The ALPHA
a single band top quality
SSB/CW transceiver
design for HF

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

A Fresh Look at the Yaesu FT200 with G3LLL

VHF CONTESTING – from hardened practitioner, John Ridd, G8BQX.
**PARTNERSHIP MICROSYSTEMS** … Things for the VHF man.

The G3WZT 2m GaAsFET mast head pre-amp.

PCB 41601 £14; S3030 £8.65; BF256A 55p

N-type connector (rear cable entry) £4

Misc. parts; comprising

2 off 100n ceramic monobloc C7, 18
2 off 1n5 chip C9, 11; 2 off 15n chip C10, 12
4 off 5082-2835 D1-4; 36" 18 swg silver plated wire

Copper foil for coil termination and input screen £3.25

Control units

PCB 41602 £9; PCB 41603 £6.50; 100n ceramic monobloc 10p

Relay DR 12V (Good for 50W at 144 MHz) £4

Chip capacitors 1n5 100V or 15n 50V 10 for £1

All the above components are EXACTLY as used by G3WZT to build prototypes.

Complete pre-amp built, tested and aligned £88.25

Logbooks for the VHF man, with VHF countries and countries list — includes space for QTH/WAB locator £2

All prices include VAT. Post & packing 50p per order.

**PARTNERSHIP MICROSYSTEMS LTD, TARDIS HOUSE, COWFOLD, WEST SUSSEX RH13 8DR**

Telephone: 040386 227

---

**FREQUENCY STANDARDS**

E2.75 each

22.000, 38.666, 70.000, 96.000, 116.000, 101.500, 116.000

**ALSO for MULTI U11**

SU12 SU16 SU18

SUB(433.2) SU20 RE10 RB4 RB6 RB10 RB11 RB13 RB14 RB15

For Pye PF1 PF2 PF7a series Wood & Douglas and FDK MULTI U11

70CM CRYSTALS £5.00/pr or £2.50 each

TX 878250

—

**4 METRE CRYSTALS FOR 70.26 IN HCI:VU AT £2.40 Each**

HC25/U 18 MHZ 25 & 20PF

HC25/U 12MHZ 30 & 40PF

HC6/U

CRYSTALS FOR 2 METRES

** repetition

**ALL PRICES ARE EX VAT PLEASE ADD 15%**

Telephone: 013-188 2414 Haanafone; Erith(03224)30830

Telex: 881327 GECOMS-G (Attention QUARTSLAB)
VOLUME TWO NO.9 SEPTEMBER 1984

CONTENTS

REGULAR COLUMNS

LETTERS ........................................... 4
RADIO TODAY ..................................... 6
RADIO TOMORROW ................................. 46

CONSTRUCTION

THE ALPHA TRANSCEIVER .......................... 12
Single band SSB/CW design for HF by G4JST and G3WPO.

CONTROL UNITS FOR THE 2m GaAsFET PRE-AMPLIFIER ...... 49
Here are two designs by G3WZT to complement last month's project

FEATURES

RADIO IN THE RISING SUN .......................... 21
Tom King, VK2ATJ, visits Japan - land of one million 'hams'

A FRESH LOOK AT THE FT200 ........................ 25
G3LLL profiles and offers servicing advice on this old warhorse

BASICODE FOR RADIO AMATEURS ................. 31
If you've got a home computer in the shack read this!

VHF CONTESTING TODAY ............................ 40
Veteran John Ridd, G8BOX, gives a pungent personal guide

REVIEWS

BELCOM LS202E 2m FM/SSB HANDHELD TRANSCEIVER ........... 36
Still hot from the production line. An assessment by G3OSS

NEXT MONTH IN HRT ................................ 11

ADDENDUM .......................................... 24

ADVERTISMENT INDEX ............................... 58

FREE READERS' ADS ............................... 63

Emporium Guide .................................... 59

Classified ......................................... 65

HAM RADIO TODAY SEPTEMBER 1984
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

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...
CWO 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 1kΩ 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, G3 YZW

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, G3 GZT/VS6 CD

ABUSE OF RAYNET

Sir, May we, through your letters section, bring to the attention of your readers 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 be 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 RACOM 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, G4 NFF

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, 36, 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 1961 Wireless Telegraphy Act.

HAM RADIO TODAY SEPTEMBER 1984
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 Studios. 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 suburban. 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, G3 RJV, of QRP fame, "Modern Developments in Electronics" by Chris Bartram, G4 DGU, of Mutek Ltd., and "An EME DXpedition to Andorra" by the HADRABS contest group.

The convention takes place in Caronald 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 RB1. 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 overswinging 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. G4 JST/G3 WPO

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 £180 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 currently negotiated with other UK and overseas dealers.

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 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 Course 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, 5th 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, (G8BXK), the course tutor at the Department of Technology on 0753 492222.

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, G8WBCX, and the course is held in the Williams Building, Hendon College of Further Education, The Burroughs, London NW4 4Bl. 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 (G4 UWU) 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 ILLEA 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, G4 KKN, and David Hunt, G6 MFR. For further information contact David Peace on 01-402 6221 Ex. 54.

Arnold College of Further Education in Mapperley, 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 7 pm and course one 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 entitled '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 786503).

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 rather cheaper 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, G4 WVR, was in operation the first contact was with VU2 AU 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, G4 6TZY, (Market Harborough. 62827) was elected chairman and Dave Lunn, G3 LSL, (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 conferences 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
Roger Frisby, G4 OAA, 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, G4 HCL.

Cirkit Steps Up Business In Toko Components

The renewal today, of an exclusive United Kingdom distribution agreement between Toko Incorporated, 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, G3 RDG, has asked us to convey his apologies to Ian Wade, G3 NRW, and Peter Martinez, G3 PLX, 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.”
The South West's largest amateur stockist
Complete range of Yaesu and Icom equipment available from stock plus
demonstration facilities.
Now official TRIO agents.
Ancillary equipment by Microwave Modules, Datong, Drae, Mutek, BNOS,
Welt, Tokyo Hypower, Hansen, Himound, Shure, LAR, Toyo and Toyoo.
Aerials by Jaybeam, TET, Hygain, G-Whip and Minibeam.
NOW AVAILABLE — FOX AND AZDEN.
Plus connectors, dummy loads, rotators, cable, etc.
ACCESS — Instant Credit—BARCLAYCARD
Open: Mon., Tues., Thurs., Fri. 9.30. Wed. 9.10. Sat. 9.5.

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.
The **ALPHA** Transceiver

Everybody knows about the joys of mobiling on two metres; the ubiquitous black box has added a completely new dimension to our hobby.

**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.**

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...
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 a 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 transistors, 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/ transit 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

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.

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 a 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 transistors, 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/ transit 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 'slug' 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 100 uA 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 cored mechnical drive. The display offers a full LCD frequency 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 amplification 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 (029, BC239)
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).

**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...
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.5 Circuit of ALPHA synthesised VFO**

---

**HAM RADIO TODAY SEPTEMBER 1984**
The latter goes to two epicyclic reduction drives, one at 6:1 and another dual type at 6.86:1, 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.
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 subtropical 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 Air-

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.

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.

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 3,150 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.

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.

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, JM1 RYK, like Mr. Takenobu Kaieda, JH1 HNH, 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 14 MHz 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, JM1 RYK, Deputy Chief, Publicity Section and Takenobu Kaieda, JH1 HNH, 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.

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, JA1 QCQ, 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."
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 IC4a 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 R6 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 apologise 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.

WPO COMMUNICATIONS

ITS UNFORGETTABLE . . . IT'S THE UNIVERSAL MORSE MEMORY

The POWERFUL CW memory add-on offering up to 2 mins of message storage from ANY type of Morse key. Connects between YOUR key and YOUR rig.

ALL THESE FEATURES: works with iambic keys, Vibraplez keys, paddle keys, hand keys, two pieces of Meccano, your key. Variable speed control can upshift 20 wpm CW to more than 200 wpm for meteorscatter. Repeat feature for beacon mode message storage. Handles any Morse speed from 0 to 400 wpm. Ideal for effortless contest working. Retains character of operator. Good Morse in; good Morse out; bad Morse in, bad Morse out. Excellent teaching aid. Inbuilt Side-tone oscillator. Memory retention when off. All this for just £49.50 ready built inc VAT & P&P.

Telephone in for:

OTHER SUPERBLY ENGINEERED PRODUCTS FROM WPO:

Kits — DS880 QRP Transceiver £37.45: DSB2 QRP Transceiver £68: 2 metre FM Transceiver £88 (Rx £39.50, Tx £32.90); VFO Kits — single band HF or Multiband — 2 metre VFO £38.50: Project OMEGA — 10 band Transceiver for the enthusiast constructor: ALPHA — Single band SSB 50W Transceiver, 160 or 20 metres, £199.50 with case etc: HF QRP ATU — £28.52: Commercial enquiries welcome. 24 hour Ansaphone for credit cards. Mostly ex-stock but allow 28 days for delivery. Short catalogue 16p stamp — Full 50p stamps.
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 plate. 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-
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. 1 Block diagram of the Yaesu FT200](image)

Fig. 2 'Pre-mixer' system used in the FT200. The diagram shows the transceiver tuned to the 16m band.
SOMMERKAMP FT-250 TRANSCEIVER - £160.0.0.

The original advertisement for the FT200 which neatly summarises the main advantages of the transceiver.

SOMMERKAMP FT-250 TRANSCEIVER

Original advertisement for the FT200 which neatly summarises the main advantages of the transceiver.
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 3.8 MHz 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 originally a pair of 6JS6A valves; these being replaced in later production by the slightly higher rated 6JS6C. These valves, which preferably should 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 50 mA, whereas, with the latter, setting the bias for 60 mA 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.

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 –50 Volts 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 +300 volt 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 will definitely result in a shortage of 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 check 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.

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 asymmetrical 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.
SAVE £4.25 by receiving a FREE magazine binder when you subscribe to.............

It's true, by subscribing to Ham Radio Today you will not only receive your personal copy direct to your door for a whole year but also have a superb magazine binder in which to keep your copies AND IT'S FREE!

All you have to do to receive your FREE binder is book a new subscription or renew an existing subscription to Ham Radio Today.

What could be simpler? Normally priced at £4.25, these attractive binders will hold approximately 12 issues of Ham Radio Today.

Not for you any longer the chore of having to track down dogeared copies of your favourite magazine, instead you will merely go to your bookshelf and they will be waiting for you in pristine condition.

Don't miss out on this outstanding offer — subscribe today and receive your FREE binder within 14 days of your order being received.

SPECIAL OFFER

SUBSCRIPTION ORDER FORM
Cut out and send to:
HAM RADIO TODAY,
INFONET LTD,
TIMES HOUSE,
179 THE MARLOWES,
HEMEL HEMPSTEAD,
HERTS HP1 1BB

Please send my free binder and commence my personal subscription to HAM RADIO TODAY with the

SUBSCRIPTION RATES
£14.00 for 12 issues
£14.45 for 12 issues
£27.00 for 12 issues

(Overseas Surface) (Overseas Air Mail)

Please use BLOCK CAPITALS and include post codes.

NAME (Mr/Mrs/Miss) ..................................................
ADDRESS ..........................................................
POSTCODE ..................................................

Signature ..........................................................

Date ..........................................................

HAM RADIO TODAY SEPTEMBER 1984
HAM RADIO TODAY SEPTEMBER 1984

BASICODE for Radio Amateurs

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 drawback 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 straight away, unless it happened to be of the same type. The use of BASICODE has overcome this problem and should allow much

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.

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 machinespecific, 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 nocturnal 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 auspicious 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 Herman 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 its 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-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 Herman 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 BASIC to, 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 repertoire 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 sub-routines, 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 programme' (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 & II E
- 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 effectively 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 call signs 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 program'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!
FREE FINANCE - 2 YEAR GUARANTEE

BRANCHES AT: SOUTHAMPTON, LEEDS, CHESTERFIELD,

**FREE FINANCE**
On many regular priced items SMC offers free finance for invoice balance over £120. 20% down and the balance over 6 months or 50% down and the balance over a year. You pay no more than the cash price. Details of eligible items available on request.

**GUARANTEE**
Imported warranty on Yaesu MUSEN products. All staffed and equipped Service Department. Daily contact with the Yaesu MUSEN factory. Tens of thousands of spares and test equipment. Twenty-five years of professional experience.

**FREE FINANCE**
On many regular priced items SMC offers free finance for invoice balance over £120. 20% down and the balance over 6 months or 50% down and the balance over a year. You pay no more than the cash price. Details of eligible items available on request.

**GUARANTEE**
Imported warranty on Yaesu MUSEN products. All staffed and equipped Service Department. Daily contact with the Yaesu MUSEN factory. Tens of thousands of spares and test equipment. Twenty-five years of professional experience.

**FREE FINANCE**
On many regular priced items SMC offers free finance for invoice balance over £120. 20% down and the balance over 6 months or 50% down and the balance over a year. You pay no more than the cash price. Details of eligible items available on request.

**GUARANTEE**
Imported warranty on Yaesu MUSEN products. All staffed and equipped Service Department. Daily contact with the Yaesu MUSEN factory. Tens of thousands of spares and test equipment. Twenty-five years of professional experience.

**FREE FINANCE**
On many regular priced items SMC offers free finance for invoice balance over £120. 20% down and the balance over 6 months or 50% down and the balance over a year. You pay no more than the cash price. Details of eligible items available on request.

**GUARANTEE**
Imported warranty on Yaesu MUSEN products. All staffed and equipped Service Department. Daily contact with the Yaesu MUSEN factory. Tens of thousands of spares and test equipment. Twenty-five years of professional experience.
Communications Ltd.
MAIN DISTRIBUTOR FACTORY BACKED
BUCKLEY, STOKE, GRIMSBY, JERSEY, EDINBURGH.

'YAESU' FOR H.F. EQUIPMENT — ’SMC’ AT YOUR SERVICE

**FT-ONE ‘ULTIMATE’ TRANSCIEVER**

- FT ONE Transceiver HF All Mode £1569.00
- KEY101 Curtis Keyer £28.50
- DCT1 DC Power Cable £10.85
- RAM1 Non volatile Memory £14.49
- FMUT1 FM unit £44.99
- XF8.9K Filter 300Hz or 600Hz or 6KHz each £19.35

**FT77 THE IDEAL MOBILE**

- TST980 £1479.00
- D41004 Interconnect lead FT980-FC757AT £24.50
- XF8.9HC £29.50
- XF455.8HC £44.99
- FP757HD £179.00
- FFM77 £105.05

**FT102 THE “WORKHORSE” BASE**

- FT102S Transceiver 9 band £719.00
- SPI102 External speaker £35.00
- FC102 Antenna coupler £185.00
- AM/FMUT102 AM/FM unit option £49.00

**FT757GX THE BIGGEST SELLER**

- TST980 £1919.00
- FP757GX £245.00
- FMM77 £105.05
- FFM77 £105.05
- FFM102 £249.00
- FFM77 £105.05
- FFM77 £105.05

**FT980 “COMPUTER COMPATIBLE”**

- FT980 Transceiver General Coverage £1329.00
- BP980 External speaker with audio filter £61.55
- XF455.8MCN 300Hz CW filter (455KHz 8 pole) £49.00
- XF8.9HC 600Hz CW filter £29.50
- XF8.9GA 6 KHz AM filter £29.50
- FFM** Computer interface (see FT757GX units) £26.99
- DF41004 Interconnect lead FT980-FC757AT £26.99
- TST980 Technical Supplement FT980 £9.50

**FRG7700 COMMUNICATIONS RX**

- FRG7700 Receiver 0.15-30MHz AM/CW/SSB/PAM £386.00
- FRG7700M Receiver c/w 12 channel memory £445.00
- MEM77 Memory option £75.00
- FMR7700 Antenna tuner/switch £64.28
- FRM7700 Active antenna £43.95
- FFR7700 Low pass filter 600KHz £11.25
- FRV7700 VHF Converters, 6 models, From £84.50-£94.25 each

LEEDS
SMC (Leeds) 257 Gile Road Leeds 14, Yorkshire
Leeds(0532) 732328 9.5am Mon-Sat

CHESTERFIELD
SMC (Chesterfield) 102 High Street Chesterfield Derbyshire (0463) 453340
9.5am Mon-Sat

BUCKLEY
SMC (Wrexham) 76 High Street Buckley, Clwyd (0244) 454953
9.5am Mon-Sat

STOKE
SMC (Stoke) 50 High Street Stoke on Trent, Staffs (0785) 23583
9.5am Mon-Sat

GRIMSBY
SMC (Grimsby) 247 Freeman Street Grimsby, Lincs (0472) 56388
9.30am-5.30pm Mon-Sat

EDINBURGH
SMC (Edinburgh) 23 Morton Street Edinburgh EH1 2HN
9.5am Mon-Sat

HEAD OFFICE | S.M. HOUSE, RUMBRIDGE STREET, TOTTON, SOUTHAMPTON, SO4 4DP, ENGLAND, & MAIL ORDER Tel: (+44) (0703) 867333, Telex: 477351SMCOMM G, Telegram: “Aerial” Southampton
Belcom LS202E
2m FM/SSB Handheld - a realistic proposition?

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 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.

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

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 x 62 x 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 connecting the charging adaptor. Underneath the rig are holes for locating and interfacing wheels select MHz, hundreds of kHz and tens of kHz. 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 only light pressure to engage it.

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

Top panel of the LS02E

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 deader 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 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 yo-yo 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 spurious, 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 Telecom's Act requirements. To end this section on a high note, the transmitted frequency accuracy was phenomenally 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 a control 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 me 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 output with less distortion, thus rectifying one of Angus’s main criticisms. Try one if you are interested and see what you think. G3ZZD
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 (Hmmm — 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 ability 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 2m 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 pre-amplifiers 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 spuri 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 spuri 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 spuri 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 kilioquid 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,
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 refueling — with space for the signature of the person who refills. Re-priming a diesel can be a swine!

A little tip to assist refueling. 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 reconnaissance 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 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 liability 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
"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 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 reconnaissance 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 important 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 capability 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???
Your at-a-glance guide to what's happening around the clubs, on the air and in general radio-wise.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
</table>
| 1 Aug | Wirral DARC: D & W  
S. Bristol ARC: Lecture — ring PRO for details  
Wirral ARS: ring PRO for details  
Lincoln SWC: RAE  
Stockton DARC: 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 DARC: Mobile Suppression  
Medway ARTS: Satellite Working by G8XLH  
S. Manchester RC: 160m DF Contest  
Harrow RS: G2 UV 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 |
Leighton Linslade RC: ring PRO  
Braintree DARS: 'Live' Operating Evening |
| 7 Aug | Southdown ARS: ring PRO  
Stowmarket ARS: Metrewave Awards by Jack Hum, G5UM  
Thornton Cleveleys ARS: Switch Mode PSUs by G4KPY  
Wakefield DRS now meet at the Otsett Community Centre, Prospect Road, Ossett at 8 pm  
S. Lakeland ARS: 2m Foxhunt  
Chichester DARC: ring PRO  
S. Bristol ARC: Pocket Phone Rally with G4 SDR  
Farnborough DRS: to be arranged  
Lincoln SWC: On-air  
Stockton DARS: ring PRO  
Nene Valley RC: Solar Data by G8AFN  
Cheshunt DARS: Natter Nite  
Southgate ARC: Demonstration of Equipment and Social Evening  
Stowmarket ARS: 2nd DF Hunt  
S. Manchester RC: ORO Miscellany by G2HW  
Harrow RS: Informal and Practical  
Wirral DARC: DF Hunt  
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 G3ZRP  
Mid-Warwickshire ARS: Town and Country Festival Planning  
Bury RS: Fox Hunt |
15 Aug  
Basingstoke RS: Contact G4OAC for details
Wirral DARC: D & W
S. Bristol ARC: VHF CW Night with G4OQP
Wirral ARS: ring PRO
Lincoln SWC: RAE/Hamfest meeting
Stockton DARS: ring PRO
Nene Valley RC: SSV - in Colour and B/W by G4ENO
Cheshtum DARS: Equipment Evening

16 Aug  
S. Lakeland ARS: ring PRO
Chichester DARC: ring PRO
Medway ARTS: Demonstration of Satellite Working by G8XH
S. Manchester RC: to be arranged
Harrow RS: Informal and Practical
Haverhill DARS: Interference
Dunstable Downs RC: DF Hunt on 160 and 2m

17 Aug  
Wirral DARC: Junk Sale
S. Lincoln SWC: Debate on "CW is a dying art?"
Glenrothes DARC: Forward Planning Discussion
RSGB 1296 MHz Contest
RAIBC/FRARS Hamfest at Flight Refuelling Avenue, Bexley Heath, Kent DA7 4 LF

18 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: Aerial Circus with G6CJ (video)
East Kent ARS regret that their mobile rally is cancelled. All booking fees will be refunded.

19 Aug  
Glenrothes DARC: Forward Planning Discussion
RSGB 1296 MHz Contest
RAIBC/FRARS Hamfest at Flight Refuelling Avenue, Bexley Heath, Kent DA7 4 LF

20 Aug  
Braintree DARS: Computers and Amateur Radio by G8NPF and G6CHJ
Thornton Cleveleys ARS: AGM
Wirral DARC: Junk Sale
S. Bristol ARC: End of Club VHF Contest
Farnborough RS: to be arranged
Lincoln SWC: Hombrewing with G8ZCD
Stockton DARS: ring PRO
Nene Valley RC: Natter Nite
Cheshtum DARS: Natter Nite

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: Aerial Circus with G6CJ (video)
East Kent ARS regret that their mobile rally is cancelled. All booking fees will be refunded.

22 Aug  
Braintree DARS: Computers and Amateur Radio by G8NPF and G6CHJ
Thornton Cleveleys ARS: AGM
Wirral DARC: Junk Sale
S. Bristol ARC: End of Club VHF Contest
Farnborough RS: to be arranged
Lincoln SWC: Hombrewing with G8ZCD
Stockton DARS: ring PRO
Nene Valley RC: Natter Nite
Cheshtum DARS: Natter Nite

23 Aug  
Edgeware DARS: SSB FD Briefing
S. Manchester RS: ring PRO

24 Aug  
Harrow RS: Informal and Practical

25 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 Bingo and Buy. Rally starts at 1100. Talk-in S22 and 70 cm. Info Q3DWO 0772 53810
British Amateur Teleprinter Group Rally at Sandown Park Racecourse, Esher, Surrey.

26 Aug  
Southgate ARC: Trent Park DF Hunt and Social Extravaganza.
Mid-Warwickshire ARS: HF on-air night
Wirral DARC: D & W
S. Bristol ARC: QRO Activity Night
Lincoln SWC: RAE
Stockton DARS: ring PRO
Nene Valley RC: The Six Metre Band by G4BAO
Cheshtum DARC: 2m Portable on Baas Hill
Common 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
RSGB 144 MHz Trophy and SWL Contest
RSGB SSB Field Day
Stourbridge ARS: “Your Construction Project” (a forum)
Leighton Linslade RC: AGM
BraineArt 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
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
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 DARS: ring PRO
Nene Valley RC: Natter Nite
Cheshtum DARC: Natter Nite
Hornum ARS: Junk Sale
World Association of Christian Radio Amateurs and Listeners Conference Weekend at the London Bible College, Northwood. Info G3AGX 0842 822276
Axe Vale ARS: The RSGB by G3XC
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 4 LF
Wirral DARC: 5th and Final DF Hunt. Salford 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 (Ansell’s Bitter) Info G8DIR 0743 642273
Chichester DARC: G2NM Commemorative Station at Chalk Pits Radio Museum. Exeter ARS: to be arranged.
Milton Keynes DARS: ring PRO
Thornton Cleveleys ARS: Morse Class
Mid-Warwickshire ARS: Metal Bashing
Bury RS: Video Vs Photography by G4OAC
Farham DARC: On-air matters night
Wirral DARC: Equipment demonstration by
Lowe Electronics
Farnborough DRS: Pre-AGM discussion
S. Bristol ARC: VHFAUHF 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
Blight 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
Lincoln Hamfest. Trade Stands, Bring and Buy, fairground attractions and model aircraft display. Food, picnic area, parking and Talk-in. Located at Lincolnshire Showground (4 m N of Lincoln A15)
Dunstable Downs Car Boot Sale at The Shuttleworth Collection, Old Warden.
Thornton Cleveleys ARS: Club Project and Construction Evening.
Mid-Warwickshire ARS: Junk Sale
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 G3 PSP as MC
Haverhill DARS: HF Operating Procedures
Dunstable Downs RC: Colour Offset Printing by G4 WYO
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
R. Woodberry
01 594 4009
Upottery 468
Barking RES
Alan Moore
0304 822738
Bryan Tydesley
0282 24254
Cheshunt DARC
Roger Frisby
0992 464975
G4OAA
C. Bryan
0243 789587
Edgeware DARS
David Wilcock
0954 50597
Wirral DARC: on-air/natter night
Dunstable Downs RC
Phill Morris
0392 68065
Thornton Cleveleys ARS: Club Project and Construction Evening.
Exeter ARS
Roger Tipper
0227 68913
Mid -Warwickshire ARS: Junk Sale
East Kent RS
Stuart Alexander
30 64342
Worthing DARC

Chichester DARC: ring PRO

Stockton DARG: ring PRO
Chesunt DARC: Natter Nite
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 coaxial 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 \( T = \text{approx.} \ 0.5 \ C3 \times R4 \). 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-
applied to the masthead pre-ampl, 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 the 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 VBE 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 line must 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 cir-
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 x 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 coax socket (SK2). The ‘POWER ON’ LED should be illuminated. Monitor
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 signals have disappeared.

**Component Listing**

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>R6</td>
<td>12K</td>
</tr>
<tr>
<td>R7, 12, 23, 24</td>
<td>1K0</td>
</tr>
<tr>
<td>R8</td>
<td>47R</td>
</tr>
<tr>
<td>R10</td>
<td>22K</td>
</tr>
<tr>
<td>R14, 25</td>
<td>1K2</td>
</tr>
<tr>
<td>R15</td>
<td>1K1</td>
</tr>
<tr>
<td>R16</td>
<td>2K7</td>
</tr>
<tr>
<td>R17</td>
<td>270R</td>
</tr>
<tr>
<td>R18</td>
<td>3K9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>10K</td>
</tr>
<tr>
<td>R2, 20</td>
<td>2K2</td>
</tr>
<tr>
<td>R3</td>
<td>56K</td>
</tr>
<tr>
<td>R4, 11</td>
<td>220K</td>
</tr>
<tr>
<td>R5, 9, 13</td>
<td>27K</td>
</tr>
</tbody>
</table>

**Fig. 5 Overlay diagram for the control unit suitable for 350W**
Top foil of 350W control unit. WILL CONSTRUCTORS PLEASE NOTE THAT ETCHED AREAS ARE SHOWN IN BLACK

Bottom foil of 350W control unit. In this, the TRACK areas are shown in BLACK!
### Capacitors
- **C1,2,4,5:** 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)

### Semiconductors
- **ZD1:** 3V3 400mW Zener
- **D1-5:** BAW62 or 1N4148
- **D6-8:** BA379 PIN diode
- **D10-13:** 1N4001
- **Q1,2,3,5.6:** MPSA06 or BC108 plastic (AM)
- **Q4:** BD236 or BD238
- **IC1,2:** 4001B
- **IC3:** 4098B

### Miscellaneous
- **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 disabl-ed. 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.
Top foil of 40W unit. ETCHED areas are shown in BLACK

### Table 1

<table>
<thead>
<tr>
<th>ATTN db’s</th>
<th>R1</th>
<th>R2/3</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>18</td>
<td>292</td>
</tr>
<tr>
<td>4</td>
<td>24</td>
<td>220</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
<td>178</td>
</tr>
<tr>
<td>6</td>
<td>37</td>
<td>150</td>
</tr>
<tr>
<td>7</td>
<td>45</td>
<td>130</td>
</tr>
<tr>
<td>8</td>
<td>53</td>
<td>116</td>
</tr>
<tr>
<td>9</td>
<td>62</td>
<td>105</td>
</tr>
<tr>
<td>10</td>
<td>71</td>
<td>96</td>
</tr>
<tr>
<td>12</td>
<td>93</td>
<td>83</td>
</tr>
<tr>
<td>14</td>
<td>120</td>
<td>75</td>
</tr>
</tbody>
</table>

**Resistors**

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

All resistors are 1/4W carbon film

**Capacitors**

- C1: 1.8pF ceramic monobloc
- 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)

**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 Eddy-stone 7134P or RS 509-939 and Feed-through insulators RS 433-882

---

**ATTN db’s**

- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 12
- 14

**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 x 6 x 28 mm die cast box, by means of 4 x 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".

**John Cooper**, **G8NGO**, for “translations from the Sussex dialect into English”.

---

**John Cooper**, **G8NGO**, for “translations from the Sussex dialect into English”.

---

**John Cooper**, **G8NGO**, for “translations from the Sussex dialect into English”.
The Key Element
SSB clarity starts at the microphone...

Heil Sound, the company that pioneered proper audio equalization techniques for major performing groups and communicators, invites you to be part of one of the biggest advancements in Single Sideband transmission since the "Donald Duck" vs. Alf days. If you are not satisfied with the "sound of your station" — it’s no wonder — most "communications" microphones used today were designed for "public address" use, not for sophisticated SSB techniques.

No one microphone can be all things to Mama, so this new 300 kHz Hall's filter element was developed only for maximum clarity on SSB transmissions. The response of this tiny ceramic element rolls off sharply under 350 Hz, and above 3100 Hz with a peak at 2400 Hz for high articulation in the speech range. Hams who care about maximum results in getting over, around and through DX pile-ups now have another weapon in their arsenal.

The Key Element! You can easily install this small, advanced HC-3 element, with its broad-range impedance-matching characteristics, into virtually any microphone case you own, or purchase the custom HM-5 with HC-3 installed.

All prices include VAT and carriage. Contact our Sole European Distributor, Amcomm Services Ltd, 194 Northolt Road, South Harrow, Middlesex, to order the 11C-3 element at £79.95, the HM-5 at £99.95 or the BC-200 at £45.95.

For further information or to order the 11C-3 element at £79.95 or the HM-5 at £99.95 or the BC-200 at £45.95 contact our Sole European Distributor, Amcomm Services Ltd, 194 Northolt Road, South Harrow, Middlesex, Telephone 01-422 9158.

Hearing is Believing...
URGENTLY WANTED by 16 year old G6, a TA1062AP and 5530 above items needed to join Raynet.

WANTED by 16 year old G6, a TA1062AP and wanted manual or any info for equivalents 7 H7 W143 W148 weekends will haggle.

evenings after 8.00p.m. and phone John 0744 819453 also software and wise and exmon roms. plus 812966 anytime.

Om -10 SLR Camera 50mm Brentwood 810831.

JAYBEAM GC £9. G4NRG 10-80m VGC £18. 4M 4ELE VGC £89.

watt 5530 above items needed to Rx 144.800 CRYSTALS Tx and urgently wanted by 16.4.30p.m.

or write 214 Horninglow Road and active ANT if possible call Southamton. SO2 1 LS.

EL91, QQV03/10 QQV02 /6 5763, Tel: 0604 47409.

GRUNDIG SATELITE professional 3400 £140. Freeman YG4RH QTHR also MBM 28 70cms Huddersfield 643124 G4 GMT working order £90 ono. Tel. 0302 770716.

3 mtr FM Transceiver C8900 very small neat and compact measuring only 5 1/2" x7" x 1" approx. and inconspicous in the few transverters available. YAESU FT980 General broadcast transceiver as new used few times only £900.00 phone daytime 01592 7800 evening 0277 823434.

SHIMIZU SS105S HF all mode transceiver absolutely as new condition. Fitted FM boards and CW filter £275 might also sell matching state of the Art Homebrew Transverter, 16W output, £60. G4ILO. Colchester 572685.

MICROWAVE MODULES MM4001 KB RTTY ASCII transceiver and keyboard perfect condition £200 Fincher 27 Albert Street Tring Herts HP23 6AX Tel: Tring 6752 also DATONG mobile doppler radio direction finding equipment £100 ono.

80cm through 70cms station. TS130V transceiver, MTT144.28, MTT432/28, VFO120. DF230. YK885N. R.F. switching module and interconnecting cables. Demonstration available. Prefer not to split. £170 ovnomarriage at cost can deliver locally. Graeme G6CSY, QTHR, Orpington (0689)29230 evenings.

RADIO CONTROL have two "PUPPETEER". A.M. transmitters fixed or at cost G4NZX 0302 719163.

As reported in this month’s Radio Today, Cirkit have recently made a new deal with Toko Ltd, the worlds largest supplier of coils and chokes, which should improve the availability of these sometimes hard-to-get components. Richard Sanders, General Manager of Toko UK is pictured here (LHS) with Cirkit’s Mike Sandham and Richard Bulgin.

HAM RADIO TODAY SEPTEMBER 1984
HEATHKIT SOFTWARE receiver SW717 and general coverage phones and ???? good order £20, Galpin, 23 Upper Highway, Hunton Bridge, Kings Langley, Herts.


KENWOOD WANTED DG5 digital display for TS 520 SW, W Salt, 8 Smallways lane, Chilton Polden, Nr Bridgewater, Somerset. Tel: 0278 722402

GENERAL COVERAGE receiver Century 21 complete coverage 0.50kHz to 29.999MHz EXCELLENT condition £70 ono, 13 element crushcraft 2 metre beam 15dB gain £25. Trio 2400 2 metre hand held c/w charger etc. £125, Texas Inst T109 computer £40 ono or would swap for something useful. W.H.Y Tel. Chester (0244) 311496. Wanted HF mobile and trap vertical antennas.

YAESU FT227RB 2m FM Tx/Rx 10 watts m/m bracket £135. Yaesu FT208R handheld 2m FM NC9C charger. Mint boxed £180. Trio 7010 2m SSB/CW Tx/Rx mic etc., vgc boxed £95. Yaesu YP150Z dummyload wattmeter mint £70. Telephone Weymouth 786930.

MM2 MORSEMATIC keyer by Advanced Electronic Applications as advertised by ICS swap for TR701 or similar or WHY. 3 hrs use mint condition might accept computer, ring 049525 67949 ask for Carl.

ROTEL RVC 240 Citizens band radio, mint condition and original packaging. Also regulated power supply, SWR meter 3 aerials, 2 ground planes, 50ul coax, patch leads, car boot mount. Lot £65. Phone Mark, Sheffield 377504 evenings.

ZENITH RO70 £350 mint, exchange 35mm Nikon camera, video recorder, WHY Chas Hayes, 01 850 1543

ZX81, 15K, excellent external keyboard. ICS cassette course with 2 manuals, software, books £69 ono prefer buyer collects, postage extra, Tel: 0253 45431. Wanted rotator in excellent condition to turn 2m beam, Martin Kay 107 St.

The Thames Valley ARTS operated in NFD from a "luxury caravan" (I) parked in the lush meadow of G30GP's farm.

Martins Road, Blackpool, Lancs FY4 2D2

YAESU FRG7 general coverage receiver, one owner, in first class condition, manual, original packing. Can demonstrate. £125 ono. Buyer collects, N. Richardson, 2 Edna Road, Ringlestone, Maidstone, Kent ME14 2QJ

70CM TRANSVERTER MMT 432/144R 10W output. Attenuators for 10W or 3W 2 metre rig. 1.6MHz shift £110. Realistic DX201 general coverage communications receiver with internal crystal calibrator, user manual and box £90 ono. Gary Davey (G6TBT) Telephone 01 995 4701 after 6:30 pm

DRESSELL VV200 GaAs, 2m preamp complete with interface vgc only £40 T.E.T. 8 ele quad 2m beam £35 ring Mike 01 504 4134 evenings.

DRAKE SPR4 comm Rx, Datong ANF auto filter. American military service manuals printers perforators BC610. Books from 1919 onwards. Valves components, S.A.E. lists offers Trowell G2HKU Hamlyn, Saxon Avenue, Minster, Sheerness Kent ME12 2RP. Tel: 0795 873100

WANTED DETAILS on converting Pye bantam from AM to FM. Tel. Cliff Manchester 061 740 9830 after 6 pm will pay expenses.

CREED 7B teleprinter plus power supply unit. Excellent condition. Band rate needs adjusting for amateur use. Recently professionally overhauled. Sell for £25 no offers. Buyer collects. Phone Dave on Ramsey (Cambs) 831396

WANTED Midland 7001 400CH owners manual. A Evans, 16 Dove House, Close Fowlmere, Royston, Herts. GSB 7SE

WANTED Yaesu FT650B 6 metre transverter good price paid for clean unit will fetch or pay carriage also SP101 speaker console please write G3XSI QTHR or phone 0742 51417

YAESU FRG7700 (+FM) 0-30MHz digital G.C.R., FFT7700 ATU, FRU7700 VHF converter 118-130MHz, 140-150MHz, 70-80MHz, all new and unused in boxes with manuals etc., (unwanted Christmas gift). Accept £300 the lot. Burgh Heath (07373) 60460

ICOM IC-255E exc cond two VFOs, band scan etc Icom scanning mic boxed and instruction manual 5XY. Yaesu beam western 5 way antenna switch £145 QTHR phone 0268 555645 (Mr Butler). HAM RADIO TODAY SEPTEMBER 1984
304 100 MHz power signal generator £50 buyer collects. G3WZT QTHR tel 0403 710585 (Horsham, Sussex). MIZUHO SB-2X crystallised 144.00-144.600 and 144.800-145.00 excellent condition Nicads £100 ono. Trio 2300 Nicads power leads helical aerial mobile mount good condition £90 ono 144 MHz valve linear 40W output £50 ono. Woods GW8XAN Newtown, Llandwit 201694 after 6.30 pm.

DIGITAL VOLT METER type DM2022S with l.f. amplifier module A1 and R.M.S. detector module B1 by "Digital Measurements Ltd". Good condition price £250.00 also video oscillator signal generator type 65B Marconi price £125.00. Collin Rogers, 64 Armagh Road, Newry, N.Ireland. Phone 67766 anytime.

DYMAR 3 channel portable xtal'd R2 S20 S16.4 battery packs Dymar automatic battery charger NOT fully working as lost interest sell £35 or swap for anything interesting astery charger NOT fully working packs Dymar automatic battery charger "marconi" price £125.00. Collin Rogers, 64 Armagh Road, Newry, N.Ireland. Phone 67766 anytime.

SONY ICF6700W 1.6-30 MHz, med and FM bands just serviced £150 surplus due to purchase TS430S with GC receiver. Has digital readout, dual conversion and is very sensitive. BM Taylor, Hillside, Ebbesborne Wake, Salisbury SP6 5UB. Telephone Broadchalk 396.

TRIO 7010 2M SSB/CW transceiver 144.100 to 14.300 MHz. Complete with microphone and mobile mount £80. G4UZQ QTHR. Telford (0952) 582903.

SOMMERKAMP FT277B amateur radio transceiver. SSB very good condition £330 ono. Hy-gain five element beam aerial £40, base station power mike £20. Thanet (0843) 43700.

SHINWA CP80 dot matrix printer, centronics interface can be used for Yaesu FT290. Dave Crowborough 63910.

HAVE PENTAX ME super (auto) flash, 200mm tele F3.5 lens (1 year old), Halina super 8 movie camera, Gnome slide projector, big screen 122, slide magazine. Wanted FRG 7700 and ATU. (0375) 72689.

GPVS 2M Colinear 6.5dB £17.8 ELE 2m jaybeam vgc £10. Wanted 4m to 2m converter circuits or module. Homebrew OK wanted high gain 2m ant eg. 16 ele tonna or 8.8 jaybeam. Wanted VHF beam rotator. Telephone Jason, Sapcote 2484.

TRIO TS-780 VHF/UHF multimode base station £625.13V 15amp power supply £60, BBC/Electron morse tutor program £6 Creed 78 £5, PCB's for ST5 TU £5. Contact T. Tugwell, 11 The Dell, Stevenage Herts. Tel: 0438 354689.

RCA AR88 communications RX with full manual and spare set new valves £55 ono. Tel 0278 423288.

TRIO R600 general coverage receiver two years old hardly used box £160 plus FRT 7700 ATU £10 plus ultra loop UL 1000 pre-am £10 will separate. I Randall, Manchester 061 320 7080.


YAESU FRG7 general coverage receiver digital readout excellent condition £120. FRT7700 ATU for receivers £30 Mr Jenkins, Sixty-One, Edinburgh St, Swindon, Wilt's SN2 6DE Phone Swindon 725914. ICOM IC2E charger DC1 BP4 CP1 spare BP3 £13.9, Kenwood 2500 case spkr mic £189. Kenwood 2400/12V chargers £110, microwave modules MM2000 RTTY converter £100, wanted FT290 Kenwood AT230 tuner, pse phone 0277 364378 (24 hrs) (Central Essex).


TOTAL SHACK CLEAROUT
Edysted B30X £30 ono plus del. Audioline 40CH FM CB 8 ext sp. Resistance box 1 -1M fully variable £10 ono. 2x 6nf 500VDC TCC capacitors 1 dairy 400nF 400V cap plus dairy 800nF 250V DC all caps 50p ono. Spares for Pye Vanguard radio telephone POA. Tel 0685 74061.

ICOM IC240 2m Tx/Rx complete with mic, mobile mount, two power leads and manual. All in good condition £100 phone G4ANW 0730 61859.

HEATHHILL SOLITARY SSB 3003 receiver 80-10m, matching SB401 Tx with transceiver capability, matching SB610 speaker, HDP-21 microphone, manuals, Professionally built VGC Tx never used on air. £275 ono. Buyer inspects and collects. G6XHR Tel. 07014 55459, QTHR.

YAESU FT221R/ME transceiver £300 ono also IC2E boxed 1 year old £1/2 wave, battery pack ICBP4, DC/DC converter, charger, case, boxes all as new £1140 telephone Alex on Farnborough (Hants) 520227.

TS120 V HR transceiver 80-10m 20 watt input plus DFC 230 digital VFO £100, memories and scanning mike £115 63DSV Tedburn, St Mary 472 (day) 753 (after 6pm).

CODAR AT5 with power supply £25.20 (new), 15m, 10m, Reycro traps, £25 the set. Collector's surplus Morse keys (over fifty available), list SAE please. Hatfield RF bridge LE300A, £15. G3IRM.2 Brianwood Avenue, Bury St Edmunds, Tel: (0284) 4318 WANTED: RTTY programs for TRS80 Mod 1 Level II. Telephone Hinckley (0455) 612655 evenings. GBAFY QTHR.

YAESU FRG7000 mint condition £220 ono. Trio TS120V £240 no offers buyers collect please, tel. Welwyn Garden City 28831.
Free Readers' ADS!

Buy, sell or exchange your gear through our free service to readers

CONDITIONS

1. These advertisements are offered as a free service to readers who are not engaged in buying or selling the same equipment or services on a commercial basis. Readers who are should contact our advertising department who will be pleased to help.

2. Advertisements will be inserted as and when space becomes available.

3. The insertion of advertisements will be on a first-come, first-served basis, subject to condition (2). As a result, it will not be possible to guarantee the insertion of a particular advertisement into any particular issue of the magazine.

4. Readers should either write out their advertisement in BLOCK CAPITALS or type it, underlining any words that are to appear in bold.

5. The magazine cannot accept any responsibility for printers' errors in the advertisements; however, we will do our best to ensure that legibly written advertisements are reproduced correctly. In the event of a gross error, at the Editor's discretion, a corrected version of the advertisement will be printed (at the advertiser's request) at the earliest issue in which space is available.

6. The magazine or its publishers will not accept responsibility for the contents of the advertisements, and by acceptance of these conditions, the advertiser undertakes to indemnify the publisher against any legal action arising out of the contents of the advertisement.

7. The magazine reserves the right to refuse to accept or to delete sections of advertisements where this is judged necessary.

8. Advertisements are accepted in good faith; however, the publisher cannot be held responsible for any untruths or misrepresentations in the advertisement, nor for the activities of advertisers or respondents.

9. Advertisers must fill in their names, addresses and (if available) telephone number in the space provided, and sign the form to indicate acceptance of these conditions (forms returned without a signature will not be used).

10. All that is to be reproduced in the advertisement should be entered into the space provided on the form printed in the magazine – note that a photocopy is not acceptable. All advertisements must give either a telephone number and/or address for respondents to contact, and this must be included in the wording of the advertisement.

11. Advertisements must be 40 words or less in length (telephone numbers normally count as two words, exchange or exchange code plus number).

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ENTER YOUR ADVERTISEMENT HERE:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I accept the conditions above.

Signature

Send this form to: Free Readers' Ads, Ham Radio Today, 1 Golden Square, London WC2,
Please include my business details in the next available issue of Ham Radio Today
Only £17.50 per insertion, call us for series discounts on 01-437 0699

Business Name: ...........................................
Address: .................................................................
Tel. No: .................................................................
Open Hrs: .................................................................
Contact (Office Use Only): ...........................................

Post to: Emporium Guide, Ham Radio Today,
1 Golden Square, London W1.
HAM RADIO TODAY

Lineage: 35p per word (minimum 15 words)

Seml Display: (minimum 2 cms)

£7.00 per single column centimetre

Ring for information on series bookings/discounts

All advertisements in this section must be prepaid.

Advertisements are accepted subject to the terms printed on the advertisement rate card (available on request)

CLASSIFIED

01-437 0699
EXT 332
Send your requirements to:
Debbie Miller
ASP Ltd.
1 Golden Square,
London W1

SOFTWARE APPLICATIONS

Special prices on surplus equipment

Band RA17 Receivers High grade communications receivers 500kHz-30MHz in 30 effective bands. From £175. Eddystone receiver 730kHz-50kHz-30MHz £5 in 5 bands £1.45. All in excellent condition. Car £15


Avo voltmeters £35 £64. New 80 range digital multimeters £40.25.


Surplus circuits Book containing circuits and notes on many surplus receivers. transceivers etc £15. Send 50p for Illustrated catalogue includes £1 voucher. Over 500 sets in stock.

Avo amateur rigs WANTED for cash.

New shop open at 218 St Albans Road. Come and see the bargains.

WEIRMEAD LIMITED
129, St Albans Road, Watford Herts

Telephone Watford 8466, Access/VISA cards welcome.

CABLES, DEMOS & WIRING OPTIONS

- all supplied ex-stock. return postage charged to special equipment required, built, tested, with instructions.

CT10W 600m range broadcast quality speech pick-up £13.95.

CT10M, prof grade, extra high power, tunable freq 70-120MHz variable microphone sensitivity £19.48.

CT10MB, as above + unique dual microphones to eliminate echoes, noise etc £31.40.

All specialised requirements catered for.

EVEN RADIO STATIONS — plus telephone line recorded device.

Please ensure: 061-905 1040.

S.A.T. ELECTRONICS
154 Washway Rd, Sale, Cheshire M33 1RH

Micro-Transmitters


AERIAL WIRE & ACCESSORIES

Hard drawn copper wire 1.000 14swg.

1.90g. 50 metres £14.90 10 metres 12swg, soft enamelled copper wire £3.50, 50 metres 1.4mm soft enamelled copper wire £6.75, 100 metres 1.4mm 7.45. GW Type Aerials £4.00. Full size £15.95, 4mm Polypropylene Rope 50 metres £2.95, 4mm Nylon Guy Rope 50 metres £3.90, 6mm Nylon Guy Rope 50 metres £5.90. Ceramic Insulators Large 50p, Small 40p. All items postage paid.

S.M. Tatham, 1 Orchard Way, Fontwell, Arundel, West Sussex

AERIALS

HORIZON and LOMA TRANSCEIVERS

Frequency scanner £89.00

10GHz WAVEMETER KIT £9.95

DC POWER SUPPLY £13.95

MICRO-MINI TRANSMITTERS

— all supplied ex-stock. return post paid for special equipment required, built, tested, with instructions.

CT10W 600m range broadcast quality speech pick-up £13.95.

CT10M, prof grade, extra high power, tunable freq 70-120MHz variable microphone sensitivity £19.48.

CT10MB, as above + unique dual microphones to eliminate echoes, noise etc £31.40.

All specialised requirements catered for.

EVEN RADIO STATIONS — plus telephone line recorded device.

Please ensure: 061-905 1040.

S.A.T. ELECTRONICS
154 Washway Rd, Sale, Cheshire M33 1RH

Micro-Transmitters


AERIAL WIRE & ACCESSORIES

Hard drawn copper wire 1.000 14swg.

1.90g. 50 metres £14.90 10 metres 12swg, soft enamelled copper wire £3.50, 50 metres 1.4mm soft enamelled copper wire £6.75, 100 metres 1.4mm 7.45. GW Type Aerials £4.00. Full size £15.95, 4mm Polypropylene Rope 50 metres £2.95, 4mm Nylon Guy Rope 50 metres £3.90, 6mm Nylon Guy Rope 50 metres £5.90. Ceramic Insulators Large 50p, Small 40p. All items postage paid.

S.M. Tatham, 1 Orchard Way, Fontwell, Arundel, West Sussex

SOFTWARE APPLICATIONS

Special prices on surplus equipment

Band RA17 Receivers High grade communications receivers 500kHz-30MHz in 30 effective bands. From £175. Eddystone receiver 730kHz-50kHz-30MHz £5 in 5 bands £1.45. All in excellent condition. Car £15


Avo voltmeters £35 £64. New 80 range digital multimeters £40.25.


Surplus circuits Book containing circuits and notes on many surplus receivers. transceivers etc £15. Send 50p for Illustrated catalogue includes £1 voucher. Over 500 sets in stock.

Avo amateur rigs WANTED for cash.

New shop open at 218 St Albans Road. Come and see the bargains.

WEIRMEAD LIMITED
129, St Albans Road, Watford Herts

Telephone Watford 8466, Access/VISA cards welcome.
COURSES

COURSES - RADIO AMATEURS EXAMINATION  City & Guilds. Pass this important examination and obtain your licence, with any RRC Home Study Course. For details of this and other courses (GCE, professional examination, etc.) write or phone - THE RAPID RESULTS COLLEGE, Dept. JN2, Tuition House, London SW19 4DS. Tel: 01-947 7272 (9am-5pm) or use our 24 hr Recordacall Service: 01-946 1102 quoting Dept. J N2.


SHOPS

S.E.C.

One Stop Electronics announce the opening of their new shop for the sale and servicing of all radio communication equipment.

Components & Kits

V.H.S. Equipment

Rigs and Beams

Decent selection of most popular I.C.'s, components, transistors, etc.

126A Maidstone Road

Rochester, Kent

Tel: (0634) 400179

KITS

934 MHz. Convert your set (RETFEC to 40 chan. at 25 KHz kit with full instructions £15. 934 MHz transceiver circuit diagram also available £1.20. “P.C.49” - 4 Haddington St., Hove, Sussex.

AMATEUR EQUIPMENT

bought, sold, exchanged. Tel: 0402 54 5772; or send S.A.E for current list G3RCQ Electronics, 132 Albany Road, Hornchurch, Essex.

AMATEUR EQUIPMENT

bought, sold, exchanged. Tel: 04024/55733; or send S.A.E for current list. Miranda Avenue, Hornchurch, Essex.

“HALLICRAFTER’’ S.S.B. Transmitter and I.K.W. Linear Amplifier. “Hamurlund HQ170 Communication Receiver, also television test equipment. Ellis 12 Hillside Road, Salford, Cornwall. Tel: 2304.

FOR SALE

934 MHz transceiver circuit diagram also available £1.20.

SWL Report Forms designed for maximum information your listening post give real meaning to your D.X Reports. Details 2 IRC ROUT. 3/137 Champion St., Christchurch, New Zealand.

WANT TO SEE YOUR AD ON THIS PAGE?

JUST PHONE DEBBIE ON 01-437 0699

AND BOOK THIS SPACE

HAM RADIO TODAY

CLASSIFIED ADVERTISEMENT - ORDER FORM

Please advertise nationally in these columns to over 100,000 readers for only 135p per word (minimum charge 15 words). Simply print your message in the coupon and send with your cheque or postal order made payable to Argus Socialist Publications Ltd for:

CLASSIFIED DEPT., HAM RADIO TODAY

1 Golden Square, London W1 R 3AB.

Tel: 01-437 0699

Please indicate classification required.

Name

Address

Tel.No. (Day)

Or Debit my Access/Barclaycard

(Delete as necessary)

HAM RADIO TODAY SEPTEMBER 1984
The most effective route yet to your Class A amateur licence!

Professionally produced for HAM RADIO TODAY by Shirley Hesketh G4HES and Ron Ray G3NCL, this advanced interactive learning system makes use of the stereo cassette format to provide tuition to the 12wpm test standard.

With its carefully designed structure, we think that the HRT MORSE COURSE is more effective than either morse classes or electronic morse generators.

Based on TWO C-60 cassettes, it offers the controlled prompting so necessary for the initial stages of morse tuition, followed by carefully paced test material to bring the student up to speed. Full tuition notes are provided with the cassettes.

To receive your MORSE COURSE simply fill in the coupon below and return it to: 'HRT MORSE COURSE', Argus Press Software, No. 1 Golden Square, London W1R 3AB.

Please send me the 'HRT Morse Course' at £11.45 all inclusive of P & P and VAT.
I enclose cheque/PO for £... (payable to ASP Ltd) OR Debit my Access/Barclaycard (delete as necessary).

Please use BLOCK CAPITALS
Name (Mr/Mrs/Miss) ........................................................................................................
Address .........................................................................................................................
Postcode .......................................................................................................................
Signature ...................................................................................................................... Date

Please allow 21 days for delivery
DEWSBURY ELECTRONICS

GAMMA TWIN

2 METRE FOLDED 1/2 WAVE ANTENNA
Copyright Gamma Aerial Products 1982

This antenna is based on the very popular and successful 'SLIM JIM' design.

The GAMMA TWIN has the following unique features:

* VERY LOW ANGLE OF RADIATION
* ADJUSTABLE RADIATOR (140-150 MHZ)
* COMPLETELY WEATHERPROOF CONNECTING BOX
* VERTICAL FIX DIRECTLY TO MAST

£7.95 inc VAT

Dewsbury Electronics, 176 Lower High Street, Stourbridge, West Midlands.
Telephone: Stourbridge (0384) 390063.
Instant finance available subject to status.
Written details on request.
Closed Monday.

GENERAL COVERAGE RECEIVER KIT
FCR 130

Model FCR 130 Receiver kit
ONLY £75.30 inc VAT. Post & Packing £2.40

* 30:1 Geared analogue tuning
* 3 Band switch with spare position
* Tape record socket
* Headphone socket
* Signal Meter
* Internal speaker + On/Off sw.
* A.F. Gain and Tone Control
* C.W. A.M. SSB.

This is a complete kit which allows you to build and learn as you go.
Suitable for anyone who has an interest in radio and can manage a soldering iron. It really is within the scope of most beginners. You don't have to be a 'semi-professional amateur' to understand how it works as we supply very comprehensive and complete instructions, written in plain language. Well spaced components so it's OK for fat fingers! The receiver tunes, in 3 bands from 1 to 30 Mhz. Solid aluminium tuning and control knobs and base panel. Black anodised front panel.

Commutech (Devon) LTD
Chapel Street, Holsworthy, Devon EX22 6AR Tel: (0409) 253504