
8	53	116
9	62	105
10	71	96
12	93	83
14	120	75

Table 1 Values of resistance needed for different values of attenuation

Component Listing

Resistors

R1,2,3	See text and Table1
R4,5,6	100K
R7	1M
R8	22K
R9	2K7
R10	390R

All resistors are ¼W carbon film Style TR4

Capacitors

C1	1.8pF ceramic
C2,5	4n7 ceramic monobloc
C3	1uF 35V bead tantalum AM 05-10501
C4,8,9	1n ceramic monobloc
C6	47uF 16V radial electrolytic RS 103-979
C7,11	100n ceramic monobloc (PM)
C10	1n5 chip (RM)

Semiconductors

D1,2	BAW62
D3	BAW62 or 1N4148
ZD1	1N5352B (or any 15V, 3W Zener)
ZD2	8V2, 400mW Zener
Q1	BC108/B238 plastic
Q2	2N2907A
IC1	4093

Miscellaneous

RL	SDS DR12V (PM)
SK1,2,3	BNC single hole fixing (AM 10-01000)
SK4	Phono socket

Fuse holder clips RS 412-784; PCB (PM 41603); Die cast box Eddystone 7134P or RS 509-939 and Feed-through insulators RS 433-882

HAM RADIO TODAY SEPTEMBER 1984

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73's Dave Gadsden, G4NXV Advertisment Manager

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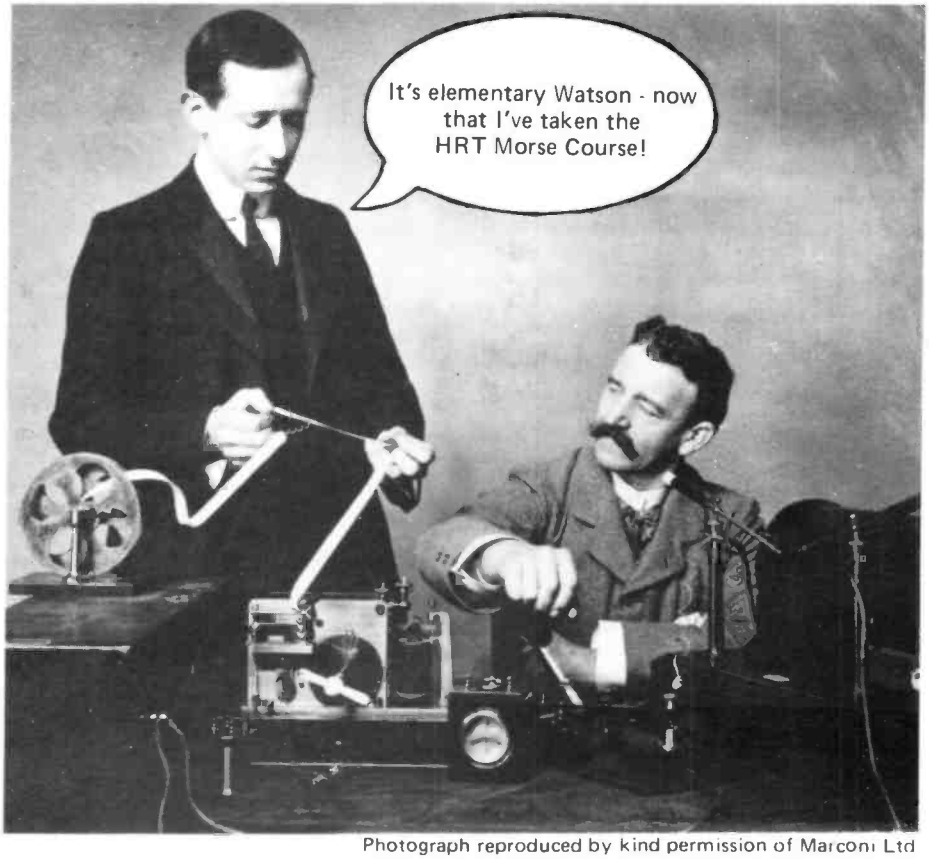

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