Radio Communication

The Journal of the Radio Society of Great Britain

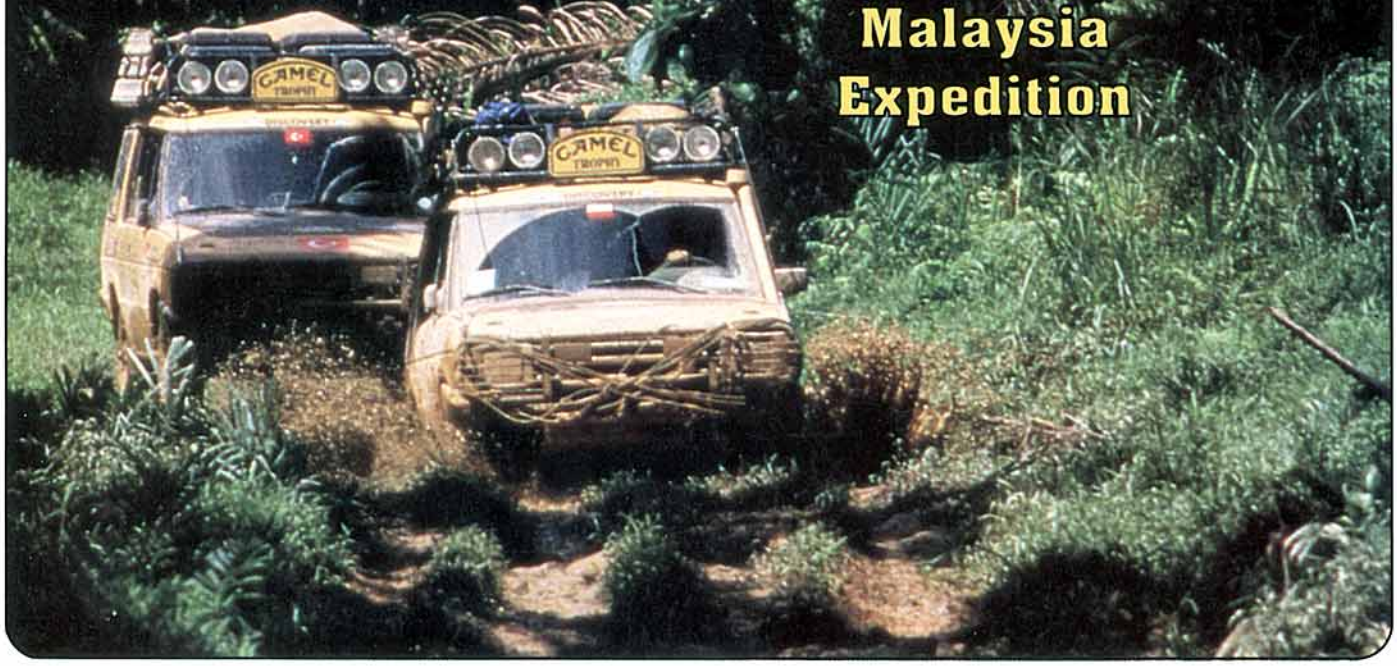
September 1993

Volume 69 No 9

THE VOICE OF AMATEUR RADIO FOR 80 YEARS

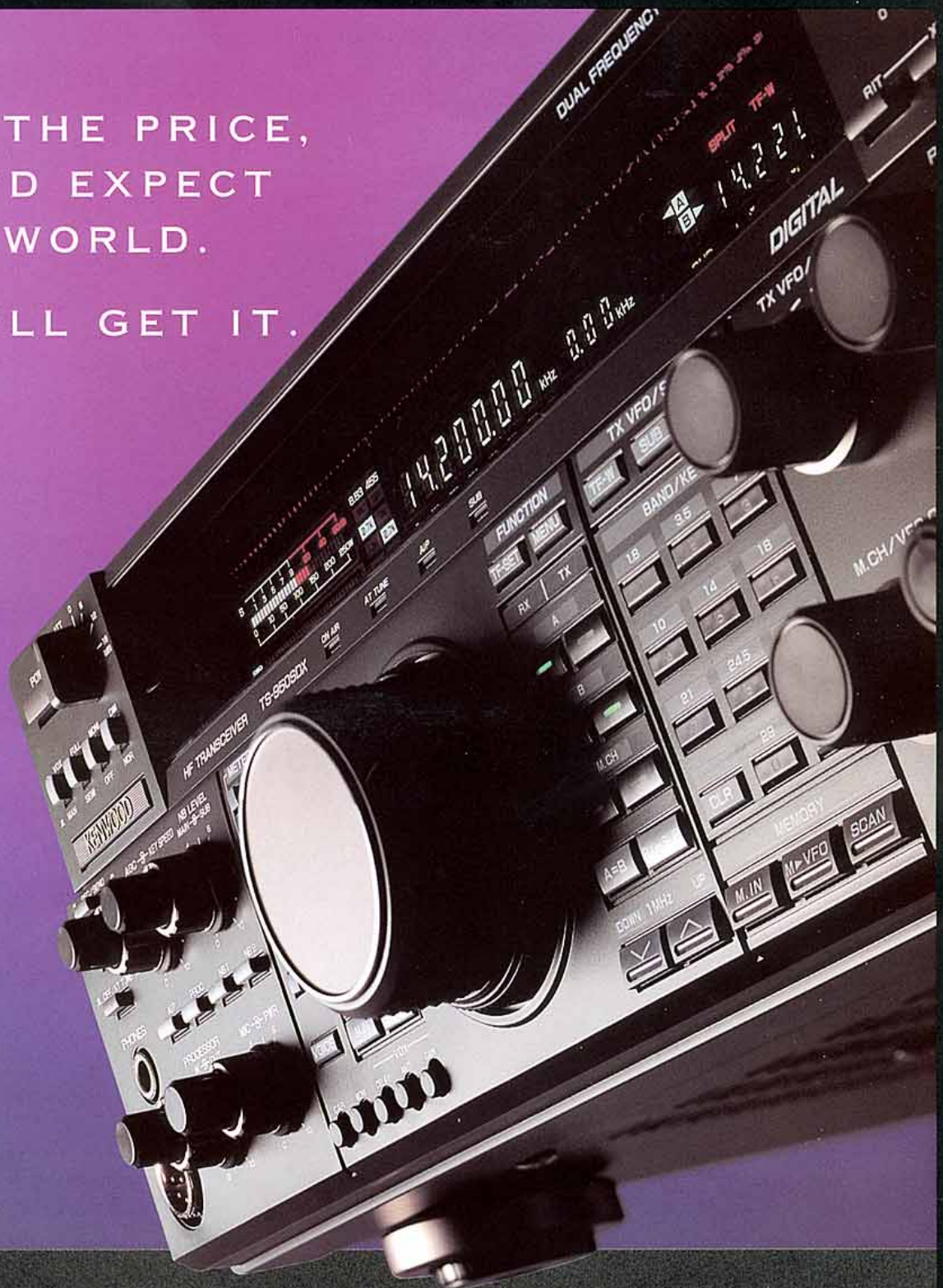
Peter Hart Reviews the IC737

News Feature: Malaysia Expedition



FOR THE PRICE, YOU'D EXPECT THE WORLD.

YOU'LL GET IT.



The TS-950SDX is at the very pinnacle of the Kenwood HF transceiver range. And when you look at its specification, that's not surprising.

It boasts a number of highly advanced features like built-in digital signal processing, 50 Volt MOSFET finals, AIP (advanced intercept point), built-in sub-receiver and built-in automatic antenna tuner. To name but some of its world-leading technical tours-de-force.

Just as important, it's made with Kenwood's traditional attention to detail and reliability, to stand up to a lifetime's use.

The TS-950SDX is part of a range of HF transceivers priced from around £1000 to £3500. And although quality is never cheap, it's still a small price to pay to have the world of radio communications at your command.

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Managing Editor
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Derek Cole

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John Davies, G3KZE

Production Assistant
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Editorial Secretary
Erica Fry

All contributions and correspondence concerning the content of *Radio Communication* should be posted to:

The Editor
Radio Communication
Lambda House, Cranborne Road
Potters Bar, Herts EN6 3JE

Tel: 0707 659015
Fax: (Editorial *only*) 0707 649503
E-mail (Telecom Gold) 87:CQQ083

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Radio Communication

NEWS AND REPORTS

TECHNICAL FEATURES

COVER PICTURE:

The heavily laden 4-wheel drive vehicles winding their way through the jungle of Malaysia.

The Camel Challenge colour feature page 66.

Photograph: Lee Farrant.

Inset: The Icom IC-737.

The Peter Hart Review page 41. A colour feature.

REGULAR ARTICLES

RADIO SOCIETY OF GREAT BRITAIN

THE NATIONAL SOCIETY WHICH REPRESENTS UK RADIO AMATEURS
Founded in 1913 incorporated 1926. Limited by guarantee
Member society of the International Amateur Radio Union

PATRON: HRH PRINCE PHILIP, DUKE OF EDINBURGH, KG

Membership is open to all those with an active interest in radio experimentation and communication as a hobby. Applications for membership should be made to the Membership Services Department from which full details of Society services may also be obtained.

Headquarters and registered office:
Lambda House, Cranborne Road, Potters Bar, Herts EN6 3JE
Telephone: 0707 659015 - Members Hotline and book orders
Fax: 0707 645105. Telex 9312 130923 (RSGB)
Electronic Mail Via Dialcom/Telecom Gold: 87 CQQ083

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Zone F: I J Kyle, GI8AYZ
Zone G: I D Suart, GM4AUP

ANNUAL SUBSCRIPTION RATES
Corporate Members: UK and Overseas (*Radio Communication* sent by surface post): **£32.00.** Airmail rates on request.
UK associate member under 18: £16.00. Family member: £14.00
Corporate (Concessionary): £27.00 over 65 or full time student under 25. (Applications should provide proof of age at last renewal date and/or include evidence of student status.)
Affiliated club or society/registered group (UK): £16.00 (including *Radio Commmunication*). (Subscriptions include VAT where applicable.)

Special arrangements exist for blind and disabled persons. Details are available from RSGB HQ.

Membership application forms are available from RSGB HQ

RSGB Main Switchboard:
0707-659015

Headquarters News

IN THE NOVEMBER 1992 EDITION of *RadCom* I made a statement in the *Leader* column regarding insurance cover for RAYNET groups following the dissolution of the RSGB RAYNET committee on 1 July 1992.

This blanket insurance coverage for all RAYNET groups ceased on the 1 July 1993. Only RAYNET groups affiliated to the RSGB are now covered by the Society's insurance. Independent groups should now make their own insurance arrangements. Copies of the insurance cover for affiliated groups is available from HQ on request.

Direct Debit Success

I AM PLEASED TO REPORT that the introduction of the Direct Debit scheme has been a success. Increasing numbers of members are taking advantage of being able to spread their subscription payments throughout the year. I have done this myself and I would recommend the scheme to any members who have not elected to pay their subscriptions in this manner.

Positive PR Response

I AM ALSO PLEASED TO REPORT a positive response to my invitation in last month's *RadCom* for volunteers with Public Relations experience to come forward with a view to setting up a PR network. To all those members who have written in, thank you. I will be in touch shortly. It is hoped to have the network set up before the end of the year.

To Scotland in September

AND FINALLY, THE SOCIETY will once again be holding an 'Open Forum' at this year's Scottish Convention on Saturday 11 September. The President Peter Chadwick, G3RZP, the President-Elect Ian Suart, GM4AUP, and I will be in attendance to listen to your views and to answer your questions. I look forward to seeing you there.

Peter Kirby, G0TWW
General Manager

NEWS & REPORTS

● WILLENHALL & DISTRICT ARS has an award based on working people in different BT STD code areas (in large cities, only one code may be counted, ie 071 382 and 071 536 count as one, not two). All bands/modes are permitted and logs plus £1 should go to the club at: PO Box 252 Willenhall, West Midlands WV13 3DW.

● A CONSTRUCTION CLUB run by Tim Walford, G3PCJ, entitles members to a quarterly newsletter *Hot Iron* and an instalment plan to defer the cost of some kits. The subscription is £5 and Tim can be contacted at: Upton Bridge Farm, Long Sutton, Langport, Somerset TA10 9NJ.

● GB2VK CELEBRATES the 75th anniversary of the first wireless contact with Australia. It will operate from the site at which this historic event took place.at Caernarfon on 22 September 1918. GB2VK will be on the air throughout the 22nd and the 25th.

● STOLEN from a car in Glasgow in July, a Kenwood TH75A. In addition to the uncommon 'A' suffix, it has some unusual frequencies programmed in: 142 to 152MHz and 420 to 450MHz, as well as non-European repeater shifts. If you come across it call PC Douglas on 041-788 3481.

● THE ITALIAN ITAMSAT satellite is due to be launched in September and will cater for 1200Bd and 9600Bd (RUH compatible) data. Uplink will be 145.875, 900, 925 and 950MHz; downlink 435.867 and 435.822MHz.

● THE CARLISLE *GB2RS* bulletin is on 51.53MHz FM and 144.250MHz SSB simultaneously. Newsreader G4LAA beams North at 0930 and West at 1030 local time.

● FIFE Packet Digipeater GB3FP closed permanently in July. For further details contact the Repeater Keeper GM4JJJ, QTHR.

● 50MHz BEACON GB3IOJ at St Helier, Jersey is off air due to a technical failure. It will be rebuilt before re-commissioning.

Prince William Makes it a Right Royal Tournament for the Air Training Corps

Radio's Tops at the ATC

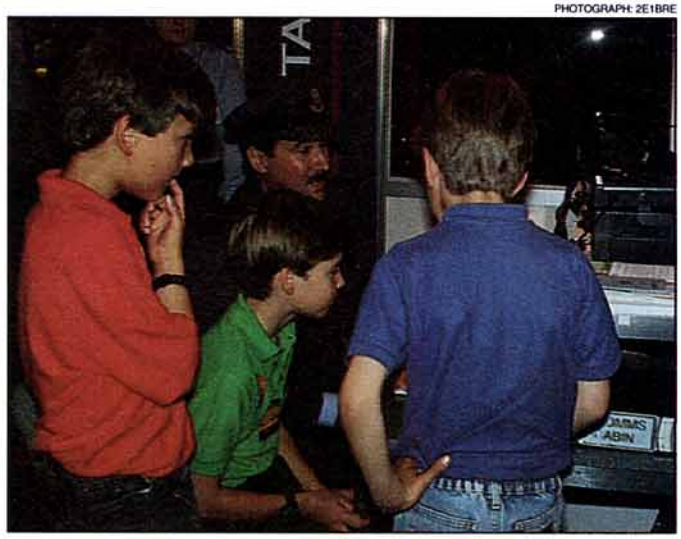
AT THE END of July, the Air Training Corps once again put on a fine stand at the spectacular Royal Tournament, demonstrating their interest in radio communications. The display, part of the RAF exhibit located just outside the main arena, included the ATC's own gear plus several amateur radio stations. On some evenings six HF stations were operational simultaneously

On HF the Cadets used a BCC39 loaned by Racal, together with a Barker Williamson 8 - 30MHz aerial loaned by RF Engineering. An FT-747 was also on loan from SMC. A contact was made with another Air Cadet station at the RAF Show in Edinburgh. Ex-PMR radios provided VHF contacts around London and out to the South Downs. The rigs were mounted on the roof and remotely controlled to avoid the 300ft runs of coax which had hampered operations in previous years.

Amateur Radio Display

CADETS WITH Novice licences and local amateurs provided the amateur radio station in the ATC Comms Cabin. The calls in use were GB2ATC, GB8RT, and for the first time G3ATC. The latter callsign had been passed to the Air Cadets by Mrs Joan Alexander who had agreed that her late husband's call could be transferred. Accepting the callsign at the Tournament was Squadron Leader Tony King who presented Mrs Alexander with a commemorative plaque. The callsign transfer was carried out with the cooperation of the licensing authority. The station comprised HF gear on loan from Lowe Electronics and weather fax gear provided by Compaq computers. Even Ray Degg's, G0JOD, butcher got into the act by providing a moving message screen! Cadets were on hand to talk to the public and to man the flight simulator

PHOTOGRAPH: 2E1BRE



Prince William takes to the air: Watched by the Air Cadet VHF Project Officer, Flying Officer Malcolm Wood, 2E1BFL, HRH Prince William samples VHF radio at the 1993 Royal Tournament.

Prince William

ON THURSDAY 29 July, the cadets and radio amateurs on the ATC stand were honoured by a visit from HRH Prince

CONTINUED ON PAGE SIX

PHOTOGRAPH: G4JKS

Mrs Joan Alexander, formally handed over her late husband's callsign, G3ATC, to the ATC at the Royal Tournament. Accepting the callsign was Squadron Leader Tony King who presented Mrs Alexander with a plaque. On the right is Ray Degg, G0JOD.

RSGB Council Vacancies

THE FOLLOWING RSGB Council vacancies exist for the term 1994 –1996:

Ordinary Members

J D Forward, G3HTA, retires and is eligible and willing to stand for re-election.

Zone members

C N Trotman, GW4YKL (Zone E), retires and is eligible and willing to stand for re-election.
J A Allen, G3DOT (Zone B), retires but is not eligible for re-election (Article 26).
I D Suart, GM4AUP (Zone G) is elected President of the Society for 1994 thereby creating a Zone vacancy.

Full details of how to nominate someone for these vacancies, and of the extent of the Zones, can be found on page 6 of August *RadCom*.

Radio's Tops at the ATC

continued from page five

William who, accompanied by two of his friends, looked at the flight simulator and then sat down to make a radio contact on the ATC's VHF station. Fortunately for us, Tony Rogers, 2E1BRE, from 2473 (Southgate School) Squadron ATC was on hand with a camera.

Novice Scheme

THE RSGB HAS FOR some time been in discussion with the Air Training Corps to find ways in which to help each other. There are many areas of similarity between the ATC's radio operators course and our own Novice licence training scheme, and it is likely that many Air Cadets will be able to become Novice licensees.

RSGB Headquarter's Novice Licence Administrator Sylvia Manco recently attended an ATC radio course to get an idea of what it entailed. She enjoyed herself, made some new friends, and even though she had attended as an observer she was persuaded to take the final exam, and passed.

This has forged even closer links between the Society and the ATC. There are 40,000 Air Cadets invoved with radio; so there is a huge potential for an influx of keen youngsters into amateur radio.

Let's hope this liaison will go from strength to strength.

PHOTOGRAPH: G4JKS

Part of the ATC's Royal Tournament stand. Mrs Joan Alexander inspects the station using her late husband's call, G3ATC, operated by Cadet Sgt Theresa White, 2E1BMH, and Peter Burchett, G0LMG.

Some of the students on the ATC radio course attended by RSGB staff member Sylvia Manco. The instructor (with moustache) was Rick Brand, G0JSR.

RSGB's at LIVE'93

*And There Are Twenty **FREE** Tickets to be Won*

LIVE '93 – the consumer electronics show – is the largest public show to be launched in the UK in the past ten years. It will be held at Olympia from Thursday 16 to Monday 20 of September.

Exhibiting their latest products will be a number of major worldwide companies including Acorn, Amstrad, BT, Canon, Cellnet, Commodore, Hitachi, Linn, Mercury, Pentax, Pioneer, Rotel, Sharp, Sony, Toshiba and Yamaha-Kemble.

The product areas will include games, computers, music and musical instruments, audio, hi-fi, television, video, cable, satellite, photography, camcorders, home communications and working from home.

RSGB Exhibit

AS PART of the home communications exhibition, the RSGB will be demonstrating the fun of amateur radio and the many ways in which the Society can help the potential amateur.

A special event station will operate using the callsign GB0CES.

Free Tickets

TWENTY LUCKY *RadCom* readers can take their whole family to LIVE '93 *absolutely free.* Just send us the label carrier from this month's *RadCom*, or a postcard showing your callsign or RS number, mark it "LIVE '93 tickets" and make up a car-sticker slogan promoting amateur radio (maximum eight words). The first twenty drawn on Monday 6 September will receive free family tickets (see below).

LIVE '93 opens at 9.30 and closes 21.30 (Thu/Fri), 19.30 (Sat/Sun) and 1700 (Mon). Olympia is easily accessible by train to the special Kensington Olympia tube station (closed Sundays) or by bus. Coach parking is available on request. Admission charges are: £7 per person (£5 after 4pm) or £16 for a family of up to two adults and three children. For tickets, phone 071 373 8141.

How about making it a day out for the family and come and see us while you're there. **Further details on page 88.**

HF Contests Committee

New Chairman

Chris Burbanks, G3SJJ (QTHR), has taken over the Chairmanship of the HF Contests Committee from Dave Lawley, G4BUO. We're sure that all contesters will join us in thanking Dave for his hard work over the last three years.

Vacancy

The HF Contests Committee is looking for a new member from amongst the HF contesting community. This volunteer job entails attending meetings in central London about eight times a year plus some adjudication work which is carried out at home. Use of a PC-type computer would be an advantage. In addition to having an interest in contesting, the ideal applicant would be keen to contribute ideas to the strategic planning and the future of contesting.

Repeaters at 29 and 50MHz?

THE SOCIETY'S Repeater Management Group has received applications for 29MHz and 50MHz repeaters. In order to pursue these, it would be helpful if any other prospective applicants would contact the RMG without delay, preferably before the end of August. Applications for documentation should be addressed to the Amateur Radio Dept at RSGB HQ. Applications and requests for information should go to the RMG Special Projects Manager, Dave McQue, G4NJU, QTHR, tel: 0908 378277, or via packet @GB7BEN.

RSGB President at the Palace

PETER CHADWICK, G3RZP, attended a Garden Party at Buckingham Palace on 15 July as President of the RSGB. He was accompanied by his wife Lynne, G4FNC. Also invited to represent the Society were Bert Mair, who many members will remember from his years of employment with the Society, and his wife Margaret who runs the print room at RSGB HQ.

Intruder Watch

CHRIS CUMMINGS, G4BOH, is the new Coordinator of the RSGB Monitoring Service (Intruder Watch). He takes over from David Owen, G0OES, who has had to relinquish the post owing to pressure of work.

Let the Blind Hear

ON 18 AND 19 September the British Wireless for the Blind Fund holds its first National Contact Weekend which aims to raise money by sponsored contacts. Special event station GB0WFB will operate from Chartwell in Kent, the former home of Sir Winston Churchill who made the Fund's first national appeal from there in 1929.

The stations, run by members of the Bredhurst Receiving and Transmitting Society (BRATS), will be QRV on 2m and 70cm as well as 80, 40, 20, 15 and 10 metres.

Value of Radio

THE IDEA for the fund was conceived over sixty years ago when a serviceman blinded in action realised in his hospital bed the true value of radio to someone who cannot see.

Each year more than 14,000 people are registered blind and many of them live on their own. Over half live in households where the weekly income is less than £70 so the cost of even the most basic radio is beyond them. The British Wireless for the Blind Fund receives no Government subsidy and is entirely dependent on voluntary donations.

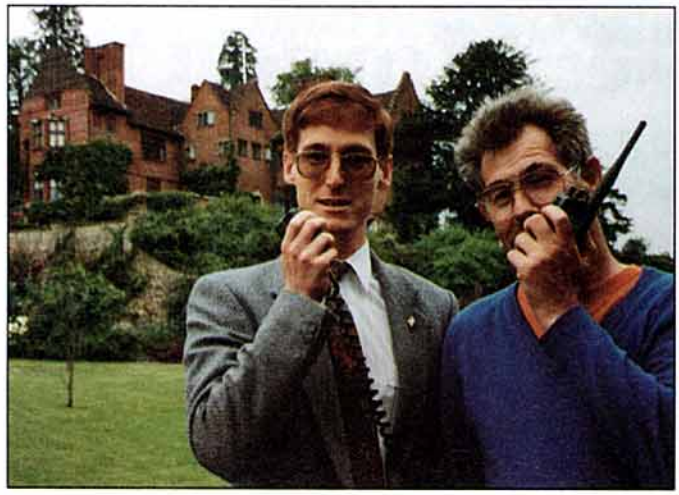
Sponsor Forms

IF YOU would like to help the Fund by making sponsored contacts on packet, RTTY, AMTOR, Phone or CW, sponsorship forms and information are available from: Laurie Philp, G7MEC, The British Wireless for the Blind Fund, Gabriel House, 34 New Road, Chatham, Kent ME4 4QR; tel 0634 832501, fax 0634 817485.

Data Comms Committee

IAN SUART, GM4AUP, has stood down as Chairman of the Data Communications Committee. The new Chairman is: Tom Lilley, G1YAA, Ian remains Council Member for Zone G (Scotland) until the end of the year when he will become the 1994 RSGB President.

There are several vacancies on the DC Committee, including one for a Minutes Secretary. All applications should be sent in writing to G1YAA, QTHR.



Asking you to help the British Wireless for the Blind Fund are BRATS members Ian Buckle, G0MIF (left), and Trevor Cannon, G6YLW, seen at Chartwell. Ian says: "We are delighted to help with such a worthwhile cause. To amateurs radio is a pleasure but to the people this fund helps it is a lifeline and a constant companion".

Copyright

MEMBERS' ATTENTION is drawn to the copyright details shown on page 3 of *RadCom* every month. All material published in *Radio Communication*, including diagrams, software listings and PCB layouts, is subject to copyright and the permission of the RSGB *must* be sought before reproducing any or part of an article. However, IARU recognised *national amateur radio societies* need not obtain permission provided the RSGB is credited as the source.

It is normal practice for *Radio Communication* to purchase *all rights* on publication. When submitting an article for consideration, authors must notify the Editor if it has already been published, or is being considered for publication, elsewhere.

TVARTS is 60

RSGB AFFILIATED Society, the Thames Valley Amateur Radio Transmitters Society held its first official meeting in October 1933. G2NN became President heading a committee comprising G6RS, G2GK, G2KI and G6GB. By 1938 there were some 50 members. After the war, the President was G5LC. He was assisted by G6CL, G3JG, G8SM and G2KI.

A celebration dinner will be held by the TVARTS this October, and RSGB President Peter Chadwick, G3RZP, will be in attendance. The society's callsign GX3TVS will be active on HF and VHF during the celebration period. Any former members who would like to attend the dinner should contact the Chairman R D Muir, G3LHN, QTHR.

For the BBC World Service programme *Waveguide*, Producer Heather Temple and Presenter Gregory Stevens interviewed Frank Claytonsmith, G3JKS, in his shack. Two 15 minute programmes featured amateur radio. In the first, General Manager Peter Kirby, G0TWW, explained what the RSGB is and what it does for the hobby. *Waveguide* is broadcast to all parts of the world.

R0 QRM

USERS OF two metre repeater channel R0 may experience some interference in the next few weeks. A 140MHz paging system which has 210 stations has a tendency to re-set its frequency to 145.000MHz following loss of supply. New software is being installed but in the meantime if any interference is experienced, repeater users should contact the repeater keeper who has details of how to report the fault to the paging company.

The Society is raising this matter with the Radiocommunications Agency as it seems unwise to install equipment which does not fail safe.

MVT-7100 Owners

WATERS AND STANTON Electronics have notified us that there could be a problem with the Yupiteru MVT-7100 receiver. They are anxious to contact the owners of serial numbers 30201181 to 30201190 and 30201231 to 30201240 so that they can arrange a substitution if necessary.

Morse in EI

IN THE JUNE *News & Reports* we said that EIs need no longer spend a qualifying year using Morse code. This was misleading. In fact licensees may choose to complete a year of CW or submit a log showing 250 CW contacts, together with 25 QSL cards. It is this latter option that was the recent change we referred to. Apologies to any EI members who were misled.

Arthur's 60th

SENIOR GB2RS news reader and RSGB Past President Arthur Milne, G2MI, celebrated his Diamond Wedding in July. Congratulations Arthur.

Zone C

NEIL LASHER, G6HIU, Zone Council Member for South-East England has a new address: 8 Highwood Grove, Mill Hill, London NW7 3LY.

● VIDEOSENDERS which use radio to transmit the output of a VCR to TVs around the house without wires are illegal says the RA. They use broadcast TV channels and could cause interference.

RAE & Morse Courses

- Reddish Vale Evening Centre, **Stockport**, offers a 25-session **RAE** course leading up to the May 94 examination. Facilities are also available for students to sit the December 93 exam at the centre. Sessions are on Mondays 7 – 9pm commencing 27 September. A **Morse** course covers all levels of ability up to 20WPM. Times are 7 – 9pm Thursdays starting 30 September. Enrolment takes place 13, 14 and 16 September, 7 – 9pm. Contact course tutor Dave Wood, G4UJD, on 061 430 6246 evenings.
- There is a wide choice of courses at North Trafford College in **Manchester** starting in September. **RAE** theory is taught on Monday evenings or Wednesday mornings, **Morse** is taught Tuesday evenings or Wednesday afternoons. Amateur Television is a bonus on a Wednesday morning and there is an advanced radio course on Tuesday afternoons. The full day (Weds) course should appeal to retired or unemployed people. Enrolment takes place 1 – 3 September. The lecturer is J T Beaumont, G3NGD, and the college can be contacted on 061 872 3731.
- An **RAE** course will be held at West Herts College (Dacorum Campus), **Hemel Hempstead**, Thursdays from 23 September, 7pm. A **Morse** course is on the same evenings starting at 6pm. Enrolment 7 September 12am to 4pm and 6pm to 8pm. Enquiries to the tutor Brain Hardy, G4BIP, on 0442 66337.
- Several radio courses are held at **Hull** College, including those for yachtsmen and boat owners. An **RAE** course is held over four terms on Tuesdays 7 – 9pm from 14 September. You can learn **Morse** on Wednesdays 7 to 8.30pm from 15 September. Call the college on 0482 29943 for further details.
- A **Morse** class will run at the Old Swinford Hospital School in **Stourbridge** from 15 September to Easter 94 when tests will be arranged at the school. An **RAE** course (tutor G0RXO) is also offered from 14 September. For enrolment details contact Phil Harris on 0299 403025.
- **Bromley** Adult Education College offers an **RAE** course on Thursdays, 7.30 to 9pm, from 23 September for next May's exam. The tutor is Alan Betts, G0HIQ, who can be contacted on 071 215 2326.
- There's a choice of times for **RAE** courses at **Rochester**. Rede School, Strood, has a course on Tuesday evenings 7 – 9pm starting 28 September. Medway Adult Education Centre has a daytime RAE course on Mondays from 27 Sept with a bonus of 'an introduction to Morse' and 'Maths for the RAE'. For either course, call the tutor Ray Petri, G0OAT, on 0634 845359.
- The new-style 12WPM **Morse** test is the target of a course at **Telford** College of Arts and Technology, Thursdays from 7pm, 23 September. The course is supported by weekly tapes and on-air practice, and operating skills are taught as well by G0ISI. Enrol 6 September 2 – 8pm, or 7 September 10am to 8pm. Contact the college on 0952 641122.
- The Milton Keynes and District Amateur Radio Society is starting **NRAE** and **RAE** classes for new and old members. Contact Secretary Verdun Webley, G0RKV, on 0908 762920 for further information.
- Beginning on 16 September is a fortnightly **RAE** course run by Hambleton ARS at **Northallerton**, Thursdays 7.30 to 9.30pm. Tuition is free on joining the club. Details from Nigel Robertshaw on 0609 776608.
- At **Brentford** School for Girls, a **Morse** class will commence on 27 September at 7pm, and an **RAE** class starts on 29 Sept 7pm. Contact Frank Coles, G3PZC, on 081 977 5343 in early September.
- Starting the last week in September is an **RAE** course at the home of tutor Len Buck, G0DLR, in **Meopham**, Kent. Although an evening course, special arrangements can be made to teach during the day for those on shift work etc. Last year, a 100% pass rate was achieved.
- **RAE** classes at **Buxton** start in September on Tuesday evenings, 7 – 9pm. Contact Dr Clive Smith, G4FZH, on 0298 85539.
- P B Buchan, G3INR is the **RAE** tutor at Sawston Village College, **Cambridge**. The course starts September and is on Tuesday evenings. For details, telephone D W Cupit at the college on 0223 834492.
- Enrolment for **RAE** and **Morse** courses at **Bradford and Ilkley** Community College takes place 7 – 9 September 9.30am to 4pm and 6 – 8pm. Further details may be obtained from the College on 0274 753371.
- Alan Lake, G4DVW, is organising three courses in the **Nottingham** area. An **RAE** course starts 22 September at Arnold and Carshalton College of Further Education on Wednesdays 6.30 to 9.15pm, or a short course for the December exam is on Thursdays. A **Morse** class is held Wednesday evenings. West Notts College of Further Education also offers an **RAE** course on Mondays 7 – 9pm, starting 20 September. Enrolment is 8/9 Sept. Details of any of these can be obtained by calling 0602 382509.
- Radio School Limited runs an **RAE** course at **Hayling Island**, Hants. This is a two-week full-time intensive course costing £600 plus exam fee. It starts 22 November and aims at the December examination.
- An **RAE** course starts at the Thorpe Adult Education Centre, **Norwich** on Wednesdays 7.00 to 9.15pm. Call 0603 35857 for enrolment details.

See *News and Reports*, July and August, for more courses. Some of the above also run their own examination centres and welcome external students. For details of **Novice RAE** courses near you, contact Sylvia Manco at RSGB HQ, on 0707 659015.

RSGB President Peter Chadwick, G3RZP, opened the eighth AMSAT-UK Colloquium which featured lectures from the world's satellite experts. Organiser Ron Broadbent, G3AAJ, looks on.

ICOM YAESU KENWOOD ALINCO

RADIO HAMSTORES

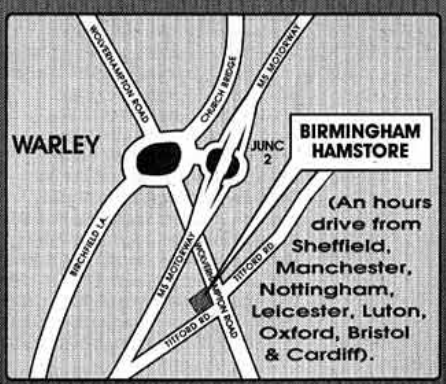
SPECIAL EVENT DAY AT 'BIRMINGHAMSTORE'

Last year we claimed to have one of the best Ham Radio Showrooms in the country... this year we know we have. Come and see for yourself between 10am & 4pm on

Saturday 18th September

Come and see how we have developed and help us celebrate our second year in Birmingham with a glass of Buck's Fizz and some nibbles, you might even get your teeth into a *NEW RADIO!* There will be some *EXTRA SPECIAL DISCOUNTS ON OFFER PLUS...*

- Selection of second-hand radios
- 2m/70cms transceiver checks
- Video presentations on Amateur Radio
- Advice on the Radio Amateur's exam
- Guidance on the Novice course
- Local Radio Club representation
- Radio Station GB5IT demonstrating modes of operation including RTTY, PACTOR and PACKET
- Shortwave listening & weather chart reception
- Operating desks c/w rigs by all the major manufacturers
- Extensive stocks of new gear
- Scanning radio displays
- Mobile radio aerials and accessories
- Portable radios of all kinds
- Loads of Radio books
- Data sheets to mull over, in fact everything for Radio Hobbyists, be they listeners or transmitters
- ICOM Marine, Avionic and PMR radios will also be on display
- HAMSTORES stock AEA, AKD, Alinco, AOR, Barenco, Comet, Cushcraft, Davis, Dee Comm, Diamond, Icom, JRC, Kenwood, Lowe, Microset, MFJ, RSGB books, Tayo, Yaesu and Yupiteru gear
- Low deposit, interest-free credit is available on most radio purchases
- Gordon, John and Ray are all looking forward to greeting you on the 18th!



RSGB VISA MasterCard ICOM SWITCH

BIRMINGHAM: (STORE IS JUST OFF M5 MOTORWAY AT JUNCTION 2)
International House, 963 Wolverhampton Rd. Oldbury, West Midlands B69 4RJ.
Tel: 021 552 0073 Fax: 021 552 0051. Also at...

LONDON:
11 Watford Way, Hendon, London NW4 3JL. Tel: 081 202 0073 Fax: 081 202 8873

HERNE BAY:
Unit 8, Herne Bay West Industrial Estate, Sea Street, Herne Bay, Kent CT6 8LD.
Tel: 0227 741555 Fax: 0227 741742. *N.B. Herne Bay closed for lunch 1300-1400.*

OPENING TIMES: Mondays to Fridays: 09:00-17:00 & Saturdays: 09:00-16:00.

NEW IMAGE SMC NEW IMAGE

All our showrooms can supply all major brands o
We will also endeavour to match any competitors genuine
20% off selected Icom Transceivers*. So why not p
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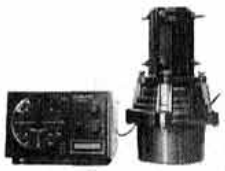
DIAWA PRODUCTS

			£	Carriage
PS120MK2	PSU	3-15V Variable 9A/12A	69.95	D
PS120MIIA	PSU	3-15V Variable 9/12A	79.95	D
PS14011A	PSU	13.8V 12/14A	69.00	D
PS304	PSU	1-15V Variable 24A/30A	129.95	D
RS40X	PSU	1-15V Variable 32A/40A	189.00	D
LA2080H		2m 1.5-5W in 30-80W out	159.95	B
DLA80H		2m/70cm 0.5-25W input auto select 80W 2m 60W 70cm out	385.00	C

ANTENNA ROTATORS

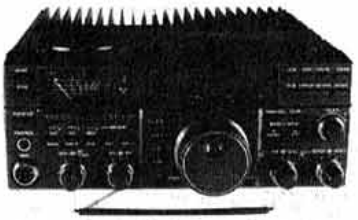


		£inc VAT	Carr.
G-250	Yaesu Bell type Twist and switch control	109.00	C
G-400RC	Yaesu Bell type Round meter 360 degrees	239.00	D
RC5-1	Create Bell type Round meter 360 deg. vari speed	255.00	C
RC5-3	Create Bell type 360 deg, vari speed + preset	319.00	C
G-600RC	Yaesu Bell type Round meter 360 degrees	329.00	C
RC5A-3	Create Bell type 360 deg, vari speed + preset	625.00	C
RC5B-3	Create Bell type 360 deg, vari speed + preset	939.00	C
G-800SDX	Yaesu Bell type 450 deg variable spd 43-90 sec/rev	395.00	C
G-1000SDX	Yaesu Bell type 450 deg variable spd 43-90 sec/rev	435.00	C
G-2700SDX	Yaesu H/D 450 deg vari speed 50-120 sec	819.00	E
G-400	Yaesu Bell type Meter control +/- 180 degrees	199.00	C
G-500A	Yaesu Elevation Meter calb +/- 90 degrees	245.00	C
G-5400B	Yaesu Azimuth & Elevation Dual Controller	469.00	C
G-5600B	Yaesu Azimuth & Elevation Dual Controller	539.00	D

KENWOOD HF TRANSCEIVERS

	£	Carriage
TS-950SDX	Call for price	E
TS-850S	"	D
TS-450S	"	D
TS-140S	"	D
TS-50S	"	D

YAESU HF TRANSCEIVERS

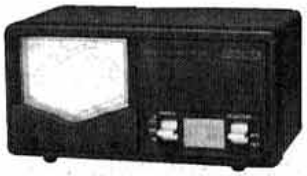


FT990
Was £~~2149~~ Now £1934
DC model was £~~2149~~
Now £1934

FT890
Was £~~1375~~ Now £1235
FT890TU unit Was £~~1575~~
Now £1417

JB ANTENNAS

		£	Carriage
LW5/2M	Yagi 5 element length 1.6M. 7.8dBd	26.20	C
LW8/2M	Yagi 8 element length 2.8M 9.5dBd	33.60	C
LW10/2M	Yagi 10 element length 3.55M 10.5dBd	40.77	C
LW16/2M	Yagi 16 element length 6.54M 13.4dBd	59.46	D
PBM10/2M	Parabeam 10 element length 3.93M 11.7dBd	80.84	C
PBM14/2M	Parabeam 14 element length 5.95M 13.7dBd	98.23	D
D5/2M	Yagi 5 over 5 slot length 1.6M 10.0dBd	47.59	C
D8/2M	Yagi 8 over 8 slot length 2.8M 11.1dBd	65.33	C
5XY/2M	Yagi 5 ele crossed, length 1.7M 7.8dBd	50.53	C
8XY/2M	Yagi 8 ele crossed, length 2.8M 9.5dBd	64.51	C
10XY/2M	Yagi 10 ele crossed, length 3.6M 10.8dBd	80.84	C
D8/70	Yagi 8 over 8 slot, length 1.35M 12.3dBd	47.71	C
PBM18/70	Parabeam 18 element, length 2.8M 13.15dBd	57.81	D
PBM24/70	Parabeam 24 element, length 4.5M 15.1dBd	73.32	D
MBM28/70	Multibeam 28 element, length 1.25M 11.5dBd	38.54	C
MBM48/70	Multibeam 48 element, length 1.83M 14.0dBd	61.57	C
MBM88/70	Multibeam 88 element, length 3.98M 16.3dBd	85.89	D
8XY/70	Crossed Yagi 8 element, length 1.5M 10.0dBd	74.03	C
12XY/70	Crossed Yagi 12 element, length 2.6M 12.0dBd	91.77	C



SWR METERS

YAESU		£	Carriage
YS60	1.6-60MHz	109.00	B
YS500	140-525MHz	95.00	B

COMET			
CM-420	140/430MHz	52.50	B
CD-120	1.8-200MHz	115.00	B
CD-160H	1.6-60MHz	104.50	B
CD-270D	140-525MHz	91.50	B

DIAWA			
CN101L	1.8-150MHz	69.95	B
CN103LN	150-525MHz	79.95	B

COMET & HOKUSHIN BASE STATION ANTENNAS

		£	Carr.
GP62	6M ⅝ 2-step colinear, 6dbi, 6.57m	76.00	D
CA350DB	6M/10M dualband colinear 2.15/6.5dB	165.00	D
GPV5S	Colinear 2M 2 x ⅝ wave, 6.4dB1/4	53.50	C
WX1/N	144/432 G/Fibre 4.5dB 2M, 7.1 DBI 70cm 'N'	85.00	C
WX2/N	144/432 G/Fibre 6.0dB 2M, 8.0dB 70cm 'N'	119.00	C
WX4/N	144/432 G/Fibre 7.8dB 2M, 10.8dB 70cm 'N'	156.00	C
WX6S	144/432 G/Fibre 9.2dB 2M, 13dB 70cm SO239	235.00	C
GP9N	144/432 G/Fibre 8.5dB 2M, 11.9dB 70cm 'N'	139.00	C
CX-725	50/144/432 G/Fibre 2.15, 6.2, 8.4dB 2.43m	95.00	C
CX-902	2m/70cm/23cm colinear 6.5/9/9dB 200W	99.50	C
CF-305	28/50 duplexer UHF 1.3-30MHz/50-240MHz	28.75	B
CF416B	144/432 duplexer UHF/N	32.99	B
CFX-514	50/144/432 triplexer UHF	46.50	B
CFX-431	144/432/1200 triplexer 'N' in PL/'N'/'N'	49.95	B

SPECIAL OFFERS

430/726	70cm unit for FT726R	£169.00
144/726	2m unit for FT726R	£139.00
50/726	6m unit for FT726R	£139.00
358 70cm 3 x 5/8 mobile		£15.95
268E 70cm mobile colinear		£16.00
SQ144 2m directional vertical		£49.00
UHF 2 channel xtal TX Boards from Yaesu FTC1044 IOW		£49.00

All Carriage C

TOKYO HY-POWER

		£	Carriage
HL100B/10	10M Linear, 10W in 100W out PEP Suitable for 21/24/28MHz	210.00	C
HL100B/20	20M Linear, 10W in 100W out PEP	210.00	C
HL100B/80	80M Linear, 10W in 100W out PEP	210.00	C
HL66V	6M Linear, 10W in 50-60W out Rx Preamp	149.00	C
HL166V	6M Linear, 3/10W in Auto select 80/160W out Rx preamp	299.00	C
HL37VSX	2M Linear, 0.5-5W in 20-35W out variable gain preamp	109.00	B
HL62VSX	2M Linear, 5/10/25W in 50W out preamp	195.00	C
HL110V	2M Linear, 2/10W in 100W in 100W out Rx preamp	220.00	C
HL36U	70cm Linear, 6/10W in 25/30W GaAs FET preamp	155.00	B
HL63U	70cms Linear, 10/25W in 50W out GaAs FET preamp	259.00	C
HL180V	2M Linear, 3/10/25W i/p auto select 170W out Rx preamp	349.00	C
HL130U	70cms Linear, 3/10/25W i/p auto select 120W out Rx preamp	459.00	C

HANDHELDS

			Carriage
FT26	2m	£259.00	B
FT76	70cm	£280.00	B
FT415	2m	£290.00	B
FT815	70cm	£310.00	B
TH28E	2m	£289.95	B
TH48E	70cm	£329.95	B

DUAL BANDERS

FT530	Now £475	C
TH78E	£469.95	C
ICW2/E	£449.00	C
ICW2/ET	£479.00	C

**Offer available 12 August to October 30 subject to availability Carriage B=£5.00 C=£7.50 D=£12.50 E=£16.50*

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* Available subject to status. Not available on special offers, or used equipment

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HF EQUIPMENT

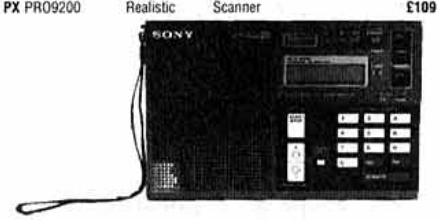
			£ inc. Vat
AX	FT901DE	Yaesu	HF Transceiver + FM Board	£439
AX	FT757GX	Yaesu	HF Transceiver, Mic	£575
AX	FT902DM	Sommerkamp	HF Transceiver, Boxed	£495
AX	IC735	Icom	HF Transceiver, Mic	£749
AX	F102	Yaesu	HF Transceiver, Boxed	£525
AX	FT757GX2	Yaesu	HF Transceiver, Mic	£750
AX	AL84	Ameritron	HF Amplifier, Boxed	£399
AX	FL2100Z	Yaesu	500W Amplifier	£550
AX	FT757GX	Yaesu	HF Transceiver	£599
LX	TS140	Kenwood	Transceiver	£749
LX	FT707	Yaesu	HF Transceiver	£450
BX	FT102	Yaesu	HF Transceiver + FM	£589
RX	FT102	Yaesu	HF Transceiver	£550
RX	TS530S	Kenwood	HF Transceiver	£550
RX	FTONE	Yaesu	HF Transceiver	£975
RX	FT902	Yaesu	HF Transceiver	£550
RX	TS930	Kenwood	HF Transceiver	£895
RX	TS440	Kenwood	HF Transceiver	£650
RX	FT101ZD	Yaesu	HF Transceiver	£475
RX	TS530SP	Kenwood	HF Transceiver	£525
RX	FT7B	Yaesu	HF Transceiver	£249.99
RX	TS830	Kenwood	HF Transceiver	£625
RX	FT102	Yaesu	HF Transceiver	£425
RX	FTONE	Yaesu	HF Transceiver	£895
RX	FT902	Yaesu	HF Transceiver	£495
RX	TS120V	Kenwood	HF Transceiver	£315
CX	FT980	Yaesu	HF Transceiver	£895
CX	FTONE	Yaesu	HF Transceiver	£950
PX	FL7000	Yaesu	Linear Amp 500W	£1499
PX	FT107	Yaesu	Transceiver + SP107P & FV107	£695
PX	FT107M	Yaesu	HF Transceiver No PSU	£475
PX	FT70G	Yaesu	HF Mobile	£399
PX	FT747GX	Yaesu	HF Transceiver	£875
PX	FT757GX	Yaesu	HF Transceiver	£625
PX	FT757GX2	Yaesu	HF Transceiver	£795
PX	FT980 (x2)	Yaesu	HF Transceiver	£895
PX	FT990	Yaesu	HF Transceiver	£1895
PX	FTONE	Yaesu	HF Radio	£939
PX	HL2K	Tokyo	2 x 3-500z 1.6-30Mhz	£1275
PX	HT180 (x2)	Tokyo	80MTR TX/RX SSB	£289
PX	IC725	Icom	Transceiver	£624.99
PX	IC735	Icom	Transceiver	£758.99
PX	TS140S (x2)	Kenwood	Transceiver	£659
PX	TS680S	Kenwood	HF Transceiver + 6m	£749
PX	TS850SAT	Kenwood	HF Transceiver C/W ATU	£1395
PX	FT707	Yaesu	HF Transceiver 80-10m	£425

VHF EQUIPMENT

			£ inc. Vat
AX	FT208R	Yaesu	2m Handheld, Mic, Charger	£145
AX	TM241E	Kenwood	2m FM Mobile, Boxed	£299
AX	FT202	Yaesu	2m 6 ch Handheld	£59
AX	IC39T	Icom	70cm Handheld, CTCSS/DTMF	£140
AX	720	ATC	Airband Transceiver	£100
AX	IC251E	Icom	2m Base fitted Mutek	£450
AX	FT690R	Yaesu	6m Portable/Mobile	£229
AX	TR9500	Trio	70cm Multimode 10W, Boxed	£325
AX	ICW2E	Icom	2m/70cm Handheld	£385
AX	TR2300	Trio	2m FM Portable	£119
AX	FT411E	Yaesu	2m Handheld, Nicad, Charger	£170
AX	2100M	Mizuho	Portable 2m SSB	£115
AX	ICW2E	Icom	2m/70cm Handheld, C/W CTCSS	£385
AX	C5608D	Standard	2m & 70cm Mobile, Boxed	£500
AX	FT470	Yaesu	2m/70cm Handl, Nicad, Charger	£299
AX	TR2500	Trio	2m Handheld, Charger, Nicad	£125
AX	FT23R	Yaesu	2m Handheld, Charger, Nicad	£169
AX	FT290R	Yaesu	2m Multimode, Nicads, Charger	£265
AX	Transverter	R&N	28Mhz Input, 50 Mhz out	£149
AX	IC211	Icom	2m Base, Desk Mic, Boxed	£369
AX	ICW2E	Icom	Handheld	£385
AX	TR2300	Trio	Transceiver	£119
LX	SAGRA600	Tokyo	2m Amplifier	£699
LX	FT480R	Yaesu	2m Multimode	£295
BX	FT290R2	Yaesu	2m Multimode, Nicads, Boxed	£489
BX	FT790R2	Yaesu	70cm Multimode, Ncds, Chrgr, Box	£519
RX	FTV901	Yaesu	Transceiver (2m fitted)	£175
RX	FT650	Yaesu	TXCR 6/10/12m C/W FP22	£1195
RX	FT204	Yaesu	2m Handheld TXCR	£145
RX	FT727R	Yaesu	2m/70cm Handheld TXCR	£260
RX	FT290R	Yaesu	2m Multimode TXCR	£225
RX	TS711E	Kenwood	2m Base Station	£725
RX	FT290MKII	Yaesu	2m TXCR	£395
RX	FT290R	Yaesu	2m Multimode TXCR	£249.99
RX	FTV107/2	Yaesu	Transverter	£135
RX	FT726R	Yaesu	2m/ 70cm TXCR	£825
RX	FT780R	Yaesu	70cm TXCR	£350
RX	4SRE	Icom	70cm TXCR Wide band RX	£330
RX	HT106	Tokyo	6m TXCR	£195
RX	IC-24ET	Icom	2/70 Handheld TXCR	£350
CX	DJ580E	Alinco	VHF UHF Handi	£395
CX	FT727R	Yaesu	B1Transceiver (FNB4A)	£275
CX	FT73R	Yaesu	70cm Handi C/W Nicad	£175
CX	TH205E	Kenwood	Handheld 2m	£175
CX	FT790R2	Yaesu	70cm Multimode	£425
PX	FT211RH	Yaesu	2m Mobile FM	£289
PX	FT23R (x2)	Yaesu	2m Handheld	£189
PX	FT26	Yaesu	2m Handheld, FNB28, NC28C	£259
PX	FT690R2	Yaesu	Transceiver	£375
PX	FT73R	Yaesu	70cm + FNB12	£189
PX	FT790R2	Yaesu	FM Transceiver	£499
PX	IC229H	Icom	2m FM Transceiver	£299
PX	IC22U	Icom	2mtr Mobile	£120
PX	SAGRA-600	Tokyo	2m Linear 600W Output	£699
PX	TX280FM	Kenwood	2mtr	£129
PX	IC229	Icom	2m FM Transceiver	£299
PX	FT209R	Yaesu	2m FM Handi	£139

RX & SCANNERS

			£ inc. Vat
AX	MX7000	Regency	Wideband Scanner	£229
AX	FRG7000	Yaesu	Receiver	£250
AX	ICR7100	Icom	Base Scanner	£1000
AX	FRG9600M	Yaesu	Scanner PSU, Boxed	£299
AX	ICR1/SSB	Icom	Scanner + SSB	£329
AX	ICF2001D	Sony	Shortwave Receiver, Boxed	£169
AX	R2000	Kenwood	Shortwave Receiver, Boxed	£389
AX	FRG7	Yaesu	Shortwave Receiver, Boxed	£179
AX	ICR7000HF	Icom	Base Receiver	£825
AX	R532	Signal	Airband Receiver, Boxed	£125
AX	800XLT	Bearcat	Desktop Scanner	£169
AX	R2000	Trio	Shortwave Receiver	£369
AX	HP200E	Fairmate	Handheld Scanner	£199
AX	AR2002	AOR	Wideband Scanner	£225
AX	ICF7600	Sony	Shortwave Receiver	£110
AX	ICR71E	Icom	Shortwave Receiver, Boxed	£639
AX	MVT5000	Yupiteru	Handheld Scanner, Boxed	£179
AX	FRG7	Yaesu	Receiver	£179
LX	IC-R100	Icom	Scanner	£380
LX	AR1500E	AOR	Scanner	£259
RX	ICF-80	Sony	Receiver with Airband	£220
RX	AR2001	AOR	Wideband Scanner	£194.99
RX	AR900	AOR	Handheld Scanner	£145
RX	AIR7	Sony	Airband Receiver	£140
RX	ICF2001D	Sony	Receiver	£225
RX	DRB600	Panasonic	HF Receiver	£185
RX	R2000	Trio	HF Receiver	£495
RX	FRG9600M	Yaesu	VHF/HF Receiver	£440
RX	RS3000	Revco	Wideband Scanner	£135
RX	SRG86000DX	Sumerkamp	Wideband Receiver	£350
RX	ICFSW55	Sony	Receiver	£225
RX	FRG7700	Yaesu	HF Receiver	£295
CX	FRG9600	Yaesu	Scanner	£325
PX	AIR7 (x2)	Sony	Airband Scanner	£169
PX	AR3000 (x2)	AOR	Scanner	£598.99
PX	FRG9600	Yaesu	Scanning RX	£439
PX	ICF2001D	Sony	Portable Receiver	£245
PX	PRO80	Sony	Sony	£219
PX	PRO9200	Realistic	Scanner	£109



DATA EQUIPMENT

			£ inc. Vat
AX	APR2010	Pocom	Auto Decoder CW/RTTY	£225
LX	AMT2	ICS	Amtor Terminal	£109
BX	PK232MBX	ICS	Data Terminal with Mailbox	£269
RX	TNC24	Tereleader	Tereleader Packet Terminal	£284.35
PX	AMT1	ICS	Amtor Unit	£99
PX	AMT2 (x2)	ICS	Data Unit	£90
PX	KB4001+KB(x2)	M/M	RTTY RX/TX Unit	£169

ACCESSORIES

			£ inc. Vat
AX	MMT28/44	M/M	28 Mhz Transverter	£80
AX	PC1	Datong	Converter	£70
AX	MML144/100S	M/M	100W Amplifier	£115
AX	UC1	Datong	HF Converter	£69
AX	Starmaster	Dewsbury	Memory Keyer	£65
AX	144/100S	M/M	2m Amplifier 100W	£110
AX	Wavemeter	SEM	HF Wave Meter	£29
AX	UC1	Datong	HF Converter	£65

AX	PS15	Icom	PSU	£125
AX	CT530	Welz	250W Dummy Load	£45
AX	FRA7700	Yaesu	Active Antenna	£45
AX	SM6	Icom	Desk Microphone	£30
AX	Supa Tota	Dewsbury	Morse Code Teacher	£50
LX	12/25A	BNOS	PSU	£185
BX	ICSP3	Icom	External Loudspeaker	£50
BX	FL2025	Yaesu	Clip-on Linear 25W	£90
BX	FL7025	Yaesu	Clip-on Linear 25W	£119
RX	KP-100	Kenpro	Keyer Unit	£75
RX	BC-8	Kenwood	Desk Charger	£30
RX	C500	Standard	2m/70cm handheld	£150
RX	MR750E	Daiwa	Rotator	£185
RX	12/6A	BNOS	6A Power Supply	£60
RX	VFO240	Kenwood	Ext VFO	£75
RX	12/25	BNOS	25A Power Supply	£194.99
RX	FV101Z	Yaesu	Ext VFO	£75
RX	FC965DX	Yaesu	Convertor for Yaesu 9600	£45
RX	FV102	Yaesu	Ext VFO	£185
RX	LP50/10/50	BNOS	6m Linear	£125
RX	MMT144/28	M/M	2m/10 Transverter	£70
RX	HX240	Tokyo	HF Transverter	£195
RX	EK150	Katsumi	Electronic Keyer	£54.99
RX	MML144/30	M/M	2m Linear	£70
RX	FRV8800	Yaesu	VHF Converter	£70
LX	12/25A	BNOS	PSU	£185
RX	12A	Drae	12A Power Supply	£45
LX	12/25A	BNOS	PSU	£185
RX	BC72	Icom	Base Charger	£75
PX	FC757AT	Yaesu	Tuner	£275
PX	FIF232C	Yaesu	Cat Interface	£75
PX	FMUT747 (x2)	Yaesu	FM Unit for FT747	£35
PX	FP707	Yaesu	Power Unit	£111.63
PX	FP757HD	Yaesu	Power Unit	£169
PX	FS500V (x2)	Yaesu	SWR Meter 50-150Mhz	£79
PX	FS50VP (x2)	Yaesu	SWR Meter 50-150Mhz	£79
PX	FS710V	Yaesu	SWR Meter 50-150Mhz	£79
PX	HK 802	Himound	Morse Key Straight	£74.95
PX	HL100B/20	Tokyo	20m Band Amplifier	£149
PX	HL100B/10	Tokyo	10m Band Amplifier	£154.99
PX	HL166V	Tokyo	6m Linear 160W	£215
PX	KP100	Kenpro	Squeeze Keyer	£69
PX	KR250	Kenpro	Rotator Bell	£70.50
PX	MD1C8	Yaesu	Desk Mic	£69
PX	MMX1268SAT	M/M	Sat TX Converter	£135
PX	MMA28V	M/M	1m Low Noise Pre Amp	£19
PX	MM1296 (x2)	M/M	1296Mhz Converter 2 MIF	£99
PX	MM144/100S	M/M	2m Linear Amp	£99
PX	MMT432/144R	M/M	Transverter C/W Repeater	£99
PX	NC15	Yaesu	Charger Quick FNB3/4	£59
PX	NC42	Yaesu	Desktop Charger	£75
PX	PS14011	Daiwa	Power Supply	£49
PX	MMT50/144	M/M	6m Transverter	£268.99
PX	PS304	Daiwa	Daiwa 24/30A PSU	£105
PX	12/25A	BNOS	BNOS 25A PSU	£189
PX	**FC707**	**Yaesu**	**Antenna Tuner**	£109
PX	FTS12	Yaesu	CTCSS Unit	£49
PX	LPM144-10-100	BNOS	2m 10-100W Amp	£139
PX	50/767 (x2)	Yaesu	6m Module FT767GX	£159
PX	LMP50-10-100	BNOS	6m 10-100W Amp	£199

KEY

PX	SMC SOUTHAMPTON	TEL: 0703 251549/255111
BX	SMC BIRMINGHAM	TEL: 021 327 1497/6313
CX	SMC CHESTERFIELD	TEL: 0246 453340
LX	SMC LEEDS	TEL: 0532 350606
AX	ARE LONDON	TEL: 081-997 4476
RX	REG WARD AXMINSTER	TEL: 0297 34918

Showroom hotline 0703 251549 HQ showroom hours 9.30–5 weekdays 9–1pm Saturday

Birmingham *021-327 1497* ***Axminster*** *(0297) 34918* ***Chesterfield*** *(0246) 453340*

International HF and IOTA Convention

8, 9 & 10 October, 1993

The RSGB 1993 HF and IOTA Convention is the second to be held at the Beaumont Conference Centre, near Windsor. The 1992 Convention was judged to be a first class event with a terrific atmosphere in which to meet fellow HF enthusiasts. The 1993 Convention takes another leap forward with a ***full 2-day Lecture Programme plus a 2-day Ladies Programme*** (contact G3PJT – QTHR – for Ladies Programme if not on a package). ***One or two nights accommodation packages are available or Convention registration on its own*** (advance registration for two days cost less). Registration includes: all DX sessions & facilities plus free parking and free hot beverages during the event.

This Year's Convention Will Feature

- **Visitors reception on Friday evening** (prior booking required if not on a package)
- **DX Dinner on Saturday evening** (a sell-out in 1992 – prior booking required)
- **Over 20 high-class presentations**
- **Hospitality suites** by CDXC, HFCC & FOC meeting point
- **RSGB bookstand**
- **Representation from** the RAFARS, UKCWG & AMSAT-UK
- **On the air station** – GB1OTA
- **Morse Tests on demand** from 14:00 – 17:00 (Two passport photos are essential for a test)
- **Amateur Radio Software demonstrations**

Lecture Programme

Saturday 9 October

IOTA Welcome and Introduction – G3KMA & G3ZAY

IOTA First Contest review – IOTA Committee / HFCC

IOTA Policy, Questions & Answers – IOTA Committee

IOTA Holiday operating from Islands

IOTA Serious Island Operation

Computer Contest Logging – EI5DI

DXpedition Videos

40m Phased Arrays – G3PJT

Working DX by HF Satellite Paths – G3IOR

HF Linear Amplifiers – GW3NWS

Recent DXpeditions – 3W3RR

Sunday 10 October

Low Band Antennas – ON4UN

IOTA Queries Workshop

Contest College (2 hours) – HF Contests Committee

IOTA – handling pile-ups

40m Phased Arrays – G3PJT

HF Awards Presentation

Computer Antenna Modelling – G3SEK

Cluster Workshop – G4PDQ (UKCWG)

HF Linear Amplifiers – GW3NWS

KH5/KH5K DXpedition – G0LMX

HF & EMC – EMC Committee

AH1A DXpedition – G4LJF

Young Amateur of the Year Presentation Ceremony

LADIES PROGRAMME – visits to:

Windsor Town Centre (for shopping & Castle) – Saturday

Hampton Court Palace – Sunday

Raffle First Prize

Kenwood TS-50S Transceiver

Donated by Trio-Kenwood UK Ltd

This Year's Convention has been sponsored by:

MARTIN LYNCH
G4HKS
THE AMATEUR RADIO EXCHANGE CENTRE

KENWOOD

BOOK NOW!

Accommodation Packages:

Tel: 0753 858633
Fax: 0753 832657

DX Dinner and Advance Registration:

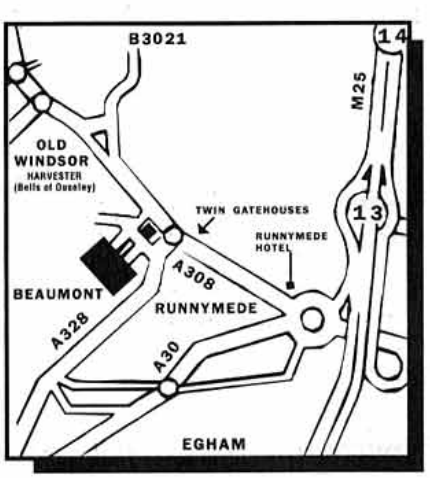
Tel: 0442 832959

Travelling to the Beaumont

By road – The Beaumont is at Old Windsor near the junction of the A308 & A328, within easy reach of the M25, M3, M4, M40, A4 & A30.

By Rail – the nearest stations are Egham, Windsor Riverside and Windsor Central. All are a short taxi ride to the Beaumont Conference Centre

By Air – Heathrow airport is less than 15 minutes drive from the Beaumont by taxi or a friend's car.



HF NEWS

JOHN ALLAWAY G3FKM
10 Knightlow Road, Birmingham B17 8QB

I HAD THE good fortune to be able to attend 'Hamvention 93' in St Petersburg recently. It really was great to be able to put faces to names – some of which I have known over the air for many years. It was also good to see that Russian amateurs are just like those of us elsewhere – in spite of the many years during which their activities were tightly controlled. I *tried* to get some idea of the proposed new system of callsigns in the CIS – but found that there is as much confusion there as here ! More information is awaited . . . .

GM4ELV has told me that he has closed down his station and that any contacts with his callsign in future will be with a pirate. He has been receiving cards for QSOs during the past two and a half years – but apart from the period 10 to 14 June 1993 he has been off the air.

There will be special activity on 12 and 13 September from ON4USA/P located in the US Military Cemetery of Henri-Chapelle in east Belgium, ON6USA situated in Mons, and ON7USA in the military cemetery at Neuville. Special QSL cards will be sent to all who make contact. Please send your QSL with SAE and return postage to P O Box 11, B-4800 Verviers 1, Belgium. (For an unknown reason the information I received says "only the PO Box address – no name and no indicatif on the envelope.")

FRENCH CALLSIGN CHANGES

REF HAS told me of the extensive modification of callsigns in France. All former FD1, FE1, and F1 call holders are now F5 with three letter suffixes. F2, FE2, F3, FE3, F5 and FE5s have become F2, F3, and F5 respectively and now have two letter suffixes. F6, FD6, and FE6 are F6 with three letter suffixes, and F8, FE8, F9, and FE9 are now F8 and F9 with two letter suffixes respectively. Club stations which previously had FF prefixes now have F and a number followed by a 'K' as first letter of the suffix. It seems that full privilege licence holders holding CEPT licenses and staying more than three months in France will now have F5V— or F8V— calls. VHF only callsigns will be F1V— or F4V—.

DX NEWS

IN A DXCC News Release dated 1 July 1993 ARRL says that the backlog of unprocessed applications at the end of June was 155 (representing 23,630 QSLs). Replies to applications being sent out at the end of May had been dealt with in just under two weeks. A second Release issued on the same day gave a list of operations where documentation has been received and approved and the dates from which effective: 3C1TR (6.4.93), 4J1FS (May 1992), 5R8DS (30.4.93), 5X1DX (26.4.93), 5X1XX (27.4.93), 9M0S (26.5.93), BV2/WD8E (17.2.93), C9LCK (22.4.93), D2AXYK (25.9.92), H44/I4LCK (2.8.92), J80I (26.4.93), KH5K/N9NS (all operations), KH5/N0AFW (all operations), S79CK/D (27.4.92), T30AJ (11.12.92), V47I (11.5.92), VU7SF/API (15.12.92), and ZX0F (22.3.93). A later list confirmed the validity of operations by 4S7/NZ9Z (13.1.93), 6Y5/VE1AI (23.3.93), 8Q7AF (17.3.93), AH1A (25.1.93), D2SA (18.3.93), S75S (28.12.92), TU4EA (14.4.92), T5HLL (15.3.93), VP5/W2IQ (1.1.93), XU7VK (1.12.92), and ZB2JL (8.1.93).

DXpress reports that PA3DWC is in **Cambodia** and has the callsign XU3DWC. *RSGB DX News Sheet* says that there is to be a new operator at 7Z1AB in **Saudi Arabia**. He will use the club callsign but will operate with his own gear from his home. He is Alan, KD4MAE, who was previously TU4BR, TU4BR/5U, and EL7FO. *EA DX Boletin* says that PA3FAC is expected to be in **Sarawak** and **Brunei** this month and his callsign in Sarawak will probably be 9M8ACP. His Brunei call is not yet known. V85BJ (wife of V85EB) is said to be found near 14.180MHz after 11.30, and 9M8ZZ near 14.200MHz around 1500. 9D2CW, in **Iran**, has been reported on 14.030MHz at 1130. G4FRE/WG3I is now in **Hong Kong** and on all bands 7 to 28MHz on CW and SSB as VR2EK.

OZ1EYE is in Africa and may

continued on page16 ▶

1993 WARC BANDS TABLE

	10MHz	18MHz	24MHz	Total
G3KKJ	112	168	142	422
G3IZD	84	130	113	327
G3IAR	109	133	75	317
G2AFV	87	86	48	221
G0MHC	52	106	54	212
G4XRV	88	–	77	165
GJ4GG	26	46	34	106
G4MUW	–	62	34	96
G3IQF	40	29	13	82
G0KDS	2	62	3	67

QTH CORNER

A71A	Box 22122, Doha, Qatar.
ex-A22GH/ A25GH	R G Heslop, Fairways, Meadow Drive, Bude, Cornwall, EX23 8HZ.
BV9P	KA6SPQ, 110 Cannon Drive, Crescent City, CA 95531, USA.
D2EYE	OA1ACB, Kagsaavej 34, DK-2730 Herlev, Denmark.
D2SA	via F6FNU, Antoine Baldeck, Box 14, F-91291, Arpajon cedex, France.
ZS6AFI	P O Box 807, Houghton 2041, Republic of South Africa.
XU3DWC	PA0RYS, De Kull 12, NL-1911 TP Uitgeest, The Netherlands.
5A0RR	P O Box 812, Sofia 1000, Bulgaria.
9D2CW	via PY2CWW c/o LABRE QSL Bureau
5H3FOE	G0GWA, 8 Lincoln Avenue, Heald Green, Cheadle, Cheshire, SK8 3LJ.

NINE BAND TABLE NO 7

CALL	1.8	3.5	7	10	14	18	21	24	28	TOTAL
G3KMA	160	275	319	245	325	282	325	271	318	2520
G4BWP	141	268	303	224	326	279	322	252	310	2425
G4GIR	130	258	299	209	325	262	320	236	309	2348
G3XTT	177	238	292	199	325	262	318	231	295	2337
G3GIQ	70	214	278	123	326	240	326	214	309	2100
G3TXF	83	187	245	129	302	152	301	115	268	1782
G4OBK	122	163	216	134	285	184	262	169	245	1780
GM3PPE	68	163	204	184	274	229	254	178	222	1776
G3SXW (CW)	78	174	212	161	283	161	276	130	238	1713
G3JXN	49	125	192	126	275	201	280	183	280	1711
G3NOF	5	103	106	–	325	204	327	210	295	1575
G4XRX	3	48	80	96	256	135	276	143	221	1258
G3IAR	59	98	113	124	222	156	198	102	128	1200
G4NXG/M	6	42	96	–	237	128	256	137	238	1140
GW3JXN	15	63	102	63	136	123	160	45	79	786
AVERAGE	78	161	204	134	281	200	280	174	250	1763

Next deadline – to reach G3GIQ no later than **8 October 1993**. Please note that entry level is 600 total and that there is no need to work all bands. Prepared by G3GIQ, 8 July 1993

BAND REPORTS

Quite a fall off in reports of interesting DX on 24 and 28MHz this month so I have left them out. However, 21MHz seems to have been in good shape at times. Thanks go to G2s AFV, HKU, G3s GVV, IZD, KKJ, YRM, G4s DBN, DJC, GW4KGR, G4s MUW, NXG/M, XRV, G0s KDS, MHC, RS 33761 and the UK DX Packet Cluster via G4PDQ. Calls shown in italics were of stations using CW;

1.8MHz

0000 *E35X, EA8AB, 4U1ITU.*
0200 *FP/N8CC, PY5CC, PY0FF.*
0300 *YV1OB, 5N0MVE.*
2100 *A22MN, UI8GDV, Z21HS, ZD8Z, 5B4AOA, 9H3XX.*
2300 *VQ9AC, VU2PI, 5B4NC, 9M2AX.*

10MHz

0500 *FO5DV, VP2EXX/HI7, ZK1AJJ/ZK1.*
1900 *OJ0/OH1VR, VQ9AC.*
2100 *A71CW, KP2J, S92SS, 4J4GAT, 4L0G.*
2200 *FY5FP, P40WW, 9M2AX.*
2300 *C56/DL7UBA, CP4BT, FP/VE7YL, PA3CXC/ST0, 9K2MU.*

14MHz

0600 D64PO, *HV4NAC,* KH6FKG, NL7WA, ZD9CQ.
0700 A35TL, FO4OK, T32O, *YI9CW,* ZS8MI, 5W1LJ.
0800 FO5IW, KG4DX, KL7/KD7TP, 5W1GC, 9G1UK.
1500 AP2JZB, VQ9IO, ZS8MI, *9V1WW.*
1600 S21A, SU1SK, TL8NG, ZA1B.
1700 XU3RLD, XX9AW, YK1AO, ZS8MI.
1800 A71A, HS0/G4UAV.
2000 BA4AD, BT2000BJ, JW6MW, KH0AS, TN1AT.
2100 BY1QH, SU2MT, TT8OBO, VP2EY.
2200 A61AB, *FS4PL/FG,* 3C1TR, 5U7M.

18MHz

0700 *KH6CD.*
1000 A45ZZ, KH0/JP1UEE, V73CF, *3D2RW/R.*
1500 *A61AD, D2EYE,* V85PB, *T5/OZ1FJB,* ZD7VJ, 5B4ZZ, 5X5A.
1800 D44BS, KL7XD, *PA3CXC/ST0,* VQ9AC, GW3CCY/5N0, *9G1ZZ.*
1900 A71CD, HZ1AB, ZD7KT.
2000 S92YL, *YI9CW,* 9X5AB.
2200 J88AQ, KP2AD, *OX3MZ, XQ0X.*
2300 *CE3ZW,* CE0ZIS, P40WW, *ZD8DEZ.*

21MHz

0700 C91AI, *JT1BH,* TJ1CR, ZK1AJJ.
0800 AP5HQ, FO4OK, HV4NAC, VS6GA, 5W1MM.
1000 BV0MM, NH6KM, T30JH, V51BG, 5W1MM.
1300 BY5BY, D2SA, FR5EL, P29JA/P, ZS9A.
1400 A71A, FH5CB, *9Y1ZB.*
1500 *VQ9AC,* ZA1B, ZS8MI, *9V1YW.*
1600 A71AN, *D2EYE,* ET3SID, *S21ZG,* TU5DX, YC6MLU, 3C1TR.
1700 *A71A, 5H3FOE,* 7Q7KB, 9G1MR.
1800 S92YL, TZ6NU, VP8CEH, *VR2UW, YI9CW.*
1900 CE0ZIS, D2/C91AM, S79KMB, ZD7SM, 5X1A.
2100 FS4GL, *P40WW,* S92YL, VK2XT.

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Set to be *THE* handheld of 1993. This radio must be heard to be believed. It provides effortless reception of SSB and CW signals using **TRUE** carrier injection with 50Hz resolution. It can even (with accessories) be hooked up for FAX and DATA reception.

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- AM/FM/WFM Modes
- Sensitive Receiver
- Supplied with all accessories & UK charger..... **£299**

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FRG8800 Digital S/Wave Receiver	£610.00
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FT290R2 2m M/Mode Portable	£516.00
FT690R2 6m M/Mode Portable	£505.00
FT790R2 70cm M/Mode Portable	£610.00
FT5200 2m/70cm dual band mobile	£657.00
FT26 2m FM Handheld	£272.00
FT76 70cm FM Handheld	£295.00

Yaesu Accessories

G-400 Bell type Rotator	£187.00
G-600RC Extra H/Duty Rotator	£309.00
GS-050 L/weight Bearing for above	£26.95
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We will (subject to status) send your goods immediately we receive the cheques!
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Using Vinyl coated annealed copper wire – supplied with matching unit for coax feed – high quality Japanese made.
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Losses quoted at 100MHz

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Canadian made high quality ATU's

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Easily matches all types of antenna's coax, long wire and balanced inputs (with a 4:1 balun included)

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Outstanding new mobile antennas from Australia. A commercial design proven in the Outback for 22 years. If you are going mobile, this new antenna is all you need. The Outbacker covers from 160 thru' to 10m including all WARC bands, without the need for an ATU. Lookout for the reviews which will be coming shortly. We have been running around with these antennas and the new Kenwood TS50 for the last few weeks, working everything in sight. The antenna is constructed of fibreglass with copper helical windings covered with a coating of urethane for strength, durability and protection. Tap points for each amateur band are clearly engraved on the antenna.

OUTBACKER
1.7m long, 300w, 80 thru' 10m **£189.95**
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As above but including top band.....**£219.00**
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Kenwood R2000 + VHF Conv.....**£495**
Yaesu FT790 70cms M/Mode.....**£325**
Kenwood TM241 Hi-Power 2m FM ...**£275**
Icom IC-728 HF Transceiver **£995**
Icom IC-726 HF + 6m.....**£725**
Icom IC-701 HF + PSU . . . nice! **£545**
Kenwood TS430S 100w HF **£675**
Tokyo HL-1K/6 Amp.....**£450**
Standard C520 Twin Bander Handie ..**£325**
Yaesu FT470 Twin Handie.....**£335**
Yaesu FT480R 2m M/Mode **£345**
Yaesu FT-690 6m Porta-pack.....**£345**
Yaesu FRG-9600 25–950MHz RX ...**£365**
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Yaesu FT-902DM HF TX, v.g.c.....**£625**
Adonis 308 Desk mic (boxed).....**£65**
Icom R100 Mobile scanning RX. **£425**
CT1600 2m H/H c/w BS25+H/Set....**£165**
Alinco DJ-560 Twin band h/held.....**£345**
Kenwood TS-530/S HF TX, v.g.c.....**£549**
Adonis 508 Desk Mic (compressor) **£75**
Icom IC-R71E S/W/ Receiver, v.g.c... **£675**
Yaesu FL2000B HF 1Kw PEP Amp **£495**
Yaesu FT102 HF Transceiver **£625**
Sommerkamp FT1012D HF TX/RX, ...**£495**
Yaesu Memoriser 2m FM mobile **£185**
Trio 130V c/w VFO120 (all filtered)....**£450**
Yaesu FT57 GX Auto ATU & H/D PSU...**£1045**
Tokyo HL110V 2m 100w Amp.....**£165**

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★ 4GHz bar graph for signal strength
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£269

HF NEWS

continued from page 13

be on the air from **Zambia** when this reaches readers. He should then go on to **Guinea Bissau** and where he may use the callsign J50EY on all bands – including 50MHz if permitted. ZS8MI, on **Marion Island**, keeps regular schedules with ZS9A and it is said that information may be obtained on 21.335MHz between 1300 and 1400. Gerry, G3KMQ/A22GH/A25GH returned from **Botswana** last September and says that anyone still needing his card should apply to the address in *QTH Corner* or via the RSGB bureau. It seems that KA3KJH/S0 was a UN military observer located at UN Teamsite Agwanit in the south east of **Western Sahara**. Permission for him to operate was granted by the military commander of the Frente Polisario. He subsequently met S01MZ, Director of Communications for the Frente Polisario military who raised no questions about his operation and Gerry said that all documentation would be sent to ARRL on his return to the USA in August.

G0GWA is in **Tanzania** and on the air as 5H3FOE. He should be still there and active mostly on CW. If you are looking for **Uganda** try listening for 5X1A who is said to frequent 21.320MHz most days from about 1500. *DXPRESS* says that XT2BW, in **Burkino Faso,** is due to leave in December and that he mostly uses CW and RTTY. It says that schedules with him can be arranged through his QSL manager WB2YQH. He now has a Cushcraft AP-8A antenna which should mean a better signal on the WARC bands and also allow some 3.5MHz operation. Andy, ZD9BV, on **Tristan da Cunha**, is said to frequent 21.313MHz between 1800 and 1900 when he keeps a schedule with KA1DE. ZD9CQ is still on from Gough Is but seems to prefer working from lists. John, PA3CXC, was expected to be in **Somalia** during August and on the air as KN4NL/T5. He may still be there. XQ0X, on **San Felix Is**, is said to be found most days between 2200 and 0400 on the lower ends of the bands. He uses a KAM modem to copy cw so it is important to give your callsign very clearly a few times to have it decoded correctly. It follows that tail-ending and trying to break into QSOs are not effective techniques !

RSGB DX News Sheet says that JA3MNP had been invited by the monk Apollo to visit **Mt Athos** together with SV2WT at the end of last month. He was taking an IC-750 and RTTY equipment with him in the hope of encouraging him back on to the air. The *Long Island DX Bulletin* says that ZA1B, in **Albania**, has a new antenna and much better signal and that he appears regularly near 14.180MHz from 2100.

DXPEDITIONS

ROGER WESTERN, G3SXW, has written to tell me that there is quite a strong possibility that he may visit **Tristan da Cunha** next month for a two week stay which he describes as "a trip of a lifetime". He hopes to be there between 8 and 23 October but the trip will probably take six weeks in total as the boat from Capetown takes ten days sailing each way because it is an Antarctic supply vessel which services weather stations and buoys en route. If successful, Roger will operate on all nine bands from 1.8 to 28MHz *on CW only*. More detailed information in next month's column.

DXPRESS says that a team of international operators will be in **Yemen** from 15 to 29 October, most likely from the city of Aden. They expect to have three HF stations using CW, SSB, and RTTY on all bands 3.5 to 28MHz. The radio equipment is being sponsored by ICOM USA and the antennas by Force 12. The callsign may be 4W1UA.

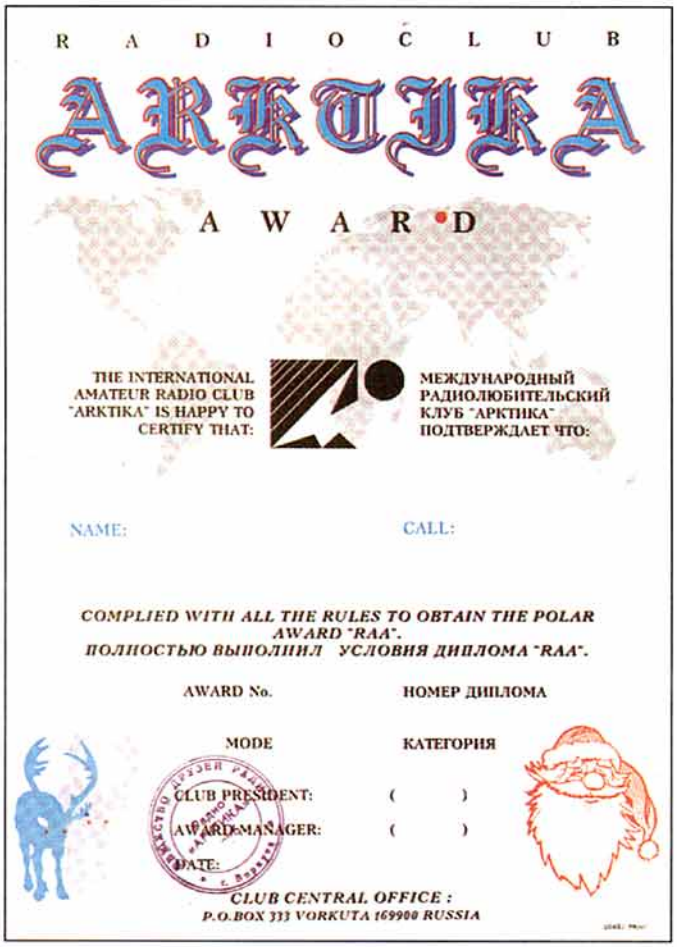
AFRICA INITIATIVE

THE AFRICA Initiative will be held in Johannesburg from 31 August to 3 September and will be attended by Cabinet Ministers from 32 African countries. IARU Region 1 will be having a small stand and there will be a special station demonstrating the practical value that countries can achieve from the amateur services. It's callsign will be ZS6AFI and a special QSL will be issued. The African Initiative Award will also be available (see *Awards*).

AWARDS

THE AFRICAN INITIATIVE AWARD

Available to all who contact ZS6AFI plus three other countries in Africa during the period 31 August – 3 September 1993. The award is free but applicants are asked to include US$3 or three IRCs to cover the postage. Requests should go to SARL, PO Box 807, Houghton 2041, South Africa.



A contest to be held on 24-30 September will help gain the Arktika Award.

RADIOCLUB ARKTIKA AWARD

Issued by the North Radioclub 'Arktika' located in the city of Vorkuta on the 67th parallel. Applicants need 67 points. For confirmed QSOs (since 24 September 1989) with members count three points, with non-members in Vorkuta two points, and with other stations located north of the Arctic Circle one point. Classes are CW, SSB, Mixed, RTTY, SSTV, QRP, and SWL. Send certified list and seven IRCs to Heinrich Niehaus, DF1EW, Baldeney 34, 4300 Essen 1, Germany. There is a special contest which runs from 0000 24 September until 2359 30 September the aim of which is to contact as many club and Arctic amateurs as possible. Five QSOs with club members or more than 30 points scored during this contest are sufficient for the award – 'Arktika' members will give their membership number. Send certified list plus US$1 to NRC 'Arktika', PO Box 333, Vorkuta 169900, Russia. For 1993 only there is a special medal (rather nice – I have seen one) for 5 QSOs with members – it costs 10 IRCs or US$5. I can provide a list of members (SASE please).

IARU REGION 3 AWARD

ISSUED BY the New Zealand Association of Radio Transmitters this is available to licensed amateurs and listeners for contacts/reports since 5 April 1982. Basic award for seven countries, silver for 15, and gold for 20. Countries are Australia, Bangladesh, Brunei, China, Fiji, French Polynesia, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, New Zealand, Pakistan,

PHOTOGRAPH: DJ9ZB

ET3DX (alias DJ9ZB) and YL Kassei who is a listener but may become the first YL licensee in Ethiopia.

Papua-New Guinea, Philippines, Singapore, Solomon Is, Sri Lanka, Thailand, Tonga, Vanuatu, plus one country from the US territories in the Pacific and either Pitcairn Is or the Chagos Archipelago. Send certified log book entries plus US$1 or two IRCs (or US $2 or four IRCs for airmail delivery) to Peter Kenny, ZL2QK, NZART Awards Manager, PO Box 108, Gisborne 3815, New Zealand.

BIRD OF PARADISE AWARD

For this you need to have had five QSOs since 16 September 1975 with P29 stations located in at least three different provinces. Send a list certified by two other amateurs (no QSLs) and US $6, or equivalent to Dave Immel, P29DK, P O Box 173, Ukarumpa, EHP, Papua New Guinea.

CONTESTS

1993 CQ WW RTTY DX CONTEST

0000 25 September – 2400 26 September

Similar to the other CQ WW DX Contests but using Baudot, ASCII, AMTOR (FEC & ARQ), or packet. I can supply photocopies of the rules (SASE please). In the **1992** contest **GU3HFN** (operated by DJ6QT) won the world single-operator section with 1,223,849 points. UK scores were as follows: (single-operator multi-band) **G4SKA** (691,899) **G0ARF** (433,273), GM3UTQ (338,242), GM0/WN1G (246,560), GW4KHQ 76,050), and (G3XVF (73,788) on **14MHz G4XDD** scored 17,228 points.

SCANDINAVIAN ACTIVITY CONTEST

1500 18 September – 1800 19 September (CW)

1500 25 September – 1800 26 September (Phone)

3.5 to 28MHz according to IARU band plans. Non-Scandinavians work Scandinavians (who are defined as Norway – LA/LB/LG/LJ, Svalbard and Bear Is – JW, Jan Mayen – JX, Finland – OF/OG/OH/OI, Aaland Is – OF0, OG0, OH0, Market Reef – OJ0, Greenland – OX, Faroe Is – OY, Denmark – OZ, and Sweden – SI/SJ/SK/SL/SM/7S/8S.) Single operator multi-band and single-operator multi-band QRP, multi-operator multi-band and listener classes. Exchanges consist of RS/T plus serial number starting from 001 and a station may be worked once on each band. Europeans score one point for each contact. Logs may be submitted on disk in the form of an ASCII file, and should be sent to NRRL HF Contest Manager, Liv Johansen, LA4YW, PO Box 142, N-7078 Saupstad, Norway. I can supply photocopies of the rules in exchange for an SASE. Thanks to GW3HCL I can tell you that UK award winners in the 1992 contest (CW) were G4UPS (57,663 points), GW3HCL (44,694), and GM4SID (29,664) in the single-operator category, and GX0MIN (14,508) in the multi-operator class. In the SSB test G4UPS scored 34,236 points and GI0KOW 13,272.

ON CONTEST

0700 – 1100 3 October (3.5MHz SSB)

0700 – 1100 10 October (3.5MHz CW)

Only contacts with Belgian and DA (Belgian Forces in Germany) stations allowed. Exchange RS/T and serial number from 001. ON and DA stations will give their club code – eg 59003 MCL. Each QSO counts three points and each club worked counts as a multiplier. Send logs to Welters Leon, ON5WL, Borgstraat 80, B-2580 Beerzel, Belgium, not later than three weeks after the contest.

PROPAGATION

THIS MONTH G8KG reports "Solar indices continued low in late June and the first three weeks of July. The provisional monthly sunspot number for June was the first to fall below 50 since February 1988 and the 27-day average solar flux continued to drift downwards for most of the period under review before levelling out at just above the 100 mark.

During the first half of July the geomagnetic field was rather unsettled but this was followed by a very settled spell with the Boulder A index down to 1 or 2. In spite of the low solar activity during this period the MUF topped 21MHz to all continents while 28MHz continued to be dominated by extensive Es conditions."

THANKS

TO ALL WHO wrote to me with information and also to the editors of *RSGB DX News Sheet* (G4DYO), the *Lynx DX Bulletin* (EA2KL), *DXPRESS* (PA3DZN), the *Long Island DX Bulletin* (W2IYX), and the *EA DX Boletin* (EA1QF). Please send everything for the **November** column to reach me no later than **15 September.** *Please note that this is very early!*

VHF/UHF NEWS

NORMAN FITCH G3FPK
40 Eskdale Gardens, Purley, Surrey CR8 1EZ

JULY WAS another rewarding month for VHF DXers and this resulted in a bigger than usual postbag. 144MHz Sporadic-E has been of good quality this summer, with openings to Greece, Portugal, North Africa and the Canary Islands. Activity at the DX end has been low. This may be because people prefer the relative ease with which 50MHz E-layer contacts can be made; it's more of a challenge on 144MHz.

REPEATERS

MEMBERS OF the Cheshunt and District ARC have built London's first ATV repeater. The project manager is Adrian Hurt, G0OJY, who gave a talk about it at the Picketts Lock event last March. By now, initial testing on site may have taken place. Donations towards the cost of the repeater and its subsequent running and maintenance would be welcome. If you would like to join the club, contact Roger Frisby, G4OAA, who is QTHR. Tel: Hoddesdon (0992) 464795.

Richard Kearnes, G7HJK (ESX), is the keeper of a couple of Essex repeaters. These are GB3TE (JO01OT) on R7 – a new QTH and channel since 2 April – and GB3CL (JO01MT) on RB9, which started on 12 February. Both serve the Clacton-on-Sea area and are of considerable use to holiday visitors. They were funded out of the proceeds of the East Coast Amateur Radio and Computer Rally, so no subs or donations are required.

Stuart Stones, G0NER (YSN), secretary of the UK FM Group (Northern), wrote that VHF repeater GB3NA (R3) has been completely refurbished. The new Tx and Rx, incorporating improved logic, were installed at the beginning of July. The UHF relay GB3SY (RB6) has also been rebuilt and may be QRV by now. For details of these repeaters and of the group, send an SASE to G0NER who is QTHR. Tel: Pontefract (0977) 620335.

The June *Newsletter* published by the Aylesbury Vale Repeater Group, carries reports on its three repeaters, GB3VA (R4), GB3AV (RB2) and GB3BV (RB1). 'VA went onto battery power on 21 March when a mains-breaker in the building tripped out, otherwise it has operated faultlessly, as has 'AV. 'BV disappeared for three days from 29 April when the site owner switched it off to attract someone's attention, having lost the keeper's telephone number! The AVRG has 162 members and the membership secretary is Mike Marsden, G8BQH, who is QTHR. Tel: Aylesbury (0296) 641783 after 6pm.

An item in the *GB2RS* News Broadcast on 1 August mentioned that the Repeater Management Group (RMG) has received applications for some 50MHz repeaters. At present there are no provisions for repeaters in the UK 6m band plan. However, the Danish society (EDR) has submitted a paper on this topic to be discussed at the De Haan IARU Region 1 Conference later this month – see page 78 in August *RadCom*. Your constructive comments on 6m repeaters would be welcome as the VHF Committee will have to weigh up the pros and cons, eventually.

BEACONS

FOLLOWING COMMENTS in the July *VHF/UHF News* about the closedown of the GB3MCB beacon on 1296.860MHz, keeper Ted Warne, G3YJX, received just *two* letters. Nevertheless, the beacon was moved from the Gas Board's mast and returned to service from the repeater site on 22 July. Ted estimates the annual electricity bill to be around £30, all paid for out of Mid-Cornwall Beacon & Repeater Group funds.

Ted Collins, G4UPS (DVN), reports a new 6m beacon in Serbia heard from 14 July. It is 4N1SIX and sends: "de 4N1SIX loc KN04OO" on FSK, followed by 4s of carrier. Ted gave the keeper's callsign as YU2IQ, name of Milo, but surely YU2 is Croatia, now using the 9A prefix – or have I missed something?

CONTESTS

THE MECHELEN CLUB of the UBA, the Belgian national society, is sponsoring a 144MHz phone and CW contest on 17 October, 0700-1100GMT. Only contacts with ON and DA stations – Belgian forces in Germany – are valid. Scoring is 3 points per contact with a multiplier for each different club worked. Usual RS(T) and serial number exchanges; the ONs and

DAs will give their club code, too. Logs should go to the club's contest manager Leon Welters, ON5WL, within three weeks; his QTH is: Borgstraat 80, B-2580 Beerzel, Belgium.

On page 16 in the May *RadCom* I gave details of the Scandinavian Activity Contests, mentioning ambiguous time information. Shortly afterwards, the official rule sheet, now entitled 'Nordic Activity Contest 1993, Open Class,' arrived but there was no mention of the times. However, in an earlier letter, SM0KAK stated 1700-2100GMT in the summer and 1800-2200GMT in the winter, summer being when the Nordic countries are on daylight saving time. The contest manager is the EDR's man Bent Poulsen, OZ1EYN, whose QTH is: Lupinvej 15, DK-3650 Ølstykke, Denmark. For details of forthcoming RSGB contests, please refer to the *Contest Classified* pages.

SPECTRUM REVIEW

THE Radiocommunications Agency (RA) is currently conducting its review of the 28-470MHz part of the radio spectrum, taking in four of the bands covered in this feature. RSGB President Peter Chadwick, G3RZP, attended a review meeting and symposium at Lords Cricket Ground on 8 July on behalf of the Society. Three points he mentioned were that: (1) the PMR folk are not interested in frequencies below 50MHz because of high noise levels. (2) There are approximately 800,000 PMR licences in the UK. (3) The average number of VHF licences per channel in the London area is 158.

OVERSEAS NEWS

GRAHAM DAUBNEY, G8MBI, has been working in Hong Kong for some while. Using his VS6YHT call on 2m, he made the first Es contacts from the colony on 6 June when he worked seven Korean stations on 145MHz FM. More HLs were worked on the 14th. He completed the first VS6 to Japan Es contact on 11 July at 0312 when he contacted JF4OUY on SSB. Seven more JAs in the 4th and 6th call areas were then worked before fade-out at 0342. The QRBs are in the 2000-2250km bracket, equivalent to London to St Petersburg or Russia's Black Sea coast. Thanks to Andy Cook, G4PIQ, and Mark Turner, G4PCS, for passing on this information.

Ian Offer, G4FDX, has been working in the USA for five years and is living in Kokomo, Indiana (EN60VL). He is QRV on 70cm and 2m and is nearing 200 squares on 144MHz. He is also on 2m EME with good power and four 18-ele Yagis; his sole UK contact up to 16 July was with G4SWX. He has enjoyed some good auroral propagation as the magnetic North Pole is much closer than it is to the British Isles. Tropo is reasonable.

Dave Sellars, G3PBV, was a regular contributor to my VHF columns up to 1986 when he used to operate from Hennock (DVN). He is now living in County Leitrim in the Irish Republic and is QRV on 2m with an IC-275H, 3CX800 PA, masthead preamp and a single 9-ele Yagi. He has available four 9-ele and four 17-ele Yagis, the latter for EME work later on. He has bought a new QTH 1000ft ASL, half way up Slieve Anierin from where he can hear every 2m repeater in Ireland; ". . . . with a whip on the car and a rather deaf old Standard C58." His Irish call is EI6HP.

MOONBOUNCE

THERE IS VERY little EME news this month. The July issue of Al Katz's, K2UYH, *432 and Above EME News* is shorter than usual due to there being only three weeks between the June and July sked weekends. Al suggests the low activity was due to a combination of low Moon declination and competing summer time activities in the northern hemisphere.

John Hunter, G3IMV (IO91), suggests that 'RA8YS' mentioned by Edward Allely, GW0PZT, last month was in fact LA8YB, who is very active off the Moon. It's very easy to miss a couple of dits when struggling to copy signals in the noise and I should have realized that there is no RA8 prefix.

The next sked weekend is 11/12 September, starting eight days after apogee. At G3FPK, moonrise is just before 0000GMT on the Saturday. The VK3UM EME Planner gives the declination as +20.5°, the signal degradation –0.87dB and the 144/432MHz sky temperatures 468/36° K. Moonset is around 1527 and Sunday moonrise occurs at 0045. By moonset around 1600, the DEC will be +15.9°, degradation –0.51dB and the sky temps 253/19° K; ie things improve as the weekend progresses.

PUBLICATIONS

THE JUNE issue of the Worked All Britain Awards Group's *Newsletter* included a note apologizing for its late delivery. The pages aren't numbered and two of them were blank. A considerable amount of space is devoted to the fund raising on behalf of the RNLI. The membership secretary is Brian Morris, G4KSQ, who is QTHR. Tel: Oxford (0865) 63696.

Dave Hardy, G8ROU, is another editor whose schedule was upset by the legendary Murphy, who caused a two weeks delay. To catch up, he produced a combined June/July edition of *The VHF/UHF DXer* and now aims to mail future issues around the 8th of each month. There are the usual band reports and the technical items include comments on power GaAsFET preamps by WA5VJB and transverter notes by G4DDK.

G4RGK mentions problems with Tonna 70cm antennas. The plastic moulding encapsulating the driven element splits after a couple of years, thus allowing water to become trapped inside. I imagine the plastic material is affected by ultraviolet solar radiation, a not uncommon phenomenon. For subscription details contact G8ROU, who is QTHR. Dave is on the DX-Cluster network, on packet radio G8ROU @ GB7HMZ.#23.GBR.EU, and on Internet E-mail g8rou@g4klx.demon.co.uk.

50MHZ

PROPAGATION

IN THE *SIX AND TEN Reporting Club's Report* for June, Ray Cracknell, G2AHU (HWR), states that June: ". . . . was undoubtedly the finest month of Sporadic-E propagation which we have experienced since the 50MHz band was returned to the amateur service in this country." He includes a table showing the daily solar flux, sunspot number, maximum Kp index and X-Ray background value, together with the number of areas worked.

Ray concludes: "It seems these results shatter many of our pet theories. Will those who have suitable computer software please do a correlation analysis of each of these indices against the number of areas worked. Even a small positive or negative correlation can be of assistance." (These monthly reports are printed and circulated by Ian Brotherton, G2BDV. The annual UK subscription is £6 and Ian is QTHR).

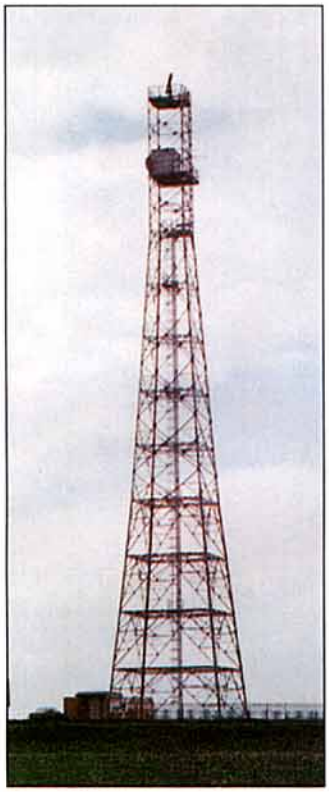
However, these are all *solar* indices. Charlie Newton, G2FKZ, commenting on the cause of Sporadic-E, pointed out: "Wind shear is the best idea we have at present, but this ignores any solar connection and cannot answer the very big openings of recent times."

For many years it has been obvious to me that E-layer propagation, particularly at 144MHz,

ANNUAL VHF/UHF TABLE JANUARY TO DECEMBER 1993

	50MHz		70MHz		144MHz		430MHz		1.3GHz		Total
Callsign	Cty	Ctr	Cty	Ctr	Cty	Ctr	Cty	Ctr	Cty	Ctr	Points
G6HKM	56	47	-	-	62	26	33	9	6	6	245
G0TRB	54	31	22	3	26	6	38	10	-	-	190
G0EHV	-	-	30	4	54	14	25	8	-	-	135
G3FIJ	1	16	24	3	41	11	22	8	1	1	128
GW6VZW	65	55	-	-	-	-	-	-	-	-	120
G8XTJ	23	32	-	-	45	9	-	-	-	-	109
GI4OWA	16	30	-	-	32	24	-	-	-	-	102
GW0PZT	-	-	-	-	65	29	-	-	-	-	94
G1UGH	11	30	-	-	39	13	-	-	-	-	93
G4OUT	-	-	32	6	39	11	-	-	-	-	88
G3UOL	2	1	-	-	59	13	-	-	-	-	75
G7EWL	11	1	2	1	36	6	7	4	-	-	68
GU4HUY	-	-	-	-	27	10	-	-	-	-	37
G6ODT	-	-	-	-	4	1	24	7	-	-	36
G3FPK	-	-	-	-	20	10	-	-	-	-	30
G7CLY	8	8	-	-	9	3	2	1	-	-	25
G3YHF	-	-	-	-	-	-	17	5	-	-	22
G1JDU	1	18	-	-	-	-	-	-	-	-	19

British counties are those listed on page 65 in the January 1993 *RadCom*; 77 in all. Up to three different stations allowed in all 12 GM regions. Do not include EI counties. Countries are the current DXCC ones plus IT9. Deadline for the next appearance is **25 September**.



GB3TE (Clacton-on-Sea) moved site and frequency on the 2nd April and is now located on the Holland Haven Radar Tower. Locator is JO1OT and the antenna is 280 feet ASL, radiating 5W ERP. Channel = R7.

results from a fortuitous combination of several phenomena. Essentially a high number of free electrons in the ionosphere, plus a mechanism – eg wind shear – to 'stir them up' to produce the conditions outlined by G2AHU on page 18 of the August *RadCom*. When the 1993 Es season is over, it would be worth our re-reading Jim Bacon's, G3YLA, definitive Sporadic-E articles in the May to August 1989 issues of *RadCom*. This year's observations may provide another piece in this fascinating jigsaw puzzle.

NEWS

G4UPS reports that the San Marino club station, T70A (JN63FW), has special permission to use SSB for the first time until the end of September. Club President T77C and I4SJZ will try to activate the station as often as possible. From Saudi Arabia, KD4MAE was expected to operate from the US Embassy from mid-July as 7Z1AB; QSL via KN4F.

The ITU has allocated the callsign block Z3A to Z3Z to Macedonia. A 6m transverter has been sent to ex-YU5DX, who is now Z31DX. Test transmissions on 50.107MHz were heard at 2031 on 15 July from this station. Z32AM will also use this equipment. The Market Reef operation on 9-12 July by OJ0/OH1VR resulted in about 150 QSOs with 19 countries. This small, uninhabited island (JP90NH) is a separate DXCC country.

ACTIVITY

In a letter dated 27 June, Emil Pocock, W3EP, wrote that trans-Atlantic E-layer propagation in June occurred on 2, 3, 5, 11-13,16, 17, 19 and 25. The best period was 11/12 when WA1OUB worked 108 stations from OX to 9H and EA8 to OZ. David Phillips, G1JDU (CHS), is a new contributor and has entered the tables. Recent new ones include UA2F/DK2ZF, F8OP, T70A, S57CC, HB9STY and TK/F5EMT.

G4UPS's five page report covered the period to 21 July. The only flat days were the 2nd and 3rd, most all others producing good Es openings to many countries. A few highlights were the OD5SIX beacon, copied at 0852 on the 8th and 1137 on the 12th and QSOs with 4Z4TT (KM72) at 1653 on the 12th and HV4NAC (JN61) at 1005 on the 16th. W1 stations were heard from 1900 on the 15th and 16th. On the 15th Ted noted: "Around 1930 hearing pings from W4DR working IK2GSO." Meteor pings from W4?

Bill Meinerts-Hahn, G3UOL (WMD), now has a 144/50MHz transverter so has opened his 6m innings in the Annual Table. Thanks to Darrell Moody, G0HVQ (GLR), Roger Betts, G0TRB (SFD), Terry Chaplin, G1UGH (SFK), Gerard Elliott, GI4OWA (LDR) and Paul Baker, GW6VZW (GWT) who sent in reports.

The Spalding and District ARS sent a copy of their log covering the 50MHz Trophy Contest on 13 June. From JO03CE, G4DSP/P (LCN) made 207 QSOs worth a claimed 3143 points with 60 multipliers. They commented: "Deep QSB on G stations. Congratulations on picking the date – we got some Es. Good event; better level of activity." Their best DX was IT9IPQ (JM78SE) at 2040km. (Note for G4DEZ. Why is there no box for the date on the Cover Sheet?)

70MHZ

EDDIE ASHBURNER, G0EHV (TWR), commented: "Not a lot to report, activity still as low as ever." He was on during VHF NFD and worked 17 stations. Ian Cornes, G4OUT (SFD), sent his list of stations worked during NFD, 37 on CW on 3 July, 36 on SSB next day. The only GM heard and worked was GM0CDA/P (IO85).

After the 18 July Es event had fizzled out on 2m at 1855, David Warr, G4RQI (YSW), QSYed to 4m and worked G0SEG. After a couple of minutes CT1WW broke in; he was running 500mW to an HB9CV antenna. The contact lasted about 10-15min with very deep QSB. I've heard nothing about any 4m permits for Portuguese stations.

144MHZ

EI6HP CAUGHT the 18 July Es opening at 1803. Dave's best DX at 2257km, was CN8HB (IM63), who was running 100W to a dipole. Other contacts were CT1WW (IN61), CT1DDN (IM58), EB7GVD and EA7GBG (IM67) and EA4CTP (IM69). G0EHV enjoyed 80min of this from 1755 and Eddie's best DX was CT1DSH (IM67). He worked three other CT1s and three EA1s.

Frank Howe, G3FIJ (ESX), added table points in VHF NFD, working into GM and GI. G3IMV has learned from another YO that YO3FBL is in KN34 and *not* KN24 as he was stating on 10 June. In the 18 July Es, G4RQI, using 25W and a 9-ele Yagi, worked EA1AFP and EA1RV (IN52), both of whom peaked S9, but QSB was deep.

Mark Holloway, G4YRY (DOR), contacted EB8ALZ and EB8BTV (IL18) and CT1BGE (IM58) in this event from 1822. From 2055, three EA8s were heard with EA8AGA worked at S1. Tropo on the 28th brought EA2AWD/MM (IN75LO) at 2059.

In the early evening of 8 July, Dave Brown, GD4XTT, had Es to HA, OK and SP and later, in a fleeting opening at 1905 he worked UA2FN (KO04). Jim Barr, GI1CET in Belfast, discovered the 18 July Es by leaving his Rx on 144.300MHz and went on to work CT1BGE, CN8HB and CN8CC (IM63), CT1WW, EA7GBG, CT1DDN, CN8ST (IM64), EA4CTP, CT1BSC (IM69), CT1TO (IM67), CT1AFS (IM68) and CT1BUN (IM59).

GI4OWA caught the 8 July evening Es to the Balkans and worked YU1LA (KN04) at 1818. Next day at 1911 Gerard contacted EA1AFP ; both openings were very short. He did well on the 18th, 2018-2100, completing with EB9OL (IM75IV), EA4CTP, EA7BYM (IM66), CN8ST, EA7GBG, CN8HB at 2361km, CT1BSC, CT1TO and CT1WW – three new countries and seven new squares.

Arlen Pardoe, GM0HUO (FFE), had an auroral SSB QSO with OY3JE (IP62) at 1708 on 2 July. NFD weekend brought a few tropo contacts with portable EIs and GMs. On the 8th, French Band 2 stations on 100MHz were coming in at 0745 and the band sustained Es propagation to France and Italy till 1930. At 1910, he heard GMs make very brief Es contacts. He heard LA6HL/TF on 9-11 July and again on the 25th, but couldn't raise Johannes.

GW0PZT (GDD) monitored Band 1 for TV all day on 18 July but saw nothing. Then at 1820 his father, GW3KJW, worked CN8HB as did Edward a few minutes later. Subsequent QSOs were with three CT1s but the real star was EB8BTV at 2889km, his best yet DX. At 2005 he contacted EA7GBG and at 2020 CN8ST. The event ended at 2104 bringing him nine CTs.

Joe Ludlow, GW3ZTH, was out portable on 27 June, mostly on 2m, though with a few contacts on 70cm. Tropo was excellent on 2m and he ended the day at 1546 having worked 18 Is, 10 HB9s, 9 DLs, 56 Fs plus 'locals' – 113 QSOs, 38 squares and 11 countries. Best DX were I5JUX (JN53CW) and F6HZL (JN23QU). He missed CN8 and EA8 which appeared via Es at 1620.

In the tropo opening on 27 June, Lyn Leach, GW8JLY (GNS), worked I2FAK (JN45) and Fs in JN25, 35 and 36. At the very end of the 8 July Es he worked S53VV (JN65) and HA8CE (KN06) between 1722 and 1737. A short opening on the 16th at 1733 brought YO2LAE (KN06). 18 July produced contacts with EB8ALZ, CT1s in IN58 and EA1s in IN52 between 1758 and 2053.

SIGN OFF

THE **NOVEMBER** deadline is **25 September** and the **December** one is **28 October**.

My CompuServe ID is 70630,603 which is also accessible via Internet as 70630.603@compuserve.com and the BT Gold mailbox remains as 76:MSX021. The fax machine is on 081-668 5582 – and there's always 'snail mail!'

VHF ARTICLES

THE EDITOR is looking for VHF articles, preferably construction projects, to help maintain a good balance of features in *RadCom*. Single part 'weekend projects' are preferred but all types will be considered.

If you are interested, write for a *Style Guide* to: Erica Fry, RadCom, RSGB, Lambda House, Cranborne Road, Potters Bar, Herts EN6 3JE, or call 0707 659015.

HF F-LAYER PROPAGATION PREDICTIONS FOR SEPTEMBER 1993

The time is represented vertically at two-hour intervals GMT for each band, ie 00=0000, 02=0200, etc. The probability of signals being heard is given on a 0 (indicated by a dot) to 9 scale; the higher the number the greater the probability with 1 meaning 10 to 19 per cent of days, and so on. Additionally F-layer openings at 50MHz and 1.8MHz are indicated by a plus (+) sign in the 28 and 3.5MHz columns, with these latter bands having a probability of 9.

Time / / GMT	28MHz 000001111122 024680246802	24MHz 000001111122 024680246802	21MHz 000001111122 024680246802	18MHz 000001111122 024680246802	14MHz 000001111122 024680246802	10MHz 000001111122 024680246802	7MHz 000001111122 024680246802	3.5MHz 000001111122 024680246802
** EUROPE								
MOSCOW	....1111...	....232221..	...25666651.	...47777873.	1.2777778984	756544445899	875211113588	+42.....25+
MALTA	....111.11..	....332222..	...26655662.	...487778851	3218777789 95	987754456899	997422223689	++4.....3++
GIBRALTAR	....	....111..1..	....3433341.	....6765674.	11.487777983	764765556899	998642223689	+++3....3++
ICELAND	....	....	.....12112..	.....443452.	47777872	532565556787	887643223568	+++3....245
** ASIA								
OSAKA	....1.....	....121.....	...24531....	...365421...	...253333331	....21..3573	351	.........2.
HONGKONG	....1221....	...1344 31...	...3565542..	...3565565 2.	...1332368 73	2.......3686	1363	.........4.
BANGKOK	...123222...	...2454442..	...3566675 1.	...3465677 3.	2...1323688 4	3.......3688	1.......1376	43
SINGAPORE	...1233321..	...3455542..	...4566676 1.	..1346567841	2...1323688 5	3.......3688	1.......1376	43
NEW DELHI	...133331...	...345552...	...4566652..	..1445567421	3121122367 75	73......3688	51......1378	2.........45
TEHERAN	...233331...	...4555553..	...1666677 62.	1.3544568852	5353112368 87	863.....3689	841.....378	5.........45
COLOMBO	...233331...	...3555553..	...4566 7872.	1.1334568852	521..2236897	72......3689	5.......378	2.........45
BAHRAIN	...2444441..	...4555663 1.	..1655678631	2.3534568863	7452112368 98	963.....3689	841.....378	+.........45
CYPRUS	...2444443..	...4666665 1.	...7888888 41	2128777889 74	7566555678 98	9863222347 99	8741....2578	5.......25+
ADEN	...3544553..	...5666775 1.	1.1655678852	3135334689 75	8552..1368 99	973.....3689	851.....378	+2.......45
** OCEANIA								
SUVA/S	....	.....111....	....1333.2..	...1344425 1.	...5542347 3.	..1531..351.	...2.....3..	....
SUVA/L	.......3..	...1.....51	11.4211..173	2216522 1.373	1137522117 41	..252...251.	...2.....3..	....
WELLINGTON/S	....	....11.....	...12442....	...3554412 1.	..1653333 54.	..1521..363.	...2.....3..	....
WELLINGTON/L	11	43	11.21.....64	2315 3.....64	223742...363	..252...153.	...2.....2..	....
SYDNEY/S	....1221....	...23432....	...466552...	...6765542 2.	..1553235562	...22...3662	.........133.	....
SYDNEY/L	11	....2.....33	11.141....65	1113521 1.174	...231..1451	.........22.	....	....
PERTH	...2433 1....	...4655 21...	...5776531..	1.1476556 31.	3111432367 52	3...1...3686	374	.........4.
HONOLULU	....	.....1..131.	....1..131.	....12..352.	...2431155 1.	..3531..22..	..22.....	....
** AFRICA								
SEYCHELLES	...3444542..	...4566764 1.	1.1555678752	4124335688 85	8541..2368 99	962.....3689	84......378	+.........45
MAURITIUS	...3555554 1.	...4666776 2.	1.1556778853	4224345689 86	8641.1236899	962.....3689	83......378	+.........45
NAIROBI	...2555664 1.	...4666787 31	2..6555789 64	5225333689 87	9752..1368 99	984.....3689	872.....378	+4........45
HARARE	...2556675 2.	...4667887 41	21.6656789 74	6326434689 97	9864111358 99	9961....2689	883.....368	+5........45
CAPETOWN	...1555676 2.	...3766788 51	2..6766789 85	52.7544579 97	9746211258 99	9973....2689	8851....368	++2.......45
LAGOS	....556777 3.	...2766788 51	32.5755689 84	6517633477 97	9967 3..1489 9	8985....1589	7862....368	4+3.......35
ASCENSION Is	....5534667 3.	....7655786 1	22..8655698 4	5511743358 97	9965 51..2699	9985 2....489	7862....168	5+3.......35
DAKAR	....4555674.	....7766786 1	11.1865568 83	4414853358 97	8867 52.1269 9	9985 2....379	7863....158	554.......25
LAS PALMAS	....3443352.	....5665574.	...1888789 82	22.3887789 95	7757766568 99	9987533335 89	8884 21..1368	++52......4+
** S. AMERICA								
Sth SHETLAND	.....255664.	3778861	2...1577888 3	4211355577 86	8755532255 68	8985 2...2246	6863.....13	354.......
FALKLAND Is	.....355564.	5777861	11.1277777 83	4413465556 86	8867532223 68	9985 3....136	7863.....14	4+4.......
R DE JANEIRO	.....555464.	7666761	11..1765578 3	4412365336 86	8866532.1379	9985 3.....48	8863.....16	+54.....3
BUENOS AIRES	.....454464.	6666761	11...776568 3	3412265445 76	8866432112 58	53.....26	8863.....4	5+4.......
LIMA	.....43243.	.....6445 51	....1165456 3	22..3254335 5	7754532 1..26	8985 31....3	6873.....1	3+4.......
BOGOTA	.....32232.	.....1545 41	3654563	22..1454335 5	7743332 1..26	8985 31....4	6873.....1	4+4.......
** N. AMERICA								
BARBADOS	.....343243.	5644651	....1764457 3	22..2653347 6	7753532..148	9985 31....16	8873.....3	++4.......
JAMAICA	.....32132.	.....53344.	1654553	21...354334 5	6632232 1..26	8985 31....3	6863.....1	3+4.......
BERMUDA	.....22132.	.....243344.	4654563	21...554347 5	7632242 11147	8975 31....15	7863.....2	4+4.......
NEW YORK	.....11111.	.....33233.	1554552	1....355446 4	6421.3221246	7974 21....14	5863.....1	2+4.......
MEXICO	.....1121.	.....3232.	254442	1.....354333	5421212 21.13	5874 31....1	2763.....	.44.......
	.....11111.	.....22232.	1444552	1....3554564	6411132222 46	7874 21....14	5863.....1	254.......
DENVER	.....1111.	.....2331 1	.....1443 32	1.....1443 32	4311..2231 13	4764 21....1	1563.....	.23.......
LOS ANGELES	.....111.	.....1432 1	.....2543 2	1.....2543 2	3211...2421 2	2564 2...1...	.363.....	..3.......
VANCOUVER	.....112.	.....1333 1	.....1333 1	.....1333 1	2111 1..2532 2	2454 21..2...	.363.....	..3.......
FAIRBANKS	.....1.1..	....1111 1221	....1111 1221	....1111 1221	1.1332 2443 2	2245 31..2311	.132.....	....

The provisional mean sunspot number for July 1993 issued by the Sunspot Data Centre, Brussels was 57.3. The maximum daily sunspot number was 80 on 4 July and the minimum was 31 on 10 July. The predicted smoothed sunspot numbers for September, October and November, are respectively: (classical method) 54, 52, 50; (SIDC adjusted values) 36, 34, 32.

SWL NEWS

BOB TREACHER BRS 32525
93 Elibank Road, Eltham, London SE9 1QJ

SINCE LAST MONTH's column, it has been decided that stations in Macedonia should now use the prefix Z3, rather than 4N5.

AWARDS

I HAVE NOT featured awards for many months. To redress the balance, here are four that I have been advised of recently. The DDIF Award can be obtained by SWLs hearing French stations in Department's 75, 77, 78, 91, 92, 93, 94 and 95. Either one, three or five stations in each will qualify you for three different classes. ten IRCs are all that is required to Dominique Bros F11ALT, 12 Rue de la Liberation, 92500 Rueil-Malmaison, France.

Secondly, how about trying for the Jubilee Medal to commemorate the 65th anniversary of the first USA-USSR radio contact. Simply log ten USSR stations and ten USA stations. One USSR station must be in Obl.065 (UB5U, UB4U, RB4U or UR0UCH) and one station must be located in the State of Iowa. Five US$ will get you this one. Send to Bill Aspin, WI8R, 188 North Mieliens Road, Munger, Michigan 48747, USA.

The third one, and the most difficult, is the ATA Award for hearing ten different stations in Taiwan. Just send eight IRCs for this award to K Hoshino, JP1RIW, PO Box 26-64, Taipei, Taiwan. If anyone is successful, please let me know as I have only heard three different stations from Taiwan in 25 years!

Lastly, there is the Tartu Award. The rules for this are a little more complicated. The full rules can be obtained from Mr T Soomets, ES5RY at PO Box 177, Tartu, 202400 Estonia.

INTERNATIONAL SHORT WAVE LEAGUE

AFTER THE mention in July, Evelyn, G0OZI, the ISWL Secretary contacted me. I was amazed to receive (from their bureau) a QSL card from a VE5 in reply to a report I sent in 1970. They never throw QSL cards away, so if any ex-members of ISWL still want to collect any old cards, drop her a line with an SASE. It seems that David Whitaker, BRS25429, is a valued member of ISWL and it was pleasing to see what he looked like after being a member for over 25 years! A more appropriate address for correspondence seems to be The Hon Secretary, ISWL, 10 Clyde Crescent, Wharton, Winsford, Cheshire CW7 3LA.

ZLs ON 80 METRES

MANY SWLS have now heard New Zealand on 80 metres thanks to the daily 3.780kHz net. This month's photograph shows those present at the annual 3.780 get-together at G4UPG's QTH in Gloucester. Stations using the net often receive SWL reports from those interested in long distance propagation on the band. For those who have not yet heard the net, I suggest that a listen at any time between 0530 and 0730 during the winter months will enable you to log your first ZL as well as hearing many of those in the picture. The net has been in existence for 20 years and some of the founder members (for example, Ted Ironmonger, G8PO) are regular participants every morning.

MORE 80 METRE DX

SEVERAL ISSUES ago, I remarked on the fine achievement of Albert Tideswell, BRS48462, of hearing 300 countries on 80m. I am pleased to say that Albert has provided more details. He has been DXing on 3.5MHz for 25 years. Having heard all DXCC countries on the HF bands, he decided to tackle something a little more difficult. He has had three receivers in use on the band - a 9R59DS, FR101 and the NRD-535D. His antennas are a 132ft long wire at only 30 feet, and a 60ft vertical. Both antennas are tuned by an ATU. Albert rightly says that DXing on 80 metres requires a lot of diligent listening because sometimes the band is very poor for DX. Indeed, he has listened long into the night on many occasions. Now that he has achieved his goal on 80 metres, he intends to try a little harder on 1.8MHz. As the sunspot minimum is with us, DXing on 1.8MHz should be quite good for the next few years - I certainly increased my current All-Time score by eight last winter.

NORTHERN LIGHTHOUSES

RADIO AMATEURS in Scotland and the Isle of Man will be activating Northern Lighthouses 28/29 August. Full detais can be found in last month's *HF News*.

A special award is available to SWLs who hear seven of the eleven stations. To claim the award log data plus £2 or 5 IRCs should be sent to P O Box 35, Prestwick KA9 1AL.

This is obviously a first, and certainly warrants some serious listening. I would suggest that 7MHz SSB is a must in trying to locate them.

VHF DX NEWS

THE Es SEASON has been bubbling along, but any 144MHz openings were missed by my reporters. Indeed, David Whitaker, BRS25429, got on the band one afternoon to find locals talking about "a superb opening to Italy". Where was David? - sunning himself in the back garden!

50MHz was quite lively with plenty of DX around, but no double-hop openings were reported this time around. Best DX was probably SV5TS on 14 July - while I was writing this! Some of the better European DX reported was CU1EZ, EH6IF, EH8ACW, EH9MH, OJ0/OH1VR, SP5CCC, T70A, YO7VJ and 9A3AT.

HF NEWS

VERY LITTLE to report this month as my reporters have deserted me! Conditions during June were rather mixed. 14, 17 and 21MHz were best for DX, while QRN made DXing at LF very difficult.

As usual 14MHz provided the most DX but 17MHz gave C56/DL7UTA, VQ9RM, 3D2WR, 6Y5EW, 8P6EM and 9K2MU. 21MHz produced BV7FL, C91AI, D2SA, J28RD, P29JA/P, ZD8DEZ and 9V1YY.

WHITE ROSE SWL CONTEST

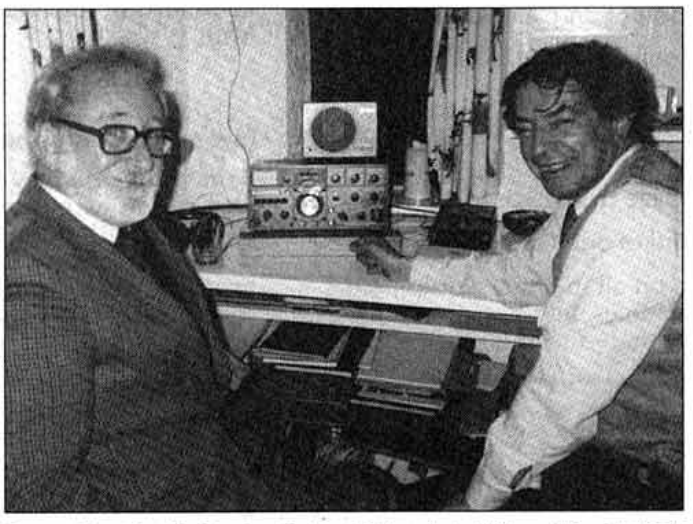
SEVENTEEN ENTRIES were received this year from seven countries including Russia and Poland. Only one entry was CW - a dying mode to the contesting SWL it seems, and only four entries were received from home shores. Propagation during the contest weekend was not good, and relatively little DX was to be heard. The poor entry may have had something to do with the poor conditions.

For next year's contest the rules will revert to a traditional low frequency bands contest - 1.8, 3.5 and 7MHz only. Inclusion of 18 and 24MHz in the last few years has shown how good these bands can be, but now we are moving along the sunspot cycle - the minimum is currently estimated to be early in 1997! - it is time for a change.

All entrants will receive a copy of the results and next year's rules will be published in more detail in due course. I must thank the White Rose ARS for their continued sponsorship of the event, and hope that it continues to attract its current level of participation to ensure that it remains in the calendar.

FINALE

NEWS AND views for the **November** issue should be received at the address shown at the top of this page by **10 September**.



George Mountford (left), a New Zealand SWL, who held the callsign ZL1AMR and SWL Arthur Miller, who used to be BRS88969, in the shack of David Whitaker, BRS25429, earlier this year.

LOWE ELECTRONICS

YES, the original "open day" is back! Make a note in your diaries, PIMs, Filofaxes, Psion Organisers, scraps of paper or the back of an envelope! Wherever you keep important information, don't forget 25th September. Yes, it is a Saturday!

As well as all the usual attractions, we'll have lots more going on for those less radio orientated so why not bring the whole family out for the day. They can indulge you for couple of hours and you can spend the rest of the day sight-seeing in and around Matlock. We'll have some special concessionary tickets on the day for some of the local attractions.

Right! That's the carrot for the family — now we've got a few for you!

1. We'll be catering for every aspect of the radio hobby, with special demonstrations covering a huge range of equipment and accessories.
2. Packet radio techniques run by DANPAC, our local Packet group.
3. Talk-in on S21 and SU21 with G4LOW run by our local radio club.
4. Free car boot sale space to sell your own gear.
5. Bargain basement full of odds and ends.
6. Super special prices on all mainline equipment, including HF rigs, mobiles, handies, antennas, PSUs, TNCs. Terrific trade-ins too!

Check our workshop

Even the workshop will be open so there's no better time to meet the biggest and best team of engineers in the country and maybe discuss some of your more technical problems with them.

We'll also be showing off our new R&D department where you might just get a glimpse of Project N and for the first time, you'll be able to visit our new receiver production unit at Cromford in the original workshop of Arkwright's Mill.

Live 'short-wave' room

Something else new for this year is the short-wave room with the world's finest receivers complete with our now famous Modemaster decoding software and Multiscan control programmes on continuous live demonstration, together with a full range of antennas, headphones and other accessories.

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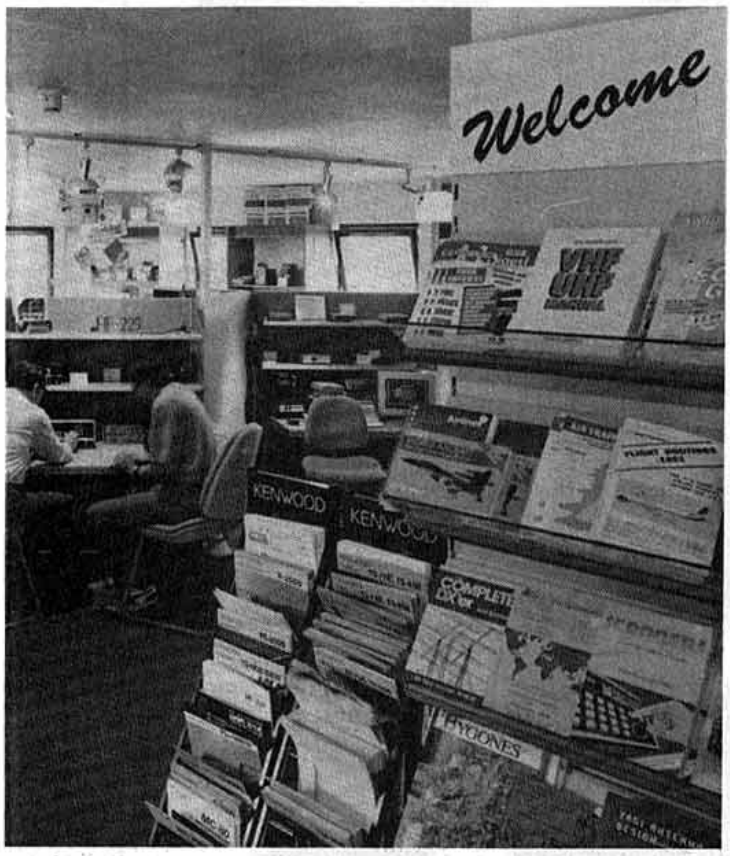
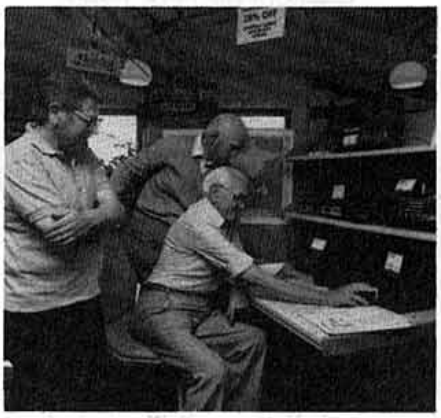
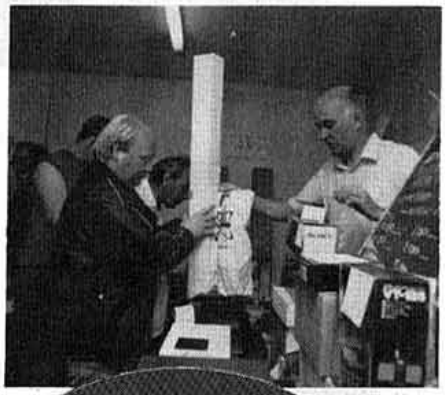
. . . HQ OPEN DAY '93



It's a great day out!



Run the rigs... Work the Dx... Bag the bargains!



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Cambridge 0223 311230
Bristol 0272 315263
London-Heathrow 0753 545255
Newcastle 0661 860418

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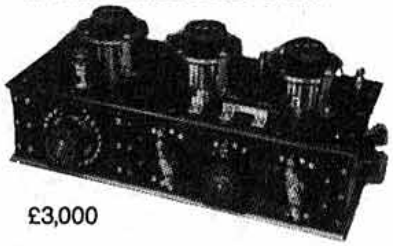
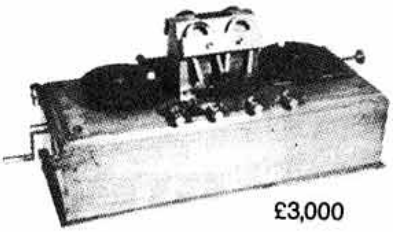
SOME EXAMPLES OF TYPES AND PRICES PAID

MARCONI MULTIPLE TUNER



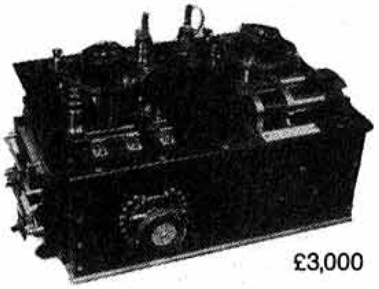
£3,000

MARCONI MAGNETIC DETECTOR



£3,000

MARCONI VALVE RECEIVER



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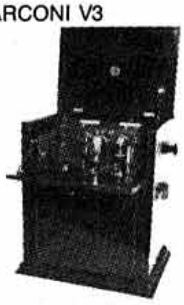

£900

PHILIPS

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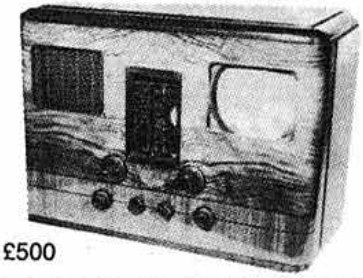
EKCO

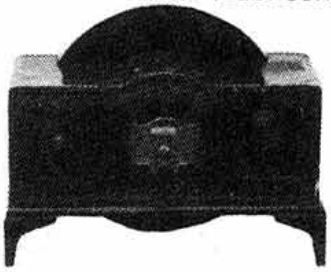
£250

HMV MARCONI TELEVISION



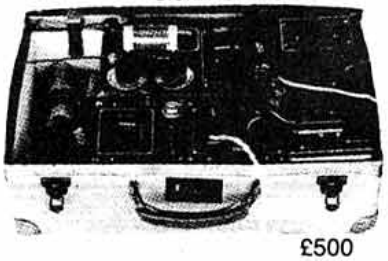
£500

BAIRD TELEVISOR



£2,500

S.O.E. SPY SET



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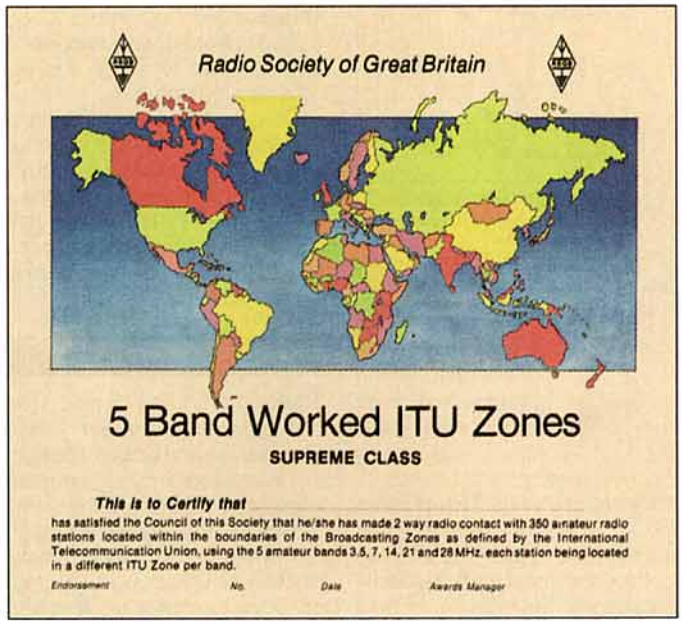
ALL EARLY WIRELESS/TELEVISION SETS WANTED, ALSO HORN GRAMOPHONES/PHONOGRAPHS. MR. YATES, THE HEWARTHS, SANDIACRE, NOTTM. NG10 5NQ. TEL. 0602 393139 OR 0860 362655 ANYTIME.

JOHN HALL, G3KVA
Corfe Lodge, Ipswich Road, Long Stratton, Norfolk NR15 2TA.

● There is some confusion about the position in Yugoslavia and the former USSR so I show below the addresses we are currently using to send QSL cards to those areas. On the former USSR situation the position is as follows:
Ukraine (UB UT RG RT RY) WRL QSL Bureau, Box 56, Kiev 1 252001 Ukraine.
Byelorussia (RC/UC), PO Box 469, 220050 Minsk.
Uzbekistan (UI), PO Box 73, Tashkent 700100
Kazakhstan (RL/UL), Box 112, Karaganda 470055
Komi Republic (UA9X UV9X UW9X UZ9X RA9X RV9X EX9X R9X RW9X RZ9X EZ9X EV9AX UA7OX), PO Box 1247, 167001 Syktyvkar.
Estonia (ES) Eran, PO Box 125, EE 0090 Tallinn.
Lithuania (LY UP), PO Box 1000, Vilninn 2001.
Latvia (YL UQ), PO Box 164, Riga 226098.
All other cards go to PO Box 88, Moscow
Yugoslavia (YU 4N Z3), P Filipovic (YT1WW), PO Box 48, 11001 Beograd Yugoslavia (Serbia).
Croatia (YU2 9A T9), HRAS Dalmatinska 12, PO Box 564, 41000 Zagreb.
Slovenia (YU3 S5), ZRS Lepi Pot 6, PO Box 180, 61000 Ljubljana
Slovak Republic (OM OK3), PO Box 1, 852-99 Bratislava

AWARDS

ANOTHER RSGB AWARD to try for is the 5-Band Worked ITU Zones which is available in Five Classes. Licensed amateurs should produce evidence of having effected two-way communication since 15 November 1945 with the requisite number of land-based amateur radio stations located in the 75 ITU broadcasting zones and using the five bands 3.5, 7, 14, 21 and 28MHz. Each station contacted should be in a different ITU zone per band. The five classes are as follows:



Supreme: 350 Stations
Class 1: 325 Stations
Class 2: 300 Stations with a minimum of 50 on each band
Class 3: 250 Stations with a minimum of 40 on each band
Class 4: 200 Stations with a minimum of 30 on each band

Successful applicants get a certificate for each class and, in addition, there are handsome plaques for those who achieve Class 1 or the Supreme Class.

Applications should be sent to RSGB HF Awards Manager, Bill Ricalton, G4ADD, 4 South Road, Longhorsley, Morpeth, Northumberland, United Kingdom NE65 8UW.

See pages 3 and 4 of the current *RSGB Call Book* for more details.

● Clarification is needed on how to activate the **Corsair 2** Keyer Memory programme. Any one able to help please contact Joe, G0JOE, QTHR or tel: 0223 316608.

● G8JM is trying to find a supplier or other source for the original '**catswhisker**' needed to restore an old crystal set. All expenses will be reimbursed. Anyone able to help please contact G8JM, QTHR.

● Michael Stott, G0NEE, wants any information manual/circuit diagrams for the Racal **Minical** (Minical SSB packset type **TRA 6929X**) by Racal Communications Inc, Rockville, Maryland. Information to Wellview, 12 Castle View, Ovingham on Tyne, Northumberland, NE42 6AT.

● Information on how APs CDs and SDs were compiled and numbered. APL, ACOS, COS what happened next? If anyone can help, contact Phil Racher, G8MQJ, QTHR or tel: 0483 572653.

● Eddystone **valve holders** wanted, Brown 7 pin round, three hole mounting. Information to Bernard Litherland, G4IMT, The Old School House, North Wraxall, Chippenham, Wilts, or tel: 0225 891254.

● Any information on the successful conversion of a **Yaesu FT101(B)** to 6146 valves (from 6JS6C). Contact Ian, G4CVL, with any circuit details or advice at QTHR or tel: 081 894 3961.

● Phil, GU0SUP, needs instructions for a AEG (AEC) twin SWR/Power Meter, Model **SWR-50A**, eg a photostat copy, of the user guide. He's willing to reimburse any costs. Contact Phil on 0481 718002 (answer phone).

● Wanted: Circuit diagrams and/or Service manuals for two Oscilloscopes; **Tektronix 561A** Main frame, 3A1 Vert Dual Trace Amp, 3B1 Delayed Sweep Triggered Time Base. Also **Telequipment D38** Oscilloscope Main Frame, Dual Trace Amp Type V4, Dual Sweep Time Base S2A. Any expenses will be reimbursed. Information to G8ZLH, QTHR or tel: 0202 570894.

● Don Still, G0OOC, is trying to contact old boys who trained at the Training Ship ***Vindicatrix*** during its life at Sharpness in Gloucestershire, to help organise a reunion of Merchant Navy personnel who are now radio amateurs. Anyone interested reply to Don at QTHR with a SASE for a reply.

● Harry, G4FEQ, needs a circuit diagram/manual for a **Plessey** 450MHz Transceiver Type 630/1/31802/002 and in particular the PA, type 630/1/33632. He will pay costs or return information after copying. Contact him at QTHR or tel: 0977 552862.

● Andrew, G1HBE, wants to contact anyone interested in a **'Home Brew' net**, for a 'real radio' discussion. If you use home-constructed VHF and up, Tx and/or Rx around the North East Cheshire area write to G1HBE, who is QTHR.

● Peter, G4PLW, needs a manual or any other information for **R Signals WS53**. A large heavy Tx with 2 x 813s mounted on the front (*not* to be confused with Canadian 19 Set Mk3.) All expenses will be paid. Phone 0438 871350 or 871398.

● G3RDG is trying to find manual/circuit diagrams for a Philips Oscilloscope model **GM5601**, an all valve type, mostly ECF80s. The 'scope was working normally and suddenly the trace vanished. A spot can be seen immediately after switching off. Any help welcomed, all expenses reimbured. Contact Ken, G3RDG, QTHR or tel: 081 455 8831 any time.

● Angie, G0HGA, is trying to trace any one who knew **Eric John Ayers**, her Uncle, who served in the RAF from 1939 as a Wireless Op and as aircrew W/Op until mortally wounded in 1940, in or over France and was taken back to Dover in a boat where he died soon after from his wounds. He was born in 1919 in Northampton, but the family later moved to St Albans. His sister (Angie's mother) says he was always messing about with radios, but if he was licensed no one knows any details. All letters will be answered/acknowledged. Contact Angie on 0438 362040 or write QTHR.

● Dave, G1XDK, needs a **Philips in-car hi-fi** circuit diagram/owners manual plus a Remote Unit, possibly originally fitted to a Renault 25 and others as an option. The remote control unit fits into the dashboard, and has six buttons and a display which allows access to the radio section of the main unit. Any information please to Dave on tel: 0553 761943.

NOVICE NEWS

MRS ESDE TYLER, G0AEC
43 Nest Est, Mytholmroyd, Hebden Bridge, W Yorks, HX7 5BH

ALL INSTRUCTORS have done a sterling job since the Novice licence was introduced – bringing many new voices and Morse signals onto the bands. Tributes from individual Novices have reached me expressing their appreciation but for the most part students' successes have been reward enough.

The Training and Education Committee (TEC) has decided to award a *Certificate of Merit* to show their appreciation. The first recipients are as follows: G0BQC, G0CBM, G0GRF, G0HQK, G0NEE, G0OIO, G4JOV, G3VWK, G4MLL, G4OBE, G6MCB, G6ZKQ, G7DGW, G8HYE and G8VHB.

These instructors have led more than 20 novices successfully through the course during the past two years, and others are hard on the tail of the leaders. However, congratulations to you *all* – whether you feature on this list or not – your dedication and commitment is truly appreciated.

BEYOND THE 2

MANY NOVICES progress to a full amateur radio licence soon after achieving that first goal. Without the Novice step on the ladder, the giant stride seems daunting without at least some related learning. This item is about that next step and Alan, G0EGX, tells the story.

When Keith, his son, was twelve he followed in father's footsteps and embarked on the RAE course under the expert guidance of Frank, G3FIJ, of the Colchester Radio Club and Alan looked at Frank's record. It is impressive. Between 1956 and 1979 when the paper became multi-choice, over 300 students had a licence – thanks to Frank. Since then, up to the time of writing, 764 more candidates have taken the RAE exam with 539 full passes and 174 referrals – that is one paper passed. Of these, most passed the examination at the next attempt. The age range of these new amateurs was twelve to 75. Over a period of 35 years more than 800 amateur licences have been gained in North East Essex – and beyond– due to Frank and his colleagues at the club.

Congratulations to Frank – and thanks to Alan for the information. Keith? He passed and on his fourteenth birthday he took Alan's old callsign – G1NTY. Welcome aboard, Keith. Are there any more success stories out there waiting to be told?

CLASS OF '93

JOHN, GI7LTF, sent this Carrickfergus Amateur Radio Group news and adds a tribute to the Instructors for their commitment and dedication to the class.

With another course this year, all new students have a reputation to maintain! If you know anyone in the Carrickfergus area who would like to become a Novice, enrolment starts on 7 September at Downshire School. Or for further information – concerning Morse classes too – ring Club secretary Gavin on 0960 351807.

SPONSOR A BEGINNER

IN APRIL a letter arrived from Mark in Kenya. He said he was seventeen and interested in amateur radio – especially in constructing his own equipment. Keen to know more, he wrote to anyone who may help or advise, saw my address in a past issue of *RadCom* and included me on his mailing list. He also asked if any amateur – especially Novice – would write to him.

I sent him some literature and passed his address to Emma, 2E1BVJ, who also wrote to him. When he replied, Emma's dad, (Richard, G3UGF) found Mark's approach and interest closely matched his own when he was much younger. Richard told Todmorden ARC members of his experiences in amateur radio – from first seeing an amateur station in action to the present day – when he is helping to instruct Novices at Rishworth School. He knew well the frustrations in not finding anyone who could help, the failed experiments and the pure joy when things went right. Richard wondered if the club could do anything to help Mark. The response from members was well up to expectations.

First, a copy of *RadCom* was sent to him. Second, we took out a subscription sponsoring him for the RSGB's *D-i-Y Radio* magazine. Thirdly, John, G0BXO, Membership Secretary of the G-QRP Club promptly offered further help. He sent him a copy of *Sprat* (the quarterly magazine of the G-QRP Club) and gave Mark the address of the Radio Society of Kenya so that he could make a more local contact.

Mark replied immediately. He is awaiting a response from the Kenya Society, and tells us that there is another pupil (Paul) who is interested. Hopefully, each will encourage the other and they will progress together.

I wonder if there are other young hopefuls who could be helped? Are there any amateur radio clubs – or individuals – who are willing to pay the *D-i-Y Radio* subscription for them – if we can find them? As Novice involvement grows, perhaps *you* know of someone who would really benefit and perhaps experience the pleasure that you have felt. If any reader has any thoughts, ideas or suggestions, please write to me at the address above and I will do my best to coordinate a system which could have far-reaching results.

KIDLINK REVIEWED

DURING THE recent Kidlink event many contacts were made and many youngsters had their first taste of radio with a brief contact with an amateur or another youngster.

The best results came on the Thursday when a group of UK school and club stations met. The youngsters showed few signs of microphone shyness and had obviously thought about the world of their future. A great deal of preparatory work had gone into the event's preparation.

Richmond School (GX0RYS) reported that contacts were made on the Friday – including one with Iceland. Virtually everyone wanting to speak did so although many were content to just listen. Over 100 visited the school club room for the first time to see what was going on, with several new members joining. The school amateur radio club has a very good track record with two of the Richmond Novices – Phil, 2E1AOJ, and Chris, 2E1ANS, achieving very high marks in the December RAE. Very well done – but that is not all. John, 2E1AJF, sat the May paper and there were two more candidates for the June NRAE with three more aiming for September.

Newminster School (GX4YPT) made about forty contacts from the Isle of Lewis to Truro on the Thursday including seven other schools.

Scarborough College (G0RCS) agreed that Thursday was the most successful day when 42 children spoke to five other schools and several foreign stations were contacted.

GB2MSR

ONCE AGAIN, some 200 scouts and leaders of varying grades and ages assembled at Ballalough, Isle of Man for their annual Scout camp. Denys, GD4OEL, set up GB2MSR on the site and contacts were made with many stations around the world with Scouts passing greetings messages between the UK and Canada and USA.

The weather was kind and the event was held in the open air. The newly initiated youngsters who had never had contact with the hobby before found it very exciting. With a brief exchange across the Atlantic Ocean as a very first experience of the hobby, to call the experience exciting would be an understatement.

The Isle of Man Post Office has had postcards printed from a series of stamps designed to commemorate various aspects in Manx history. They generously gave some of the cards to be used as QSL cards – which then gained a cryptic message on the back before being sent to radio contacts made. So, to receive one of these unusual QSL cards listen for GB2MSR.

Instructors and students at Carrickfergus. Gavin, GI0GMG; Ian, GI0JPR and Marion, GI0RSH, have ensured a 90% pass rate in the NRAE for their students so far this year.

THE THREE POINTS OF THE KENWOOD TRIANGLE REPRESENT ADVANCED TECHNOLOGY, QUALITY AND STYLE

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BUCKINGHAMSHIRE
Photo Acoustics, 58 High Street, Newport Pagnell. Tel: 0908 610625

CAMBRIDGESHIRE
Lowe Electronics, 162 High Street, Chesterton, Cambridge. Tel: 0223 311230

DERBYSHIRE
Lowe Electronics, Chesterfield Road, Matlock. Tel: 0629 580800

South Midlands Communications, 102 High Street, New Whittington, Chesterfield. Tel: 0246 453340

DEVON
Reg Ward & Co, 1 Western Parade, Axminster. Tel: 0297 34918

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Lowe Electronics, 27 Gillam Road, Northbourne, Bournemouth. Tel: 0202 577760

ESSEX
Coastal Communications, 19 Cambridge Road, Clacton. Tel: 0255 474292

Waters & Stanton, 22 Main Road, Hockley. Tel: 0702 206835

Waters & Stanton, 12 North Street, Hornchurch. Tel: 0708 444765

EIRE
Intronic Ltd, Windsor Hall, Glounthaune, Cork. Tel: 010353 2135 4422

HAMPSHIRE
Nevada, 189 London Road, North End, Portsmouth. Tel: 0705 662145

South Midlands Communications, S M House, School Close, Chandlers Ford Industrial Estate, Eastleigh. Tel: 0703 255111

HUMBERSIDE
Peter Rodmell, Field Head House, Leconfield. Tel: 0964 550921

KENT
ICOM UK, Sea Street, Herne Bay. Tel: 0227 741741

Lowe Electronics, "The Corner House", Chatham Road, Sandling. Tel: 0622 692773

LONDON
A R E, 6 Royal Parade, Hanger Lane W5A. Tel: 081 997 4476

Radio Hamstore, 11 Watford Way NW4. Tel: 081 202 0073

Martin Lynch, 286 Northfield Avenue W5. Tel: 081 566 1120

MERSEYSIDE
Amateur Radio Communications, 38 Bridge Street, Newton le Willows. Tel: 0925 229881

MIDDLESEX
Haydon Communications, 132 High Street, Edgware. Tel: 081 951 5782

Lowe Electronics, 223 Field End Road, Eastcote. Tel: 081 429 3256

NORFOLK
Eastern Communications, Cavendish House, Happisburgh. Tel: 0692 650077

NORTHUMBERLAND
Lowe Electronics, Newcastle Airport, Woolsington. Tel: 0661 860418

NORTHERN IRELAND
GM Electronics, 1 Evelyn Avenue, Belfast. Tel: 0232 671876

Tyrone Amateur Electronics, 44 High Street, Omagh, County Tyrone. Tel: 0662 242043

NOTTINGHAMSHIRE
R A S Nottingham, 3 Farndon Green, Wollaton Park. Tel: 0602 280267

SCOTLAND
Lowe Electronics, Cumbernauld Airport, Cumbernauld, Strathclyde. Tel: 0236 721004

Jaycee Electronics, 20 Woodside Way, Glenrothes, Fife. Tel: 0592 756962

WEST MIDLANDS
Dewsbury Electronics, 176 Lower High Street, Stourbridge. Tel: 0384 390063

Radio Hamstore, 963 Wolverhampton Road, Oldbury. Tel: 021 552 0073

South Midlands Communications, 504 Alum Rock Road, Birmingham. Tel: 021 327 1497

Ward Electronics, 422 Bromford Lane, Birmingham. Tel: 021 328 6070

WEST SUSSEX
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YORKSHIRE
Lowe Electronics, 34 New Briggate, Leeds. Tel: 0532 452657

South Midlands Communications, Nowell Lane Industrial Estate, Nowell Lane, Leeds. Tel: 0532 350606

Alan Hooker, 42 Nether Hall Road, Doncaster. Tel: 0302 325690

WALES
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KENWOOD

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Contest Exchange

ANDY COOK, G4PIQ
Fishers Farm, Colchester Road, Tendring, Clacton-on-Sea, Essex, CO16 9AA. (Packet: @GB7MXM)

AS FAR AS I am concerned, one of the major sources of trauma for the year (VHF Field Day) is now out of the way! Getting all of the hardware to the site and making it all work can be a stressful experience as any of the members of my group could testify. It's truly amazing how easy it is to suffer a momentary loss of one's cool after discovering a small problem such as one of the rotator cables not having a plug on its end, after the tower has been wound up, and when you haven't a clue which pin is which. It becomes even more explosive when the amplifier PSU simply refuses to supply any screen volts, the tower appears to have a bent section so it won't go to full height and even getting it half way up exhausted three people in the process, the rotator control box appears to have died anyhow, and the masthead pre-amp was almost put up with an intermittent in one of its cables. And I promise you, all this, and much much more really happened to us! You will be able to read all about everyone's exploits in a few months time when the results are published.

CQ OR SEARCH?

WHEN OPERATING in a contest, always keep it in your head that making QSOs, making the right QSOs, and making and logging them accurately is what it is all about. Everything else, like being loud, putting up big antennas, working that station on the south coast of France on 70cm is simply a means to an end. One of the first decisions you need to make is whether you are going to call CQ, or whether you are going to 'search and pounce'. If you are intending to put a reasonable entry into the contest, you will need to spend a proportion of your time doing both. What exactly this proportion is depends on how monstrous a signal you have, whether the contest is a multiplier event, whether you are single or multi operator, what conditions are like, what activity is like and so on.

A basic rule is that, the louder you are, the less time that you have to spend searching the band since most people will come to you. However, in every contest, there are periods when the QSO rate drops, and you do need to consider whether you could be achieving a better rate by scouring the band looking for QSOs. To make this decision you do need that key piece of information – the rate at which you are making QSOs. I find it remarkable how difficult it is to gauge that factor accurately without some form of external metering. Pressures such as heavy QRM can make it appear that you are making very few QSOs, but in reality you may well be doing OK. Alternatively, it may be Sunday morning, you are tired, but working people at quite a regular rate you think; however, your actual rate may be only twenty QSOs per hour.

Happily, technology comes to the rescue in the shape of computer logging packages, most of which have a display of QSOs/hour for the last 10 and 100 QSOs. Incidentally, these displays are really useful for helping the operator to keep motivated and move things along when he has a pile-up. There is nothing quite like getting the last-100 QSO rate up above 200/hour for getting the adrenaline flowing.

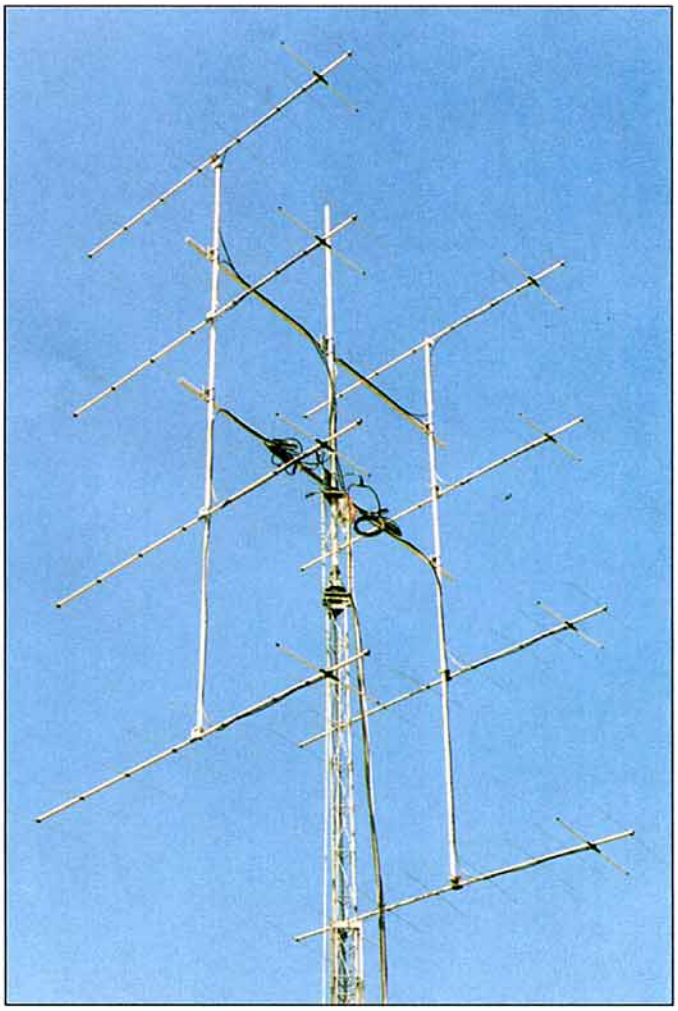
So, you have identified that your rate has dropped, and decided to take a look around the band for people who you have not worked. This implies that you have a list of stations worked which you can very rapidly check as you tune the band. This is known as a check-log or dupe sheet, and there are a number of ways of implementing it. If you are logging on a computer, once again the problem is already solved for you since all packages have a facility for typing in all or part of a callsign and checking if it is a duplicate or not.

If you are forced to a low-tech solution, the normal approach is to have a large sheet of paper – preferably A3 size, with two rows of at least 13 columns, marked with letters A-Z. As you make QSOs, you do not only enter them into your main log, but also onto this check log, placing the callsign into the appropriate column according to either the first or last letter of the suffix (excluding /P, /M, /A endings). So, G4PIQ goes in the 'Q' column, and G4MRS/P goes in the 'S' column. This gives you something which you can quickly check.

While tuning the band, do it carefully, and, if you hear someone you have not worked, but who is engaged on a time-consuming difficult QSO, make a note of the frequency and come back to them rather than hang around. Watch your QSO rate while tuning as well – if and when it drops much below what you achieved calling CQ – get back to calling. At VHF, in a 24-hour type contest, you can probably productively make a small number of tuning-the-band visits. At HF in a similar length major contest, you may well be able to make more since the general level of activity is higher, and propagation of course changes as the day goes by.

None of these guidelines is at all hard and fast, and the real answer only comes with experience of that particular contest since they will all require different tactics. Operating procedure is a matter of personal preference, but I think some key points are as follows:

1) When you are calling CQ – remember that you are trying to entice people to call, so sound interested – it may well be six in the morning and you haven't eaten or slept for the last 24 hours, but don't make it sound like it! Also, do use phonetics when you are calling – there is really no point in not doing so.
2) Don't leave too long a pause between CQs – no more than four seconds preferably. Often when I have been tuning I have come across the end of a CQ call where I did not catch the callsign, and have tuned off again because they didn't call CQ again within 10 seconds. Short times can seem an eternity when you are under pressure in a contest!
3) When you make a QSO, keep it fairly business like – don't repeat the information more than twice unless signals are really weak – once should be good enough if it is given slowly and clearly first time.
4) After you have all the information you need, thank your QSO partner and call QRZ – there may well be other stations waiting, and the longer you take the less likely they are to hang about. On that front, if more than one station replies to your CQ go back to one, and ask the other(s) to standby – most times they will.



G4WFR's 8 x 9 el F9FT makes an excellent 2m contest system with good gain, a wide horizontal beamwidth, and useful sidelobes!

Novice Note Book

IAN KEYSER, G3ROO
Rosemount, Church Whitfield, Dover,
Kent CT16 3HZ

HANDS UP THOSE who admit to having clipped a battery on the wrong way round! I would hazard a guess that even if we have not done it ourselves we know of someone that has 'reverse poled' a piece of electronic equipment. This is very easily done, especially when using battery equipment in the field as we are usually rushing to set a station up. If lady luck is on our side the designer has thought of the danger and built in some form of protection device. So either no damage is caused or a fuse is blown. In home brew equipment we often don't bother or decide that we must do it sometime . . . . and never get round to it!

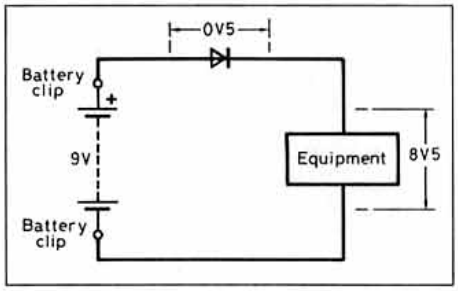


Fig 1: Simple series diode protection.

POLARITY PROTECTION

THERE ARE SEVERAL ways that we can protect our equiment for as little as a few pence, even the most sophisticated protection will cost little more that a pound or two if we use new components.

The simplest method of protection is shown in **Fig 1**. It consists of a diode in series with the battery supply lead. If we think of the action of the diode we'll remember that it will only allow the currrent to flow when the anode (to the left of the arrow head in the circuit diagram) is more positive than the cathode (bar). In Fig 1 the current from the battery positive terminal will flow through the diode, then through the equipment and back to the battery negative terminal.

At first we might think that this is the perfect KISS (Keep It Simple, Stupid) solution, however, there is a drawback! When current flows through a diode a voltage is developed across it, known as the 'depletion voltage'. Depending on the material used to make the diode, this can be between 0.2 and 0.6 volts. Because silicon diodes are common, cheap, and freely available for a few pence, it is almost certain that they are the devices we will use. They will cause a voltage drop of about 0.5 volts, so a 9 volt battery with a silicon diode will only present 8.5 volts to the equipment. In many cases this is fine as the equipment will function perfectly well way below this figure.

PROBLEMS RECTIFIED

IN THE SITUATION where the voltage drop is important we can still use a diode and a fuse to protect the equipment as in **Fig 2**. Here you will notice that the diode is connected across the battery via the fuse but because the cathode of the diode is connected to the positive terminal of the battery and the anode is connected to the negative one, no current will flow. If we inadvertantly connect the battery the wrong way round current will flow freely through the diode and the fuse will blow. The rating of the fuse must be sufficient not to blow due to the current drawn by the equipment and a suitable value would be about one and a half to twice the peak current drawn for low current equipment.

In both these protection circuits the diode must be selected to be able to cope with the current that is likely to be drawn through it. For circuits up to 1 amp consumption in Fig 1 a diode of the 1N4000 series will be suitable, the voltage rating is of no importance in this circuit. In the Fig 2 circuit the diode must be able to cope with the surge of current that will flow while the fuse blows. This only takes a few milliseconds and it will *usually* be safe to use a 1 amp diode such as a 1N4003 for fuses up to ten amps, for 20 amp fuses use a 6 amp MR752. For 100% safety a fully rated diode should be used for either circuit.

HIGHER CURRENTS

A CIRCUIT WHICH overcomes these problems is shown in **Fig 3**, but this is more suitable to high current equipment being run off car batteries as the relay consumes some power from the battery while in use. For 12 volt supplies, Relay RL1 needs to have a 12 volt coil and a contact suitable for the current being drawn by the equipment. The two diodes are small switching diodes such as 1N4148. D1 must pass sufficient current to energise the coil of the relay and D2 is protection to absorb the back EMF produced by the collapsing magnetic field when power is removed.

You will nearly always see diodes across relay coils and in some cases they are actually built into the relay itself. The relay can be mounted on the back of the equipment where the power comes in and, providing the polarity is correct, D1 conducts and the relay will energize. The relay contacts will then switch the supply to the equipment. If the supply is inadvertantly connected the wrong way round D1 will not conduct, the relay will not be energised and the equipment will remain isolated from the supply.

A nice feature of this little circuit is that a switch can be included at point 'X' and mounted on the front panel of the equipment as an on/off switch, its current rating need only be suitable for the relay energising current and so only light weight wires need to be routed through the equipment.

BUILDING BRIDGES

THE FINAL CIRCUIT offered is a diode bridge **Fig 4**, and with this circuit the battery can be connected either way round! If the top of the bridge is connected to the battery positive and the bottom connected to the battery negative D1 and D3 will conduct to supply the

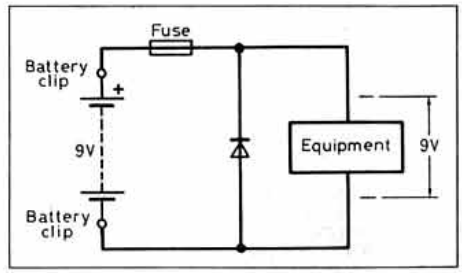


Fig 2: This arrangement avoids a voltage drop across the diode.

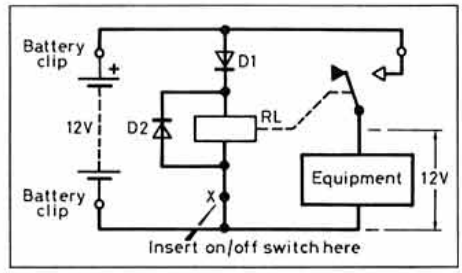


Fig 3: A relay is useful for higher currents.

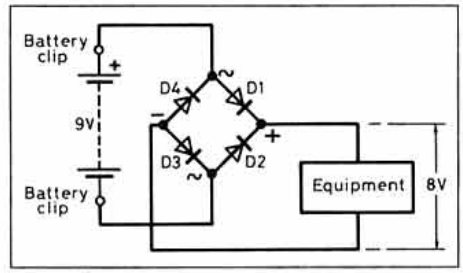


Fig 4: With this arrangement the equipment will still work with the battery reversed.

correct polarity to the equipment, D2 and D4 will not conduct. If the battery is connected the other way round D2 and D4 will conduct but D1 and D3 will not, maintaining the correct polarity! Neat, but two problem arise with this circuit. Firstly there are two diode drops, causing only 8V across the gear for a 9V battery and secondly the battery can only be used for the one piece of equipment as diodes in the bridge will be shorted under some circumstances. Nevertheless a useful circuit to have in your notebook.

All these circuits are useful somewhere, you will come across them all, depending on the quality and cost of the equipment. Japanese 'black boxes' use Fig 3 extensively, whereas Fig 1 and Fig 4 are usually found in home brew projects. The bridge will also often be found where low cost is important but where a 'sure fire no knowledge' option would be an distinct advantage. I have seen this included in expensive baby alarms and the like. Simple inclusion of these circuits can save money and many hours of fault finding after a disaster caused by a moments recklessness!

Finally, have you any ideas? We always wish to include your ideas in this column.

RADCOM SOFTWARE REVIEW

Super-Duper Contest Log

Reviewed by Bob Whelan, G3PJT, & John Jones, G4PKP

COMPUTER LOGGING for contests is here to stay (*RadCom*, Feb 1993, p65). Although the idea of operating the rig and a computer in the rush and tumble of a contest might seem a daunting prospect it turns out in fact that the computer really does pick up the drudge part. It will track the duplicate QSOs (dupes), send the repetitive CQs and exchanges as well as preparing the final paperwork.

But most programs do more than this, they help spot the missing multipliers, they prod you to keep the QSO rate up, they help you send accurate CW and banish illegible scrawls on coffee-stained bits of paper. The RSGB, in common with many other contest organisers, now accepts a computer disk log as an entry, together with a paper Summary Sheet and Declaration. The K1EA package, CT, is well-known in contesting circles but has the limitation that it really only copes with the big US contests and is not very flexible for most of the contests sponsored by the RSGB and other national societies.

SUPER-DUPER

PAUL O'KANE, EI5DI, has now developed Super-Duper (SD). This is one of the first commercially available contest logging packages flexible enough to handle all of the RSGB contests including Commonwealth and the new IOTA contest as well as the ARRL and CQ contests. And it only costs £20.

The most important feature of SD is that it is a comprehensive but straightforward program. It is easy to learn and build up a good degree of skill so that the benefits really can be appreciated by the new user and contester. SD supports single and multi-operator contests.

SYSTEM REQUIREMENTS

FIG 1 DESCRIBES the system requirements for SD, and these are modest. Almost any IBM-PC, PC clone or laptop can run SD. The CW interface is based on the serial port and should be connected in parallel with the manual keyer - in the event of errors it is often quicker to correct by hand and enter the call in the computer later. SD does not support a DX Cluster interface. DX Cluster support is not permitted anyway for single operator RSGB contests. It can be configured for both mono and colour displays.

SD IN OPERATION

IN SETTING UP FOR a contest SD prompts for contest type and details of the main operator (the licensee) and the keying interface if CW. The program then displays the main logging screen (Fig 1) with the cursor in the callsign field. After you have entered the call of a station SD automatically checks for dupes and flags the details of any previous QSO. It is up to you whether you reject the QSO or log it anyway (usually quicker than arguing!) Either <enter> or <tab> moves between fields, SD writes immediately to disk when all the fields are complete. The program sends a different audible warning for a dupe, a good QSO, a multiplier or if the station has been worked on another band. This is an excellent and, we believe, unique feature.

Everyone makes mistakes when logging. The question therefore for any program of this type is whether it has features to help. SD does. To delete an individual field, use <esc> or <-> to delete a complete QSO. If you delete by accident, hit the key again and the entry reappears! To take care of the '2 letter brigade', type in the two letters followed by a full-stop, and SD pops up a window of possible calls already in the log and positions the cursor at the front to wait for the prefix.

The excellent, fast dupe checking features a very fast partial suffix and prefix routine and listing of QSOs by callsign.

SD allows the operator to change from always 59(9) to exchanging real (?) reports, simply by entering 'RST' in the callsign field. The F1-F6 function keys select displays of QSO rates, stations worked on other bands and multipliers worked (F9), but most of the important information is on screen at all times. Multipliers still needed are highlighted.

Program control is accessible from the callsign field, for example enter 'B20' and you are on 20 metres, at least in the computer. But don't forget to change the linear while you're at it. If you hit 'M' in the callsign field you can write a memo for QSL info, operator change, skeds or the call of one to look out for.

Log entries can be edited and such changes are automatically propagated through the log. For example, if you work a W1 and log him as being in Connecticut on one band and then work him later on another band and find he is actually in Maine, SD will ensure that any editing you do edits all the QSOs, not just the latest.

Although QSOs are saved to disk as logged, there is also a facility to dump the log to a back-up in drive A: during the contest. Concurrent printer operation is not supported.

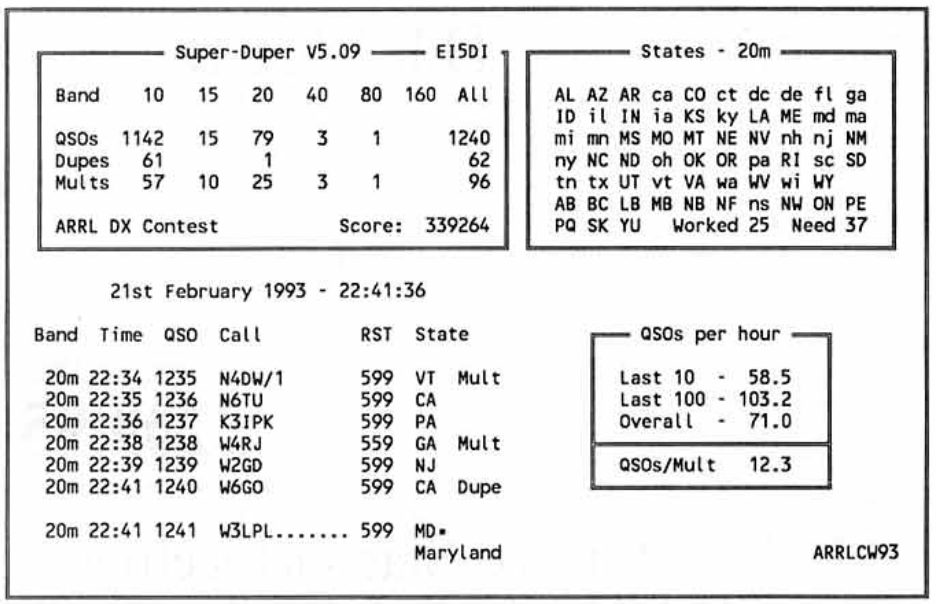


Fig 1: The Super-Duper screen display gives a wealth of useful information.

CW AND SSB

SD INCLUDES A 10 memory CW keyer. These memories are selected using a cluster of keys at the left-hand side of the keyboard. They include serials both current and previous and other information such as county code or power as required. For a CW contester the key combinations are conveniently left-handed, assuming right-hand keying but not as convenient as the single keystroke F1-

F6 used on the K1EA/CT interface. CT compatible keyer interfaces would be an advantage. The keyer can be used from the keyboard and provides for speed and weight adjustment. Contents of the CW memories can be edited to suit the operator but are not saved to disk so have to be re-edited each time. This is annoying as it precludes setting up for a contest some time in advance.

All commands use a single key for SSB operation. Gone forever are the days of <shift F2>, <ctrl T> or <Alt W> etc. These sort of commands are fine at the start of a contest but can be very confusing at 4am!

POST CONTEST

PROCESSING IS VERY easy. The WRITELOG command in the callsign field will write a file in the correct format for the contest with the name NAME.LOG where NAME is the callsign in the opening screen. To avoid overwriting your last contest entry, which might well have the same filename, you should copy and rename this file to a backup straight away. Other routines split the log by band and generate any check logs required by the organisers. Copy your log onto a disk, print out the cover sheet, sign it and you are ready to send your entry off.

As all the files generated by SD are ASCII they can be edited with a text processor. You need to be sure what you are doing and that you do *not* insert any strange characters into the edited files.

Although it is stated that the .LOG files can be exported to Turbolog (see review *RadCom*, April 1992) this is not strictly true since Turbolog does not have the ability to analyse and format date fields in the format YY/MM/DD as used by SD and other programs.

CONTESTS SUPPORTED

OVER THIRTEEN contest scoring descriptions are included with SD (V5.02) but the multiplier files (country or county) can be edited by the user using a text editor, so the experienced contester can set up specific multiplier files for the more unusual contests.

Assuming a country's national contest does not contain more than 96 regions or provinces, you simply replace the RSGB County codes in TYPE4.MLT file (UK Counties) with your new multipliers and log the contest as if you were a DX station working the UK. SD then loads the multiplier file thinking it's UK Counties but surprise, surprise, finds Italian provinces, Swiss Cantons or whatever. Pretty smart eh? This feature makes SD proof against obsolescence.

PARTICULAR CONTESTS

Both G3PJT and G4BUO used SD for their entry to the RSGB Commonwealth Contest in 1993. The program worked well including the routine for inserting new HQ stations. The program does not allow 'HQ' to be logged in the serial field as appears to be needed. I wrote 'HQ' in by hand later. The display shows on which bands a particular bonus call area is needed, and it also gives a good overall picture of bonuses. Scoring appeared to be correct. Processing G3PJT's log this year took about 30 minutes, including checking, last year it took days.

The RSGB 7MHz Contest scoring is already programmed into SD. No problems were encountered except for an incorrect county code which should be entered in capitals. This has been cleared in the later updates.

FINAL COMMENTS

THIS PROGRAM IS highly recommended, even for the newcomer. In the words of one of the reviewers, "sheer brilliance from this side of the ocean".

The reviewers have tried to collect a number of opinions about this program from both CW and SSB contesters, these are gratefully acknowledged. Finally Paul, EI5DI, has always been very helpful in sorting out the inevitable glitches and responding positively to user suggestions.

Super-Duper is available price £20 from Paul O'Kane, EI5DI, 36 Coolkill, Sandyford, Dublin 18, Ireland. Telephone 010 353 1 295 3668. A VHF version is also available.

A demo version is available but at the price I recommend you buy the full program and have some fun. Good contesting!

PC with MS-DOS and 3.5" drive	
A hard disk is recommended but is not essential	
RS-232 serial port (for keying)	
Uses 640k of conventional memory	
Smaller memory sizes and earlier DOS versions limit the number of QSOs	
640k (V 5)	3500-4100 QSOs
640k (V < 5)	2900-3500 QSOs
512k	1700-2300 QSOs

Table 1: System Requirements.


ALINCO
ELECTRONICS
ALINCO EA0024
DJ-180
V/M
SCAN
CALL
OFF SET
STEP
APO
LAMP KL.PL
MONI H/L
TONE MW
ALINCO
ALINCO
DJ-580
VHF/UHF FM TWIN BAND
elf
RENAULT
Labatt's
Canon
Labatt's
5

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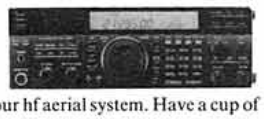
HF Super Deals

IC-737



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RADCOM CONSTRUCTION FEATURE

A Two-band Superhet

The first of a two part article by Steve Price, G4BWE

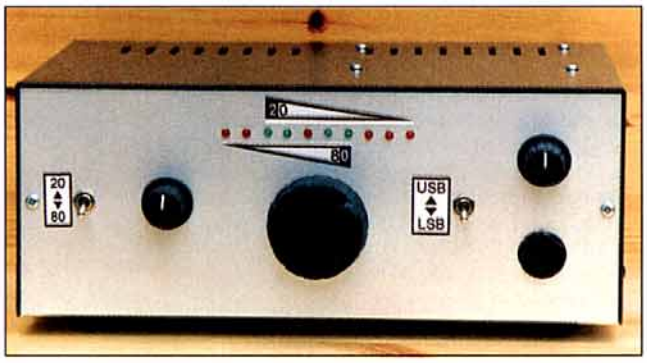
THE CONSTRUCTION OF simple HF receivers has been an important part of amateur radio since the nineteen twenties, and even now the performance of quite rudimentary designs can pleasantly surprise both novice and experienced constructors. Aside from the satisfaction of proving that complex technology isn't always necessary in order to hear what's on the bands, building your own receiver is a great way to learn more about modern components and circuitry.

Direct conversion (DC) receivers are probably the simplest to construct, but have definite limitations when compared to superheterodyne (superhet) types. In a superhet, image responses are suppressed using bandpass filters ahead of the first mixer, and the main intermediate frequency (IF) filter eliminates most forms of breakthrough. As we shall see, a feature of the superhet is that by careful choice of intermediate frequency it is possible to make a two band receiver that is barely more complex than one for a single band.

PRACTICAL DESIGN

THIS TWO-BAND SUPERHET covers two of the most popular HF bands – 20 and 80 Metres. It boasts a sensitivity of around 0.5μV and features an 8 pole crystal filter which gives excellent SSB selectivity of approx 2.5kHz at –6dB points. Despite its high performance, component costs have been kept to a minimum, and all items should be readily available. Also, In order to make construction as painless as possible, printed circuit boards plus detailed assembly instructions are available from the author (see next month).

Fig 1 shows a block diagram of the receiver. Signals picked up by the antenna are routed through two bandpass filters – one covering 3.5 to 3.85MHz (80m), and the other 14 to 14.35MHz (20m). Because these filters have a bandwidth of at least 350kHz, there is no need to provide tuning controls for them. S1 selects the desired band by connecting the output of the appropriate filter to the input of the first mixer, IC1. Amazingly, this is all that is required to switch between 80 and 20.



The receiver is a single conversion type with an intermediate frequency of 8.867MHz. IC1, working in conjunction with the VFO, has the job of converting signals to this frequency so that they may pass through the 8 pole crystal filter. The VFO is tuned between 5.017 and 5.483MHz by RV1 and RV2 to provide coverage of 3.384 to 3.85MHz and 13.884 to 14.35MHz. This works as follows: Imagine that the VFO is tuned to 5.017MHz. The mixer will now produce an output of 8.867MHz in the case of two signal frequencies; firstly by subtraction for a signal at 13.884MHz (13.884 – 5.017 = 8.867) and secondly by addition for a signal at 3.85MHz (3.85 + 5.017 = 8.867). If the VFO is set at its HF limit the signal frequencies become 14.350MHz (14.350 – 5.483 = 8.867) and 3.384MHz (3.384 + 5.483 = 8.867) respectively. These calculations reveal that choosing an IF frequency of 8.867MHz results in unnecessary coverage extending 116kHz below the lower edge of both 20m and 80m (13.884 to 14MHz and 3.384 to 3.5MHz), but in practice this matters little. Of course, satisfactory performance hinges on the ability of the bandpass filters to provide sufficient attenuation of signals on the unselected band. If this condition is not met, S1 will be only partially effective as a band change switch.

FILTER CRYSTALS

THE REASON FOR CHOOSING an IF of 8.867MHz, rather than the nearest round figure – 9MHz – which would work just as well, is that 8.867MHz quartz crystals are manufactured in large quantities for use in domestic TV receivers (some TVs use a 4.433MHz crystal, but that simply means that both types are readily available). In consequence 8.876MHz crystals are normally a lot cheaper than 9MHz types and so it makes sense to construct the IF filter using these.

After passing through the IF filter, the selected signal is demodulated by a product detector. This stage is simply another mixer, and has the job of down converting the 8.867MHz IF to audio. It does this by mixing the IF signal with the output of a crystal

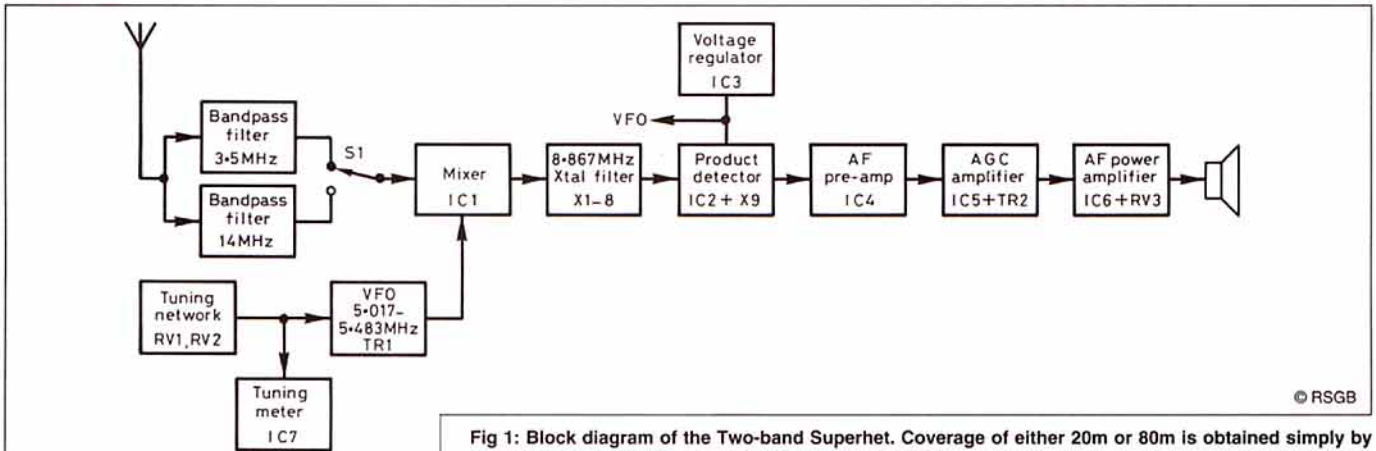
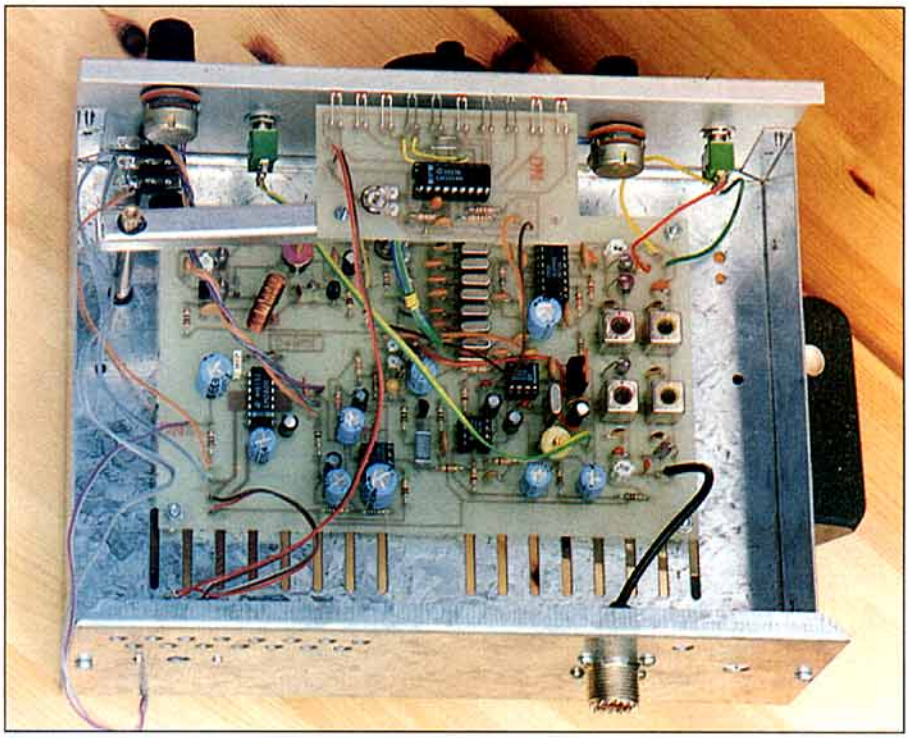


Fig 1: Block diagram of the Two-band Superhet. Coverage of either 20m or 80m is obtained simply by selecting the appropriate input bandpass filter with S1.

oscillator operating close to the IF frequency. The next stage is a low noise audio pre-amplifier. This produces an output that varies from approximately 1 millivolt (mV), for a signal of strength S1 (ie 1 microvolt at the antenna), to around 250mV if the signal is S9. There clearly needs to be further voltage amplification in order to make S1 signals loud enough to drive an 8Ω loudspeaker – 1 millivolt would produce only 0.125 microwatts! There is a problem, however, in that by providing additional amplification for weak signals, we run the risk of the much stronger S9 signals grossly overloading the receiver and causing distortion.

This is where the AGC (Automatic Gain Control) amplifier comes in. IC5 has a maximum gain of 1000 (60dB), but a special circuit has been added which senses when the output of IC5 rises to a pre-determined level (around 1 volt), and then gradually reduces the gain to maintain roughly the same output as signals grow stronger. This helps avoid overload and also obviates the need to adjust the AF gain (volume) control (RV3) every time the signal strength varies.

Finally, there is an audio power amplifier which delivers a maximum output of around 500mW.



A CLOSER LOOK

FIG 2 SHOWS THE MAIN circuit diagram, excluding the tuning meter, which will be discussed later. Signals from the antenna are routed to the bandpass filters via L1 and C1. These components from a simple diplexer which works rather like the crossover network in a Hi-Fi loudspeaker. They direct the lower frequencies to the 3.5MHz filter (C2-8, T1 and 2 plus L2) and higher frequencies to the 14MHz filter (C9-13 plus T3 and 4). RF transformers (T1-4) have adjustable ferrite tuning slugs which enable the filters to be aligned following construction.

The 3.5MHz filter has an additional low pass section at its output, known as a Pi-network, consisting of C6, 7, 8 and L2. This helps to block very strong broadcast signals at around 7MHz (eg. from stations on the 41M shortwave band). It is necessary to attenuate these because the mixer (IC1) partially functions on the third harmonic of the VFO. But how can this cause interference? Well, imagine that the VFO is set at 5.362MHz in order to listen on 3.505MHz (5.362 + 3.505 = 8.867MHz). The third harmonic of the VFO will be 5.362 x 3 = 16.086MHz.

Now, if the 3.5MHz bandpass filter has insufficient attenuation at 7.219MHz, a strong signal on this frequency may be audible (16.086 – 7.219 = 8.867MHz). It would be wrong to pretend that the additional attenuation above 3.85MHz provided by the Pi-network is always sufficient to completely eliminate this form of interference, or 'spurious response', but in practice it is reduced to a very low level. Luckily, the simpler 14MHz bandpass filter has proved just as effective at rejecting 7MHz signals.

The output from the appropriate bandpass filter is selected by the band change switch, S1, a single pole double throw (SPDT) miniature toggle type mounted on the front panel. IC1 is a high performance bipolar mixer with an on-chip VFO buffer amplifier. The VFO utilises an FET (TR1), and is tuned with a varicap (variable capacitance diode), D2. This component functions as a voltage controlled variable capacitor, the control voltage being determined primarily by RV1, a ten-turn wire-wound potentiometer. RV2 is the fine tune control and enables the frequency set by RV1 to be altered by plus or minus 2kHz. C60 determines the VFO upper frequency limit (5.483MHz), and R28 fixes the lower limit (5.017MHz).

The mixer output (IC1, pin 14) feeds an 8 pole crystal ladder filter formed by a network of 8.867MHz quartz crystals (X1-8), which work in conjunction with C19-27. In essence, the capacitors spread out the resonant frequencies of X1 to X8, and give a bandpass response over approximately 2.5kHz. This bandwidth is fine for SSB, and also allows reception of CW and data modes. The product detector, IC2, is a mixer complete with on-chip oscillator transistor.

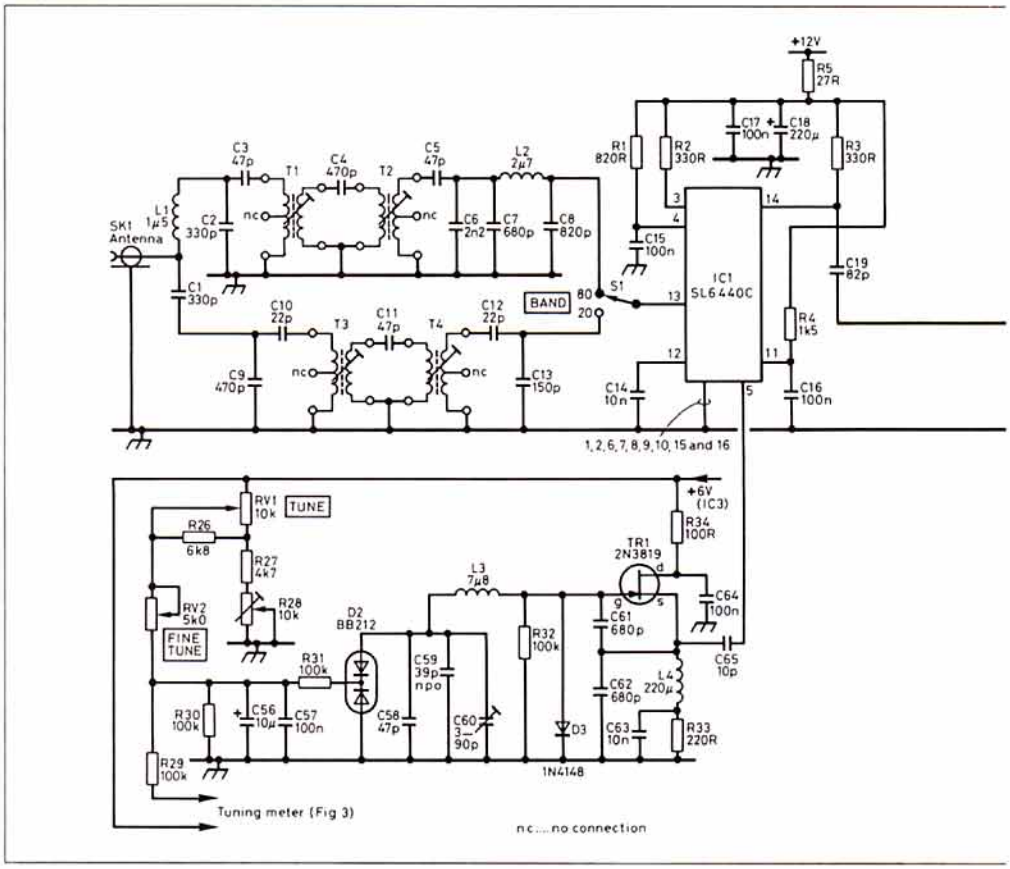


Fig 2: Main circuit diagram. The VFO tank coil (L3) is wound on a powdered iron toroid.

SIDEBAND SELECTION

CRYSTAL X9 DETERMINES the oscillator frequency, which – when S2 is open – is increased slightly by C32. S2 selects the appropriate carrier frequency for either LSB (Lower Sideband – normally employed by amateur stations on 80m) or USB (Upper Sideband – for 20m SSB). IC2 requires a 6 volt supply. This is generated by the voltage regulator, IC3, which is also used to power the VFO and tuning network.

IC4, a low noise operational amplifier (Op-Amp), has the job of raising the level of the demodulated signals appearing at the outputs of IC2 (pins 4 and 5) by 36dB (ie the voltage gain is approximately 65). Using both the product detector outputs (which are antiphase) helps promote stability and increases noise rejection. The AGC amplifier, IC5, generates a gain control voltage as follows. After passing through IC5a, signals are routed via a simple buffer stage comprising IC5b. IC5b has no gain and is simply used to isolate the output of IC5a. D1 rectifies the signal by allowing only the positive half cycles of the audio waveform to reach C46. The voltage across C46 is therefore proportionate to the average signal level and can be used to control the receivers gain.

TR2 acts as a voltage controlled variable resistor and works in conjunction with R12 to form a potential divider at the input of IC5a. As the gate voltage of TR2 (derived from C46 via R14) rises, the resistance between its source and drain falls. This will attenuate the signal by a factor dependant on the ratio between the value of R14 and the source/drain resistance. For instance, if the source/drain resistance is the same as R14 (47k), the signal level will be halved (ie attenuated by 6dB). This action reduces the input to IC5 and so prevents overload. A very strong signal will cause the source/drain resistance of TR2 to drop to only a few hundred Ωs, thus attenuating the signal by over 40dB (a factor of 100). R15 determines the gate voltage at which TR2 begins to operate. It is set to prevent the AGC affecting signals that are weaker than about S5. R20 provides a discharge path for C46, thereby allowing the receiver to gradually recover gain when signal levels drop.

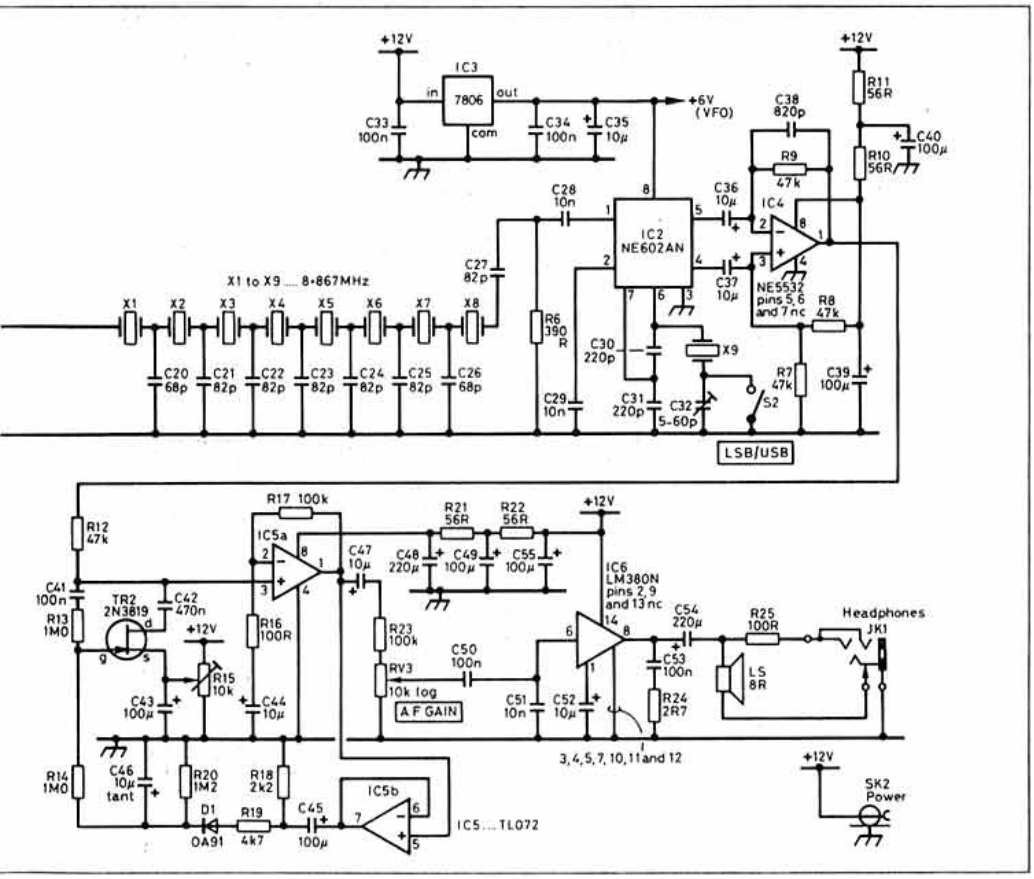
IC6 is the audio power amplifier. This drives an internal 8Ω loudspeaker, or alternatively, headphones via JK1. A stereo jack socket is preferred because it enables ordinary Hi-Fi headphones to be used without having to change their plug. Readers who are more familiar with the design of superheterodyne receivers may be surprised that there is no IF amplifier (although it should be noted that both IC1 and IC2 contribute significant gain). To make up for this, the AF gain is much higher than in most other superhets. Steps have been taken, however, to maintain audio stability. For instance, both IC4 and IC5 are 'double-decoupled' by C39, C40 plus R10, R11 and C48, C49 plus R21, R22 respectively.

TUNING METER

AN ANALOGUE TUNING scale could be made by arranging for a pointer to move across a strip of card, suitably marked. As the shaft of RV1 rotates ten times, it is not possible to fix the pointer directly to this and so a reduction drive, or a system of pulleys, must be considered. The alternative is an electronic indicator which works by measuring the tuning voltage presented to the varicap (D2).

Fig 3 shows the circuit of such a meter designed for the Two-band Superhet. It uses an LM3914 bargraph driver (IC7) and, as can be seen, requires only a few additional components. The LM3914 measures the tuning voltage fed via R29 (Fig 2) to pin 5 and illuminates one of ten light emitting diodes (LEDs 1-10) depending on its magnitude. The upper scale limit (LED 10) is determined by the voltage on pin 6, which is equal to the maximum tuning voltage (6 volts), minus a small drop introduced by R38. The lower limit (LED 1) is set by adjustment of R36. LED brightness is controlled by R35.

The tuning meter, including LEDs 1-10, is built onto a separate PCB. This gives greater freedom in positioning the display on the front panel. Small round LEDs (3mm diameter) are most convenient as these can simply be pushed into a row of equally spaced holes drilled through the front panel. **Fig 4** and the photograph(s) show how the display looks. Note the use of different coloured LEDs to highlight the bottom 100kHz of each band where CW (Morse) and data transmissions are normally found. Because the relationship between VFO frequency and display indication is slightly non-linear, the LEDs highlighting the CW/data segment of 80 metres are one position further in from the scale end than those for 20 metres. The arrow markings above and below the display act as a reminder that the receiver tunes 'backwards' on 80 metres.



CONSTRUCTION HINTS

THE FIRST PROTOTYPE of the Two-band Superhet was built on Veroboard (stripboard) and worked perfectly well. Nevertheless, most constructors will no doubt wish to make use of the two printed circuit boards (PCBs) now available.

The PCBs are supplied with layout drawings, which show the positions of all components; a parts identification and mounting guide, plus notes on the finer points of assembly and testing. It is recommended that all the ICs except IC3 and IC6 are mounted in sockets.

Components may be obtained from a number of well known suppliers by mail order (see the end of the components list for ordering details of kits and PCBs), or you could go bargain hunting at the next mobile rally! Clubs eager to promote home construction might consider ordering some, or all, of the parts in bulk as a service to their members.

Once all the components and flying leads have been soldered onto the PCBs, the next task is to drill the selected case (this must be metal for screening reasons – see components list for a recommendation). The exact positions of the mounting holes for the PCBs, controls, LEDs, sockets and loudspeaker are partly a matter of choice. The dimensions of these components and the size of the chosen case must also be taken into account.

. . . to be continued

THE FINAL PART of this feature next month will give construction hints, calibration test procedure and the components table.

IN PRACTICE

IAN WHITE, G3SEK
52 Abingdon Road, Drayton, Abingdon, Oxon OX14 4HP – or @ GB7AVM

GROUNDS FOR CONCERN

*I BUILT THIS 432MHz preamp from a kit, and mounted it in a tobacco tin (**Fig 1**). Why doesn't it work?*

THERE'S NOTHING WRONG with the kit, but just about everything's wrong with the way it is mounted in the box. Any RF circuit needs solid, low-impedance ground connections, and where are the RF ground-points in Fig 1? Actually there aren't any – the PC board is suspended in the middle of the box on six lengths of wire! Each input and output lead is over an inch long, which is quite a large fraction of a wavelength at 432MHz. To put it another way, if the preamplifier was built to scale for 1.8MHz, would you seriously expect it to work with leads that were 20 feet long? Also the DC negative lead has for some reason been brought in through a feedthrough capacitor in the same way as the positive supply, and with the same long lead length. This serves no purpose, except to isolate the preamplifier module even further from RF ground.

As well as the ineffective ground connections at the input and output, there are problems with the long wires carrying the RF signals. These form sections of high-impedance transmission line, which will transform the 50Ω-ish impedances of the outside world into mismatches that will severely upset the performance of the preamp. Probable symptoms would be very low gain (as in this particular case) and/or oscillation at some frequency determined by the resonances of the input/output leads.

Contrast this with **Fig 2**. The same preamplifier is now mounted in a home-made tinplate box of exactly the right size, with input and output sockets mounted directly on the ends. Now there are no leads at all: copper groundplane on the PC board is soldered all around the case, allowing the case itself to act as a further low-impedance RF ground. The bodies of the coaxial sockets are bolted or soldered directly to the box, and the centre spills of the sockets are soldered directly on to the tracks of the PC board, avoiding any significant impedance mismatch. The DC+ lead enters via a feedthrough capacitor but the DC– lead is simply soldered to the outside of the box.

Fig 2 is nearly ideal VHF/UHF Construction, in that the RF signals are entirely confined inside metal screening boxes, with no unwanted coupling between the input and output. The preamp now works exactly as it should.

WHAT EXACTLY DO YOU MEAN by 'RF grounding', anyway? Where is 'true ground'?

WHAT WE CALL 'GOOD RF GROUNDING' actually means an absence of unwanted coupling between circuits via their ground returns, because at HF and above there is almost no such things as 'true RF ground'. **Fig 3** is equivalent to Fig 2 with the RF current paths drawn in. On the input side, the RF current appears at the centre pin of the coaxial socket, flows through the input matching network and reaches the transistor. However, this is balanced by the little-considered ground return current, which flows out of the transistor (usually through the emitter), through the ground-plane and back into the shield of the coaxial cable. In other words, it isn't just 'a signal' but a complete current loop.

Good RF grounding means that the current flowing around this loop must encounter very little impedance on its return path through the so-called 'ground'. It also means that the input signal loop must intersect with the equivalent output loop at the transistor and nowhere else. Any external ground impedance common to both loops will cause coupling between them, resulting in unwanted feedback whose phase may change from positive to negative across the frequency spectrum. Positive feedback can lead to oscillation or 'skittish' behaviour, while negative feedback results in loss of gain.

WHAT ABOUT MORE COMPLEX units such as transceivers?

FIG 1 WAS AN extreme case where the grounding faults were very clear. The long connections, particularly the long DC– lead, created obvious unwanted impedances which were common to both the input and the output signal loops. But compared to this, the average 'open-plan' transceiver layout is a nightmare of complex intersecting RF ground paths between different modules. You have grounds through the pillars supporting the PC boards, grounds through the coaxial interconnections, grounds at input/output sockets at various places around the case, and direct grounds to the chassis.

The problem is that RF grounds are very difficult to analyse, except in highly formal layouts. They are also very difficult to test, except sometimes in high-power circuits where the currents are large enough to create measurable voltage drops. Mostly, you have to try and visualise where the RF ground-return currents might be flowing, and where these might intersect with currents flowing in other circuits. This can often be extremely difficult: development of the celebrated Racal RA17 receiver was plagued by unwanted coupling between various parts of the novel RF circuit, in spite of increasingly complex and expensive efforts at screening. The eleventh-hour solution was a strategic hacksaw-cut on the chassis, interrupting two intersecting ground-return paths and sending each to find its separate way.

A similar problem occurred in a home-made transceiver which used separate screened modules in diecast boxes. With the Racal experience in mind, the spurious-signal problems were solved by inserting a QSL card between two of the boxes! We never found out exactly why, but perhaps it interrupted an RF ground loop (see July column) involving contact between the outsides of the boxes. Yet another example was the IF filter leakage in the IC271 and IC251 transceivers for 144MHz [1]. There was some kind of indirect low-level signal path around the filter, probably because the IF board was single-sided with no continuous groundplane; but despite intensive efforts nobody ever managed to cure it.

These three stories highlight a particularly nasty feature of unwanted coupling: in complex systems such as receivers, transmitters and synthesized local oscillators, it can be

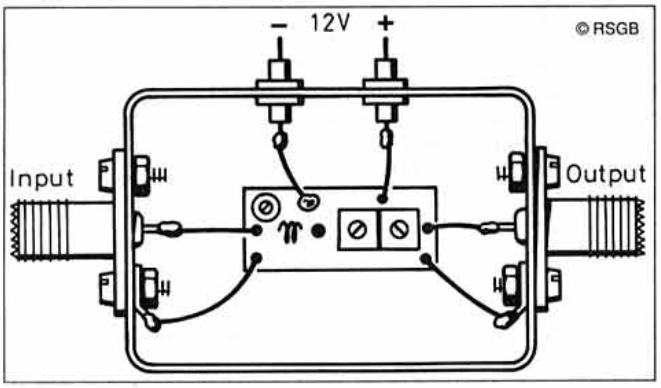


Fig 1: Original layout of RF preamplifier, with the PC board floating on long leads inside a tobacco tin. This layout did not work.

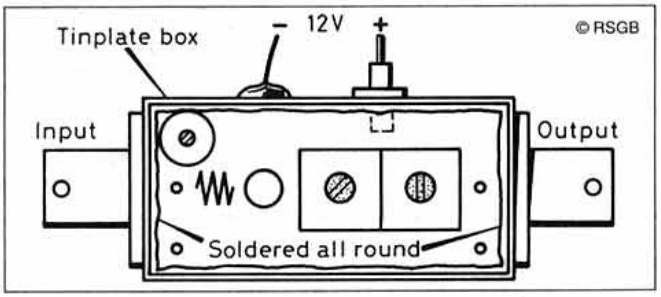


Fig 2: The same PC board as Fig 1 in a close-fitting box with 'no-leads' construction. This layout worked well.

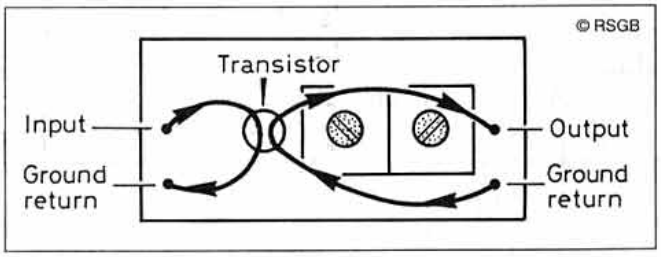


Fig 3: Enlarged view of preamplifier board showing loops of input and output currents. In a good layout, the ground-return currents intersect only in the amplifier transistor.

extremely difficult to plan a layout which keeps all spurious signals at least 70-80dB down.

I'M JUST BEGINNING a transceiver project. What can I do to avoid RF grounding problems and unwanted feedback?

THERE ARE NO GUARANTEES. All you can do is minimise the risks by adopting 'defensive' design strategies. I made a few suggestions in an earlier article [2], and here are some of them again:

1. Plan the unit in modules which can be separately boxed and screened if it proves necessary, as in Fig 2.
2. ALWAYS use a full copper groundplane for RF printed circuit boards, with the connecting tracks on the other side. This is your largest single assurance of good RF grounding. To quote Chris Bartram, G4DGU, founder of the original muTek Ltd and a consultant who has designed more RF boards than most: "It's virtually impossible to make a successful first-pass design of an RF board without a continuous groundplane. I wouldn't ever contemplate designing a single-sided board for RF unless a client demanded the lowest possible production cost."
3. Keep inputs and outputs well separated – for each stage, each PC board and the whole unit.
   a) Lay out all the stages in a straight line.
   b) Never let the RF signal path double back or re-cross itself.
   c) Keep stages at different frequencies well-separated to avoid breakthrough.
   d) Use interstage screens where necessary, but don't rely on them to cure a bad layout.
4. Make all RF ground connections short and direct to the groundplanes of the individual PC boards. Use screened inductors or toroids in preference to open coils. Keep the RF voltage points close to the groundplane, and keep all interconnecting wires well away from RF signal circuits. Design every board with extensive bypassing and filtering of all non-signal leads.
5. Use metal mounting pillars and a metal case. Make low-impedance RF interconnections using good-quality thin coaxial cable such as RG174. If an interconnection is carrying any other form of signal except a pure DC level, screen it. Bypass all DC interconnections directly at the connection points to the PC boards.
6. Select the outer case last of all. First plan your layout, following the above guidelines, and then let the layout dictate what size of case it needs.

These guidelines are not guaranteed to avoid problems caused by poor RF grounding and unwanted coupling, but they will help – a lot.

WELL, I DID WHAT YOU SAID. Everything worked perfectly until I put the PC boards into boxes!

THIS HAS BEEN A PROBLEM ever since radio construction abandoned the good old wooden breadboard. Contrary to everything I've said above, some circuits may work perfectly well as a rat's-nest of wires and only give trouble when they're boxed up. One problem may be that the screening is too close to tuned circuits or other points of high RF potential. This can easily be detected by removing the lid and waving any large metallic object near the suspected sensitive locations while monitoring for a change in performance.

Placing a circuit in a box can sometimes create unwanted coupling and feedback paths where none existed before. This particularly applies when several modules are mounted in the same screening enclosure, or the whole unit in its metal case. The only solution is to go back to the guidelines above. If you can't position the individual modules better, try screening them individually and screening or bypassing all leads.

Everything may work perfectly until you put the lid on the box, and then it becomes unstable. Microwave and UHF circuits are particularly susceptible to this, and it's because adding the lid creates an unwanted resonant cavity or waveguide. The same problem was also encountered with extremely high-gain IF amplifiers in the early days of radar; putting the bottom cover on the module created a waveguide structure which, although exceedingly lossy at 30MHz, permitted just enough feedback from output to input to make the whole unit oscillate. The solution to this type of problem is to eliminate the unwanted resonances by using additional cross-screens or other forms of 'mode killers', or by lining the covers of microwave units with RF-absorbent material such as conductive foam or ferrite-loaded rubber.

COMPONENT CODES

WHAT ARE THOSE CAPACITORS with odd-looking values such as 331 and 104?

ACTUALLY THEY'RE NORMAL VALUES, 330pF and 100nF – it's just that the values are given in a three-digit code. It's very much like the three-ring resistor colour code: the first two digits are read at face value, and the third digit is the number of zeros.

Most fixed capacitors have values based on the same six 'magic numbers' as resistors – the so-called E6 series – or sometimes on the E12 series which fills in the gaps.

E6	E12	E6	E12
10	10	33	33
	12		39
15	15	47	47
	18		56
22	22	68	68
	27		82

Three-digit values on small capacitors are almost always in picofarads, so the ones marked 331 are 33 followed by 1 zero, ie 330pF. The ones marked 104 are 10 followed by 4 zeros, ie 100,000pF – otherwise known as 100nF (nanofarads) or 0.1µF (**Fig 4**). Always look for the two familiar digits from the E6 or E12 series and then work out the rest.

But there's a pitfall. What would a capacitor marked 330 be? If it's a three-digit code it means 33 and no zeros, ie 33pF. But it just might mean what is says – 330pF – though you'd probably expect to find such a capacitor marked 330p (Fig 4). To be certain, you'd either need to see some capacitors with different values from the same batch, or measure it.

While we're on the subject, you may also find capacitors marked in nanofarads. 100n is obviously 100nF, and 1n5 would mean 1.5nF. The reason for putting the 'n' where you'd expect to see a decimal point is that it's easier to read on a tiny component. As a final example of this type of coding, n33 would mean 0.33nF or 330pF (Fig 4). Many other types of components use similar coding. For example chip components use strict three-digit coding, so a chip resistor marked 220 is definitely 22Ω. Small wire-ended RF chokes are often marked with the same colour bands as resistors (values in microhenries), while those with alphanumeric codes are generally marked with values such as 1µ5 meaning 1.5µH.

Unfortunately there always seem to be exceptions to these general rules! But you won't go far wrong if you look for the 'magic numbers', and remember you're never going to be offered capacitors marked with genuinely strange values such as 331pF or 104pF.

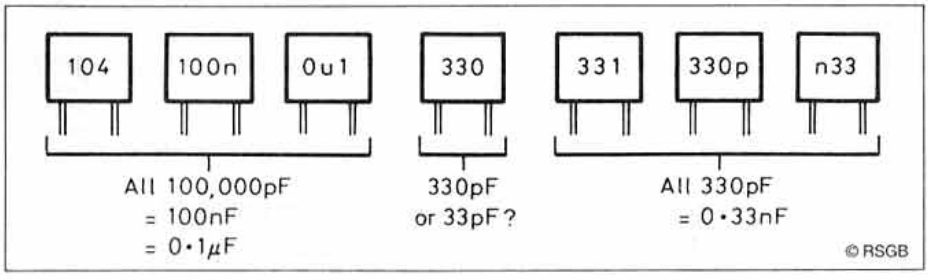


Fig 4: Capacitors which are actually the same value are often marked in different ways, but some markings can be ambiguous.

UNTIL NEXT MONTH . . .

IF YOU HAVE NEW QUESTIONS, or any comments to add to this month's column, I'd be very pleased to hear from you by mail or by packet (see head of column). But please remember that I can only answer questions through this column, so they need to be on topics of general interest.

REFERENCES

[1] *Buyer's Guide to Amateur Radio*, Angus McKenzie, G3OSS. RSGB (out of print).

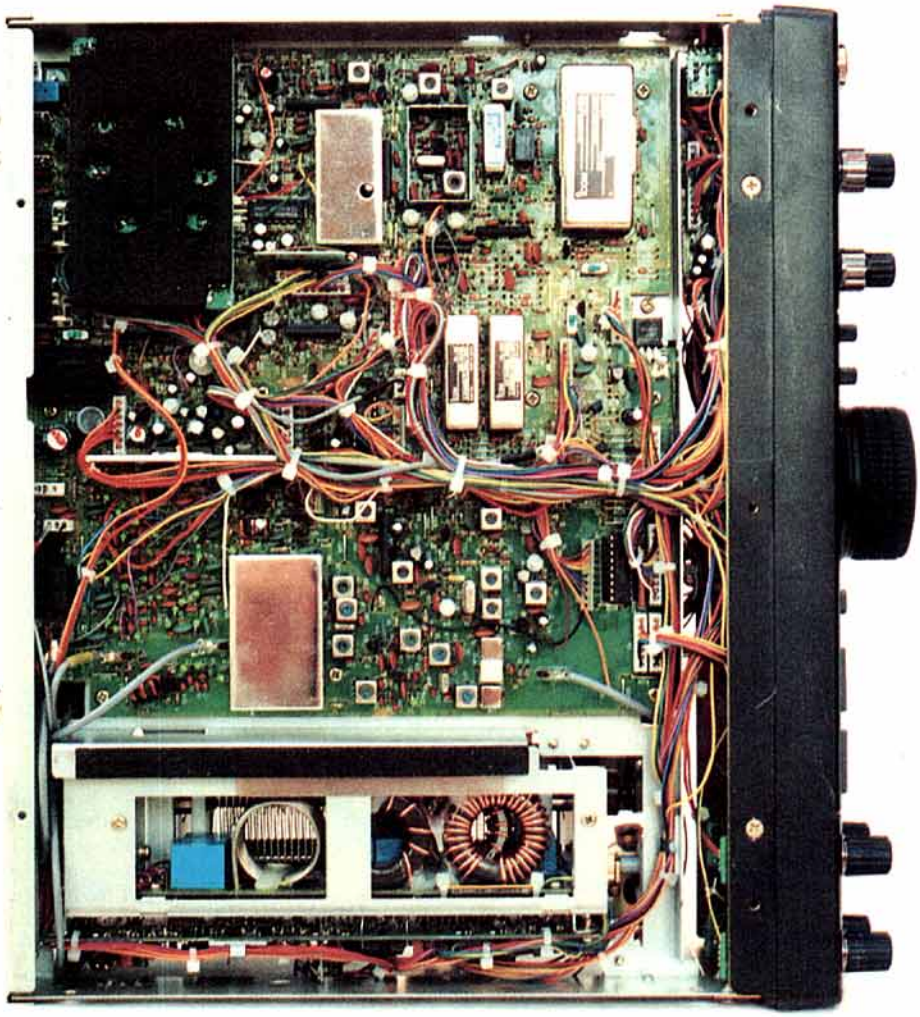
[2] *How to lay out RF circuits . . . . and how to build them* (part 2), Ian White, G3SEK, RadCom, March 1991.

The Peter Hart Review

The ICOM IC-737

HF TRANSCEIVER

EARLIER THIS YEAR, Icom introduced the IC-737 HF transceiver as a 12 volt operated mid-priced base station. This has filled a gap in the Icom range between the small budget priced radios such as the IC-728 and the current deluxe and top of the range models, the IC-765 and IC-781. Indeed, there is very little choice on the market from any supplier for a radio of this type and price.



PRINCIPAL FEATURES

The IC-737 COVERS USB, LSB, CW, CW narrow, AM and FM modes. There is no specific provision to cover data modes (RTTY, AMTOR or packet). These should use SSB or FM as appropriate with AFSK, unplugging the microphone on transmit to avoid modulation.

The receiver tunes 30kHz to 30MHz although the handbook states a lower frequency limit of 500kHz. However, the sensitivity is somewhat reduced below this limit. The transmitter covers the amateur allocations plus a hundred or so kilohertz on either side. Individual push buttons select the amateur bands, returning the last used frequency and mode on each band. A second press of the band key returns a second frequency and mode for each band. Further key presses toggle between these two settings. This is particularly useful when working both CW and SSB. A separate key selects general coverage.

The frequency may be set in a number of different ways. The 50mm diameter main tuning knob tunes in 10Hz steps at 2kHz (200 steps) per revolution (default setting), alternatively 20Hz or 50Hz steps at 4kHz or 10kHz per revolution respectively. Using the 10Hz or 20Hz step settings, auto speed-up is engaged when the knob is rotated quickly. A quick tuning step button engages coarser tuning steps of 1 – 10kHz, programmable in 1kHz increments, at 100 steps per revolution. This is useful for larger changes of frequency.

UP/DOWN keys step the frequency in increments of 1kHz – 1MHz, programmable in intervals of 1kHz. This is most conveniently left at 1MHz to provide band setting in general coverage mode. Alternatively, the frequency may be entered directly using the numeric keypad which also doubles as the band select keys. Last but not least, the frequency may be tuned, albeit rather slowly, using the UP/DOWN keys on the microphone.

The usual A and B VFOs are provided with split frequency capability. The VFOs may be equalised and split operation selected by a single key press. Another button (XFC) allows reception on the transmit frequency and enables the transmit frequency to be tuned from the main tuning knob. In split operation, the transmit frequency is indicated as a sub-frequency on the main display panel. RIT is provided over a range of +/– 1.25kHz in 10Hz steps or +/–2.5kHz in 20Hz steps. Independent transmit tuning is also provided.

The IC-737 has 101 memory channels selected by a small click-step rotary control. 89 of these store one frequency and mode, 10 will store two frequencies and modes for split operation and two memory channels are used to store scan limits. There are the usual read/write operations but no memory preview. This would have been simple to include as the sub-frequency display is already provided for split operation. There is also no provision to partition the memory into smaller units as is done on many radios. In addition to the memory channels, the IC-737 provides a 'memo pad'. This is a quick and easy temporary store and recall facility which stores up to ten frequencies on a stack. This is read out sequentially, last in, first out.

Three scan modes are provided, scanning between two frequency limits, scanning of all occupied memory channels and scanning of selected memory channels. Scan resume condition and scan speed are selectable.

There is no selectable IF bandwidth setting on SSB, AM or FM but variable bandwidth is available on SSB and CW in the form of passband tuning. On CW, narrow bandwidth filters may be fitted to both the 2nd and 3rd IFs as optional extras with a choice of 250Hz and 500Hz bandwidth available. An audio based notch filter is also fitted.

Receive functions include switchable preamp, switchable 20dB input attenuator, dual speed AGC, single noise blanker and all-mode squelch. There is no RF gain control or CW pitch variation, which is fixed at 800Hz.

Transmit functions include audio based speech processor, built-in CW keyer, full and semi break-in on CW, power output variable from a few watts to 100W and an exceptionally quiet fan. Metering of relative power out-

put is provided and ALC operation is indicated by brightening the transmit LED. A sub-audible tone encoder is available as an optional extra for repeater working and this can be enabled on FM.

A large backlit LCD panel is used for the display and this is clear and very easy to read. Frequency is indicated to 10Hz resolution with a separate smaller sub-display indicating RIT offset or split transmit frequency. The memory channel number is shown and the usual status indicators for mode, VFO/memory status etc. When operating on data modes, the displayed frequency needs to be offset to indicate the true operating frequency.

The IC-737 includes an auto-ATU as standard fitment matching antennas up to about 3:1 VSWR. This functions on transmit only and is bypassed on receive. Band stores are provided to give fast tuning by returning to the last used settings when a particular band is selected. Two separate antennas may be connected to the IC-737 and selected from the front panel. Band stores memorise which antenna is used on which band and switch to the appropriate antenna when that band is selected.

Three accessory sockets are provided on the rear panel to interface to external auto-ATUs, data terminals, Icom linear etc. Relay controlled T/R switching and ALC is also provided for general linear use and these interface connections are common to all transceivers in the Icom HF range. Hence accessories and external connections to other units are all directly interchangeable. The Icom CI-V serial computer control interface is also fitted, fully compatible with other Icom radios. No provision is made for low power RF output for a transverter.

A sixty-page instruction manual is provided with the transceiver, together with a set of circuit diagrams.

DESCRIPTION

THE IC-737 IS A NICE size for a home station radio, measuring 330mm (W) by 111mm (H) by 285mm (D) and weighing 8kg. The transceiver is constructed in four sections – the lower section containing the chassis and main PCBs, the upper diecast assembly containing the PA, the front panel assembly and the auto-ATU. A 6.5cm diameter speaker is mounted facing upward using the diecast assembly as a baffle.

The receiver is triple conversion with IFs of 69.01MHz, 9.01MHz and 455kHz on all modes. The transmit signal is generated at 9.01MHz and mixed via 69.01MHz to the final frequency. The frequency synthesiser uses a combination of DDS (direct digital synthesis) and PLL (phase locked loop), a standard configuration in virtually all transceivers now to give fast tuning and good spurious performance with small step size. Two lithium back-up batteries are used to preserve the memory contents of the main microcontroller and the auto-ATU.

MEASUREMENTS

MEASUREMENTS WERE MADE with the IC-737 powered from a 13.6V PSU and are detailed in the table. Additional comments are as follows.

RECEIVER MEASUREMENTS

S-METER CALIBRATION

The calibration was similar on all modes except FM where the range and linearity were very poor. This is fairly typical of most transceivers.

SPURIOUS REJECTION

Rejection of all measured spurious responses including first and second IFs and first mixer image was in excess of 95dB which is very good.

SELECTIVITY

The review radio was fitted with 500Hz CW filters in both the 9MHz and 455kHz IF positions. The measurements show the extremely good skirt selectivity measured on CW which is primarily due to the 455kHz filter. Although this is an expensive filter, it is well worth fitting if CW is of major interest. With both filters fitted, passband tuning is also effective on CW, narrowing the bandwidth still further. This is preferable to fitting 250Hz filters in my opinion. Do not be tempted to economise by fitting only the 455kHz filter and not the 9MHz as the full performance will not be achieved due to dynamic range limitations in the second mixer.

The IF bandwidth on SSB was a little narrow for my liking.

STRONG SIGNAL PERFORMANCE

The overall strong signal performance in terms of front-end dynamic range, reciprocal mixing and close-in performance is very good indeed, some of the best figures I have measured on any radio. The reciprocal mixing performance allowed the measurement of IF bandwidth down to –70dB which is unusual. The overall effect of IF filter selectivity and reciprocal mixing is shown in **Fig 1** – an excellent result.

Wideband second order responses measured at 21.1MHz (test signals 11.6 and 9.5MHz) and 14.3MHz (test signals 7.2 and 7.1MHz) showed a response some 5dB worse than the normal 3rd order 50kHz spacing test.

FREQUENCY CALIBRATION

When measured at room temperature, the receive and transmit frequencies were accurate to within 40Hz. The CW frequency reads correctly for a beat note of 800Hz.

TRANSMITTER MEASUREMENTS

POWER OUTPUT

The figures given in the table opposite were measured with the ATU out of circuit. The ATU introduced a loss of about 10% (0.5dB). The power output was variable smoothly down to about 10W and the power meter, although calibrated in percentage output, read remarkably close to the true power in watts above 25W. Into a mismatched load, the power output reduced substantially (2:1 VSWR 70W min, 3:1 VSWR 32W min) but the auto-ATU restored output to around the 100W level.

SSB PERFORMANCE

The distortion products were poor on the higher bands but improved dramatically if the power was limited to 80-100W output. The audio speech processor did not substantially effect the level of distortion products.

CW KEYING PERFORMANCE

Fig 2 shows the CW keying waveform with semi break-in at 40WPM and **Fig 3** the equivalent keying spectrum. With full break-in, there was slight character shortening at this speed but overall a very good performance.

ON-THE-AIR PERFORMANCE

I USED THE IC-737 in place of my IC-726 and, having identical accessory connectors, it needed no changes to the linear and keying interfaces. Note that, as with other Icom HF rigs, the linear switching contacts are rated at only 16V 2A. I use an additional external relay to switch my TL922 linear which needs a much higher voltage switching capability.

I was quite impressed with the performance of the IC-737. The receiver performed

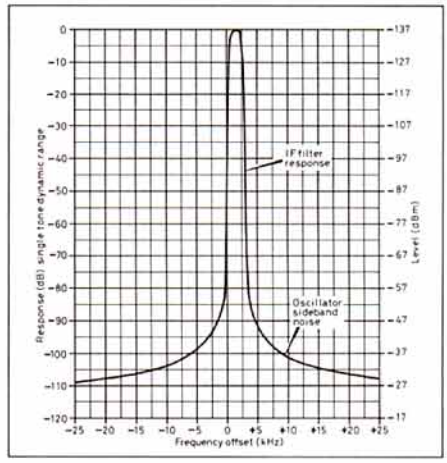


Fig 1: IF selectivity measurements (USB) produced an outstanding result.

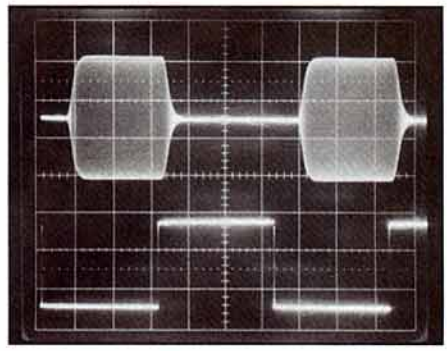


Fig 2: Keying waveform. Horiz scale 10m/div.

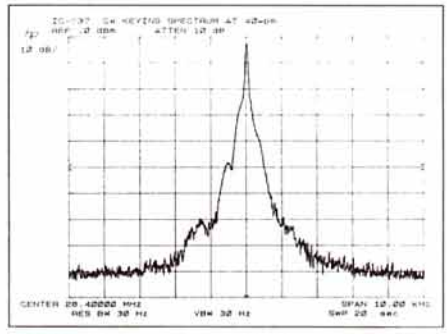


Fig 3: Keying spectrum. 1μHz/div; vert 10dB/div.

ICOM IC-737 MEASURED PERFORMANCE

RECEIVER MEASUREMENTS

FREQUENCY	SENSITIVITY SSB 10dBs+n:n PREAMP IN	PREAMP OUT	INPUT FOR S9 PREAMP IN	PREAMP OUT
1.8 MHz	0.13µV (–125dBm)	0.28µV (–118dBm)	22µV	71µV
3.5 MHz	0.11µV (–126dBm)	0.25µV (–119dBm)	20µV	71µV
7 MHz	0.11µV (–126dBm)	0.22µV (–120dBm)	20µV	63µV
10 MHz	0.13µV (–125dBm)	0.22µV (–120dBm)	20µV	71µV
14 MHz	0.11µV (–126dBm)	0.22µV (–120dBm)	20µV	63µV
18 MHz	0.11µV (–126dBm)	0.22µV (–120dBm)	18µV	63uV
21 MHz	0.10µV (–127dBm)	0.22uµV (–120dBm)	16µV	63µV
24 MHz	0.10µV (–127dBm)	0.25µV (–119dBm)	16µV	63µV
28 MHz	0.10µV (–127dBm)	0.28µV (–118dBm)	18µV	71µV

S-READING (14MHz)	INPUT LEVEL SSB	FM
S1	1.7µV	0.2µV
S3	2.7µV	0.4µV
S5	4.7µV	0.6µV
S7	8.9µV	0.7µV
S9	20µV	0.9µV
S9+20	180µV	1.3µV
S9+40	1.6mV	1.8µV
S9+60	14mV	2.5µV

MODE	IF BANDWIDTH –6dB	–60dB
SSB,CW	2030Hz	3250Hz
CW(N)	495Hz	770Hz
AM	7430Hz	13.5kHz
FM	12.5kHz	23.6kHz

AM sensitivity (28MHz): 0.7µV for 10dBs+n:n at 30% mod depth

FM sensitivity (28MHz): 0.16µV for 12dB SINAD 3kHz pk deviation

AGC threshold: 0.4µV

100dB above AGC threshold for +3dB audio output

AGC attack time: 3ms

AGC decay time: 0.1-0.2s (fast), 1-2s (slow)

Max audio before clipping: 2.1W into 8Ω at 2% distortion

Inband intermodulation products: –30dB

Frequency	INTERMODULATION (50kHz Tone Spacing) PREAMP IN 3rd order intercept	2 tone dynamic range	PREAMP OUT 3rd order intercept	2 tone dynamic range
1.8 MHz	+6dBm	94dB	+19dBm	98dB
3.5 MHz	+11dBm	98dB	+24dBm	102dB
7 MHz	+16dBm	102dB	+26dBm	104dB
14 MHz	+16dBm	102dB	+26dBm	104dB
21 MHz	+7dBm	96dB	+20dBm	100dB
28 MHz	+11dBm	98dB	+17dBm	97dB

TONE SPACING (7MHz BAND)	3rd ORDER INTERCEPT	2 TONE DYNAMIC RANGE
3 kHz	–25dBm	74dB
5 kHz	–17dBm	80dB
10 kHz	–5dBm	88dB
15 kHz	+1dBm	92dB
20 kHz	+5dBm	94dB
30 kHz	+10dBm	98dB

FREQUENCY OFFSET	RECIPROCAL MIXING FOR 3dB NOISE	BLOCKING	TX NOISE IN 2.5kHz BANDWIDTH
3 kHz	90dB	–26dBm	–79dBC
5 kHz	96dB	–26dBm	–87dBC
10 kHz	104dB	–23dBm	–93dBC
15 kHz	105dB	–19dBm	–95dBC
20 kHz	107dB	–16dBm	–96dBC
30 kHz	110dB	–8dBm	–97dBC
50 kHz	114dB	+3dBm	–98dBC
100 kHz	120dB	+3dBm	–99dBC
200 kHz	124dB	+3dBm	–99dBC

TRANSMITTER MEASUREMENTS

FREQUENCY	CW POWER OUTPUT	SSB(PEP) POWER OUTPUT	HARMONICS	INTERMODULATION PRODUCTS 3rd order	5th order
1.8 MHz	125W	128W	–70dB	–28dB	–38dB
3.5 MHz	127W	130W	–75dB	–28dB	–38dB
7 MHz	127W	130W	–60dB	–25dB	–40dB
10 MHz	126W	128W	–65dB	–22dB	–38dB
14 MHz	125W	129W	–63dB	–22dB	–33dB
18 MHz	121W	125W	–67dB	–18dB	–35dB
21 MHz	123W	129W	–73dB	–15dB	–32dB
24 MHz	128W	132W	–75dB	–16dB	–32dB
28 MHz	119W	125W	–75dB	–19dB	–33dB

Carrier suppression: 65dB. Sideband suppression: 70dB @ 1kHz. Transmitter noise: see table above. Transmitter AF response at –6dB: 527-2850Hz (USB), 303-2543 (LSB). Transmitter AF distortion: 1%. Microphone input sensitivity: 15mV for full output. T/R switching speed (SSB): mute-TX 7ms, TX-mute <1ms, mute-RX 22ms, RX-mute 1ms. Power into load mismatch: see text.

NOTE: All signal input voltages given as PD across antenna terminal. Unless stated otherwise, all measurements made on SSB with the receiver preamp switched in and operating from a 13.6V PSU. All two-tone transmitter intermodulation products quoted with respect to either originating tone.

well on SSB and CW with adequate sensitivity on the higher bands and excellent strong signal performance. The close-in dynamic range appeared excellent, confirming the measurements. The receiver also performed very well on AM broadcast signals. The audio bandwidth seemed a little restricted on SSB which reflects the rather narrow IF bandwidth on this mode. Also there was some difference in audio tonal quality between LSB and USB which probably indicated that a small adjustment to the BFO was needed. This was also reported during transmitter tests and was seen in the measurements. I found the notch filter poor. The notch itself was rather broad and there was noticeable attenuation across the audio band.

The ergonomics were generally good but I dislike the use of auto speed-up which comes into operation at relatively slow tuning speeds. In my opinion, there is really no substitute for a 1000 step/rev shaft encoder for the main tuning drive (giving 10kHz/rev with 10Hz step size). Attempts to use cheaper lower resolution encoders (200 steps/rev in this case) together with speed-up and/or switchable step sizes always results in a less friendly system. The tuning is entirely free of clicks and other 'quirks', as is now normally the case in modern synthesiser systems. Split frequency operation is particularly easy to use and the memo pad feature useful. As an equal user of SSB and CW, I particularly like the use of double band stores for each band.

The transmitter performed very well and good reports were obtained. Full break-in was very effective up to quite high speeds and the processor seemed to be clean and provide that extra punch.

CONCLUSIONS

OVERALL, I FOUND THE IC-737 an excellent radio. It is a good all-round base station, easy to use and with plenty of features. The only real omission is a dedicated provision for data modes. The electrical performance is excellent. The measured figures for reciprocal mixing, dynamic range and close-in performance are amongst the best I have seen on any receiver at any price.

The current list price of the radio is £1495 inc VAT. This is good value for a radio of this type with a full set of features and a built-in ATU. Add to this figure the cost of a 12V PSU if one is not already available. The 500Hz bandwidth CW filters cost around £65 for the 9MHz units and £129 for the 455kHz units.

Anyone looking for a 12V operated home station radio, something a little larger and with a few more features than the compact budget priced radios, yet not as expensive as the top of the range mains-only base stations, will find the choice very limited. For this reason, demand for the IC-737 should be fairly high. Perhaps the Kenwood TS-850 is the nearest contender. A radio such as this is useful as the main station workhorse for the serious HF operator but with the capability to use it remote from the AC mains supply.

ACKNOWLEDGEMENTS

THANKS TO ICOM (UK) of Herne Bay, Kent for the loan of the equipment.

Peter Hart, G3SJX

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RADCOM TECHNICAL FEATURE

The Shape of Bits to Come

The first of a two-part tutorial by James Miller BSc, G3RUH

This article is reproduced by courtesy of AMSAT-UK and first appeared in their journal *Oscar News* No. 88, April 1991.

THIS ARTICLE IS about bits, bandwidth and the control of both. Lately a number of expressions have crept into amateur radio data transmission, creating both interest and confusion. What, for example, is the 'raised cosine modulation' used on microsats AO-16/18/19? And what is the RSM-8 on Rudak/AO-21? What PSK modulation does Fuji-20 use? Come to that, what is PSK anyway? This piece is not just 'about satellites', or 'about packet'. The principles discussed here form the foundation of all data transmission, and ought to be as familiar as Ohms law. Read on!

Let's come clean at the outset; 'raised cosine', RSM-8, PSK and DPSK are the same thing. They're all forms of PSK – 'phase shift keying'. In the amateur environment we are usually trying to send data as fast as possible within a limited AF or RF bandwidth. This limit may be set by the receiver alone, or it may be due to some statutory, aesthetic or technical requirement. So a very important part of data transmission concerns the data's spectrum.

UNDERSTANDING PSK

LET'S BEGIN WITH a statement and explain later: "PSK spectral considerations at RF can be analysed by examining the characteristics of an isolated bit at 'DC' or baseband."

I have to start somewhere, so I'll make the assumption that you have in your head an image that 'data' is the sort of regular signal you have running down a piece of cable. On a 'scope it looks like random highs and lows spaced at regular intervals. Each of these elements is called a 'bit', and they flow at the 'bit rate', described as 9600 bits/sec or sometimes '9600 Baud' depending on the context. See the waveform 'Data In' of **Fig 1**.

There are many ways to modulate this data onto an RF carrier, for example ON/OFF keying, carrier FSK, two-tone AFSK and so on. Here I am concerned with double sideband modulation, DSB. That is, the data signal drives a balanced modulator whose other input is the RF carrier. The output is then simply a frequency shifted replica of the input data, much the same as when the input is speech.

Now, binary data has only *two* states. It is either a '1', represented by +1 volt say, or a '0', represented by –1 volt. And that means that the modulated RF carrier also takes only *two* states; either it has phase 0° or 180°. This is because, compared with the +1 volt level, the –1 volt inverts the carrier. This means a 180° phase shift. Voila! We have Binary Phase-Shift-Keying or BPSK. The term PSK is often used by default, but is actually imprecise as it embraces other shifts as well as 0/180°. 'Antipodal PSK' is correct but long-winded.

It follows then that if we know the spectrum of the 'baseband' data signal, then the RF spectrum is just its replica above and below the carrier frequency, because it's DSB, double sideband suppressed carrier.

If in addition, the data signal has amplitude variations, then these will translate into identical amplitude variations at RF. This is a very important equivalence, and it's worth restating: 'Binary data DSB modulating an RF carrier' and 'binary phase shift keying (BPSK)' are exactly the same thing. If we want to control or analyse the RF spectrum characteristics, we only need to control or analyse the source data characteristics.

Let us now make a reasonable assumption: the data stream consists of random bits. If the data is random, for the purposes of analysis we don't then need to know anything about the content of the message stream. All we need to know is the properties of *one isolated bit*. Whatever properties we can discover about the isolated bit will also apply to the average summation of the random assortment of bits that make up the stream.

So our problem of spectral considerations at RF can be analysed via the relatively simpler job of examining the characteristics of an isolated bit at source level, DC or, as it is appropriately called, 'baseband'.

As a communications theory aside, it is worth noting that with efficient communications, that data *must* in fact be random. For if it were not, that would imply something systematic about it. So the data could actually be represented or coded more efficiently, resulting in fewer transmitted bits, which would then have a random distribution.

BIT, EYE AND RF SPECTRUM PLOTS

NOW LET'S EXAMINE some representative cases. What happens if we modulate the carrier directly with unprocessed rectangular bits?

Fig 2 shows three things: a) an isolated rectangular bit, b) its RF spectrum and c) what the data stream looks like on an oscilloscope. Of course the bit edges are in reality almost invisibly fast, so I have emphasised them slightly.

a) **Isolated Bit:** The horizontal axis is time, and is marked off in bit intervals (eight are shown). The vertical is voltage.

b) **RF Spectrum:** The horizontal axis is frequency, and is marked off in units of the bit rate R bps. For example, if the data rate is 1200 bit/sec (R = 1200), the vertical markers are at 1200Hz spacing. The mid point of this spectrum is of course the RF carrier frequency. The vertical is marked off at 10db intervals. Before modulation, at 'DC' or baseband, the audio spectrum is just one half of this, the right of Fc, which therefore represents zero Hz

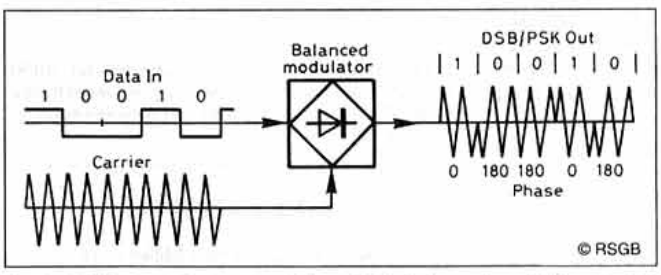

Fig 1: PSK is usually generated by a DSB balanced modulator. So DC spectrum is simply shifted to RF. Data '1's give carrier phase 0°, data '0's give phase 180°.

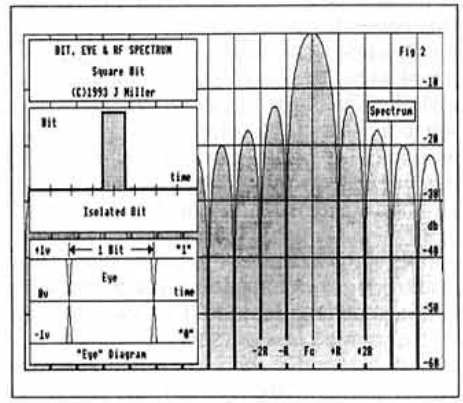

Fig 2: Rectangular bit, its eye and spectrum.

c) Oscilloscope diagram:

1. The horizontal axis is time, and spans a total of two bits; so it's expanded x4 compared with the isolated bit. The vertical is voltage. Imagine the 'scope is triggered by a local bit-rate clock. The displayed trace is the resultant pile-up of bits. It is the sum of many positive and negative isolated bits, each displaced in time by one bit.
2. The received waveform which is sampled by the data detector to decide if a '1' or a '0' has been received. Usually this decision is taken at the mid-time point of the received bit by a sampler. Above the horizontal line is the regime of '1's, below '0's.
3. This display is also universally known as an 'eye diagram'. It is a concise representation of the quality of the received signal. The less confused the trace, the greater the distinction between high and low at the mid-bit sample point, then the more reliable (less error prone) bit detection will be.
4. These traces show no channel noise. That is to say, the signal to noise ratio is assumed high. If noise was present, the traces would be blurred. If this noise was momentarily large enough to cause the waveform accidentally to cross the middle horizontal line, an erroneous detection decision would be made. This would lead to a received bit error.

RECTANGULAR DATA BIT

RETURNING TO OUR rectangular bit shape, two things are clear from Fig 2. First, the extremely high fidelity of the data waveform and second, the price for this, profligate use of bandwidth. The diagram shows significant energy spreading well beyond 10 times the data rate. Indeed, as far away as 30 R (R = bit rate), the sidelobes are still only 40db down. As computer hash sufferers will know, rectangular bits are effective noise generators.

In some applications (for example spread spectrum communications) this might be the desired result. In the conventional amateur radio environment where we want to get maximum data through the limited bandwidth of our receivers, more finesse is required.

Obviously we need to filter the data stream before transmission, because this will attenuate those sidelobes and constrain the bandwidth. So the key issue, indeed perhaps the central problem of all data transmission, is: "What form should this filter take?"

SIMPLE DATA FILTER

NOW WE CAN TENTATIVELY try a simple filter. Let's pass the data stream through an R-C network with a –3db point equal to half the data rate. The result is shown in **Fig 3**, and a look at the spectrum shows that while the main lobe is hardly changed, the sidelobes are reduced by 10db or more. This is what we want and a look at the isolated bit shows it has become rounded. But note particularly that its duration now exceeds one bit. In fact it's stretched to roughly two bits long, and this means that successive bits will overlap. This, in turn brings a potential new design problem; inter-symbol interference (ISI). We now find that not only do we want spectrum control, but we have to do it with the constraint that successive overlapping bits must somehow not interfere with each other.

Finally, look at the 'scope trace. The line at the top corresponds to the sequence 111 . . . , that at the bottom 000 . . . The sweeps from top to bottom are caused by . . 10 . . and . . 01 . . transitions and so on. You can also see that the traces are not confused; highs and lows of successive bits are separable, so there is no significant inter-bit interference.

INTER-SYMBOL INTERFERENCE

IN AN ATTEMPT TO FURTHER attenuate the sidelobes, let's now double the RC filter's time constant. That is, the –3db frequency is now ¼ the bit rate (R/4). See **Fig 4**.

The sidelobes are indeed reduced – but the real casualty can be seen in the 'scope trace. Under certain conditions (for example the sequence . . 010 . . or . . . 101 . . .) the voltage barely gets half way up to the top line. Bits are still distinct and detectable, but the noise margin is drastically reduced by some 50%.

The reason for this is seen in the isolated bit diagram of Fig 4. The bit starts off at T=0. At T=1 it reaches its peak. At T=2, it hasn't fallen back to zero again, but has a value approximately ⅓ peak. This aberration is the sole cause of the inter-symbol interference apparent in the 'scope trace. At T = 3, 4 etc, the voltage is back to zero again. From this observation we can formulate the requirement for a bit shape that guarantees no ISI. There should be a peak of unity at T=0. Then at all other exact bit points (T= –2, –1, +1, +2, etc) the isolated bit waveform should be exactly zero. What happens in between doesn't matter, at least, not from the ISI point of view.

FO-20'S DATA FILTER

AN EXAMPLE OF A BIT SHAPE that meets this requirement is that transmitted by the satellite Fuji-OSCAR 20. The data filter is (I believe) a 3rd order Bessel type with a –3db point at 0.532 times the bit rate (0.532 R). 'Bessel' filters driven by square waves have a nice steady rise, and negligible overshoot or ringing. In circuit terms, the filter is merely 3 resistors, 3 capacitors and an op-amp **Fig 5**. The response is shown in **Fig 6**.

The spectrum is quite reasonably controlled; 99.9% of the energy is contained within a bandwidth of 1.75R (as compared with 15R of the rectangular pulse). Since the FO-20 bit rate is 1200BPS, this means that most of the signal occupies an effective RF bandwidth of the order of 2.1kHz, so it stands a fair chance of passing through the SSB receiver filters without significant distortion.

The isolated bit shape is zero at all T points except at one, and this leads to a nice 'scope trace. The origin of the term 'eye diagram' can be seen here, as the trace is supposed to resemble a human eye. Notice that as a consequence of negligible inter-symbol overlap in the isolated bit, the 'scope trace has perfect bit convergence at the sample point.

The isolated bit has a duration of just 2 bits. This means that there can be only $2^2 = 4$ trajectories on the 'scope trace (00, 01, 10, and 11). The 01s and 10s show up as a very clean zero crossover. If the RF bandwidth were narrower then the isolated bit would span more than 2 bits, so the 'scope trace zero crossings would show dispersion.

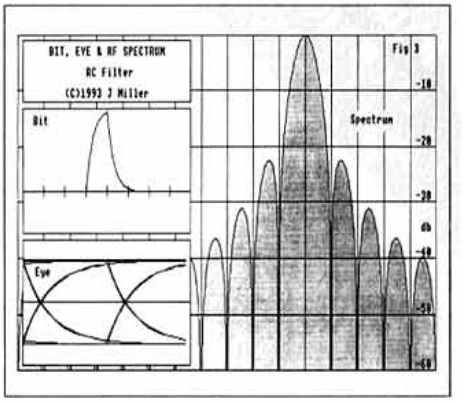

Fig 3: Rectangular bit through R-C filter has classic exponential rise and fall, and RF sidebands are reduced slightly.

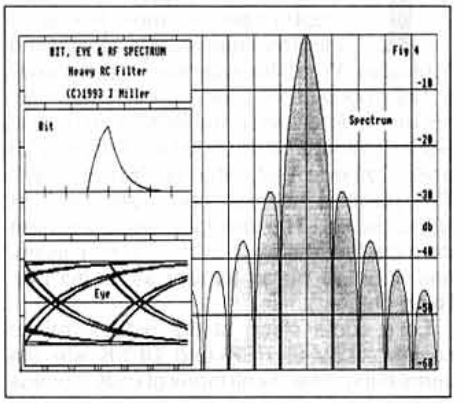

Fig 4: But too much ill-designed filtering gives inter symbol interference (ISI).

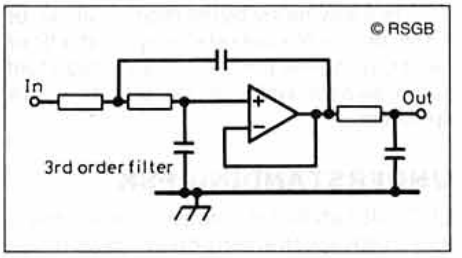

Fig 5: Packet satellite FO-20's 3rd Order Data filter is similar to this. Waveshapes as Fig 6.

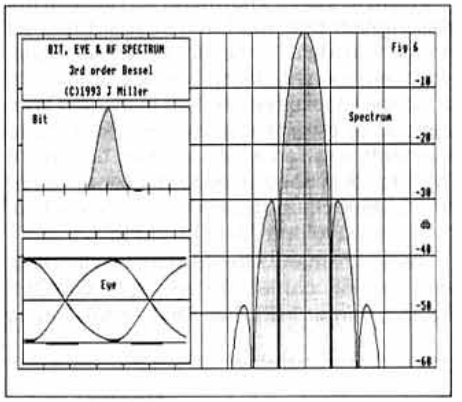

Fig 6: Characteristics of FO-20 Data. The far-out RF sidelobes are much more rapidly attenuated than in figure 4, yet there is no confusion between adjacent bits (no ISI).

NEXT MONTH

IN PART TWO, James Miller explains raised cosine and looks at PSK on RUDAK-2/OSCAR-21.

IDEAS FROM ABROAD

TRANSLATED AND EDITED BY ERWIN DAVID, G4LQI

This month we publish **Antenna/earth** topics from two European magazines: the **earthlead tuner** is by **Olle Lindqvist, SM6AQR**, from *QTC* (S) and the **toroidal-coil Z-match** is by **J Dorvier, EA4EO**. The latter article was originally published in *CQ-Radioamateur* (E).

IT CAN HAPPEN that the outside of an HF transmitter and its microphone, key or headset are 'hot' with RF, eg if the antenna is end-fed from the shack or if, improperly, there is RF on the outside of a coax feeder.

How can a cabinet which is properly connected to the mains 'earth' be 'hot'? It cannot for the 50Hz mains but for RF things are different. The mains earth lead from the transmitter cabinet to where it is connected to 'real' earth near where the mains enters the building may be tens of metres long. At frequencies where this length is near one or three quarter wavelengths, the mains earth would act as an RF insulator, ie just the opposite of what is wanted! This is bound to happen in one or more of our nine HF bands.

The best remedy is one which keeps stray RF outside the house altogether: a remote ATU [1] for an end-fed antenna and coax chokes [2] where 'outside' current maxima might occur. If that is not practical, the 'artificial earth' deserves consideration.

ARTIFICIAL EARTHS

TEXTBOOKS RECOMMEND connecting a quarter-wave radial to the transmitter's earth post and running the free end outside, away from the transmitter. As the end of that wire must carry zero current, it follows that at 1/4 wave inward, ie where it connects to the transmitter, there must be zero voltage (with respect to earth).

Problem solved? . . . . Maybe. If you are lucky, adding the radial to the system does away with the resonance causing the problem; if you are not, considerable RF current may flow into the new radial, making it an antenna in its own right, possibly radiating straight into your neighbour's TV. Only trial and error will tell. [It seems likely (though I have not tried it) that folding the radial into a sardine-tin-opener shape [3] would reduce that radiation and make for a more compact installation – *G4LQI*]

One radial would be required for each problem band. Alternatively, one single random-length radial or earth lead *(but not the mains earth)* often can be tuned to place a 'cold' point at the transmitter on any band by inserting an LC series tuning circuit between the transmitter and the radial or earth lead. [The US Company MFJ have popularized this technique with their model 931 *Artificial Ground*. I consider this a misnomer; this box is *not* an artificial ground, it merely *tunes* one and ought to be called a *groundlead (earthlead) tuner – G4LQI*]. Whatever its name, in some cases it helps.

In addition to the LC circuit, the box contains a through-current indicator which helps tuning the radial or earth lead to resonance (maximum current).

SM6AQR's version, **Fig 1,** uses a 200 – 300pF air spaced tuning capacitor with at least 1mm plate spacing; the capacitor and its shaft must be insulated from the tuner cabinet. The inductor is a 28µH roller coaster. Alternatively, a multi-tapped fixed coil plus 10-position switch could be used. K8ZGC [4] uses a 365pF valve-receiver tuning capacitor with inductors wound on Amidon toroids: 36 turns of 0.4mm enamelled wire tapped every fourth turn, on a T68-2 core. In the 3.5MHz switch position, if required, a second toroid is connected in series with the first. It has 13 turns of 0.65mm enamelled wire on a T68-3 core.

The first and last switch positions could short the LC circuit or leave it open for bands where the tuner is not required.

The tuning indicator consists of a current transformer, rectifier, smoothing filter, sensitivity potentiometer and DC microammeter. The 'primary' of the current transformer is the artificial earth lead itself; it simply passes through the centre of the T1 ferrite toroid, onto which a secondary of 20 turns of thin enamelled wire has been wound. R_x, the resistor across the T1 secondary, should be non-inductive and between 22 and 100Ω; it is selected such that a convenient meter deflection can be set with the sensivity control R2 on each required frequency and for the RF power used.

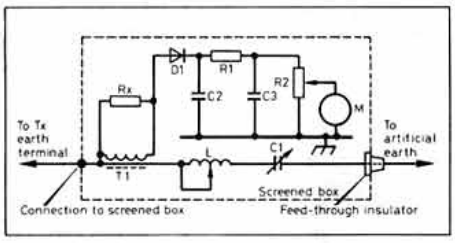

Fig 1: SM6AQR's earth lead tuner. T1=Amidon T-50-43 ferrite toroid; the primary is the earth lead running straight through the hole; secondary = 20t small enamelled wire. L = 28µH roller-coaster or multi-tapped coil with 10-pos. switch; see text. C1 = 200pF or more air variable, >1mm spacing, insulated from panel and case. C2 = C3 = 10nF ceramic D1 = AA119; R1 = 1kΩ; R2 = 10kΩ pot. R_x see text. M = 100µA or less.

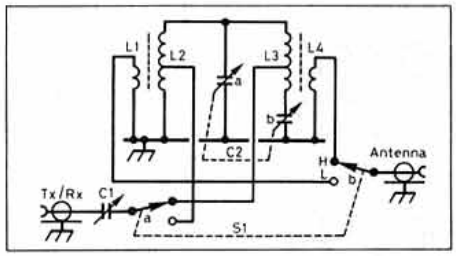

Fig 2: EA4EO's Z-match is smaller because its inductors have powder-iron ringcores. L1 = 7t; L2 = 13t tap at 3t; L3 = 7t tap at 2t; L4 = 6t; C1 = 300-500pF; C2 = 2x410pF.

A SMALLER Z-MATCH

JORGE DORVIER, EA4EO, initiated his RSGB membership by contributing more than his fee: he sent his Spanish magazine article, with an update in English, of which the essentials are given here.

Adapting G5RV's improved version of the ancient Z-match antenna system tuner [5] to his needs, (150W and G5RV antenna), Jorge wanted to avoid the winding of self-supporting coils and to reduce the size of the assembly. Both aims were achieved by the use of powder-iron toroids; the smaller size derives not only from the coil dimensions themselves but because air coils require one coil diameter clearance from the metal case; toroids do not.

Jorge uses coax-fed antennas, hence the bottom ends of L1 and L4 in **Fig 2** are earthed. S1 is a non-miniature DPDT power-type toggle switch. For balanced feeders, these ends could be brought out to an insulated terminal; a third switch section may not be required.

The coils are wound with 2mm enamelled wire on Amidon T-200-2 cores. Best results were obtained with the primaries adjacent to the secondaries; winding one over another resulted in overcoupling and core saturation; placing them on opposite sides of a ring produced undercoupling with critical tuning and high insertion loss.

Both capacitors are husky air-spaced types from valved receivers. C1 must be insulated from the case. With the component values given, the tuning ranges are 2.6 – 11.6 and 8.3 – 36MHz.

REFERENCES

[1] L B Uphill, G3UCE, 'A remote-controlled ATU for your end-fed antenna.' *RadCom*, Feb 89 p49. [Beware – G3UCE got away with 500V capacitors @ 400W PEP but you may not be so lucky – *G4LQI*]

[2] According to W0KKQ, an inexpensive sleeve-type coax choke can be made by running the coax axially through a two-foot length of 1½" plastic tubing stuffed with fine steel wool; no extra coax connectors are required and the choke can be slid along the coax to where it does most good. Once that spot has been ascertained, the choke can be weatherproofed. See Technical Topics, *RadCom* Mar 93, p37.

[3] After DL1VU. See *Eurotek*, *RadCom* Feb 91.

[4] F Brumbaugh, K8ZGC, in *73 Amateur Radio Today*, Apr 91, as quoted by PA0SE in *Electron* (NL) May 93.

[5] L Varney, G5RV, 'An improved Z-match ASTU', *RadCom*, Oct 85 or *HF Antenna Collection*, G4LQI, RSGB, p117.

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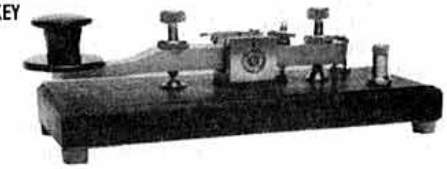

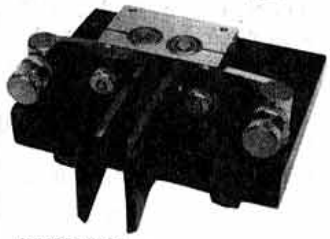

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RADCOM NOVICE PROJECT

Simple BFO for Short-Wave Radios

From an article published in *D-i-Y Radio*, March-April '92

THESE DAYS IT'S possible to obtain short wave broadcast receivers at low cost from car boot sales and rallies. They often have good sensitivity, but the lack of a BFO means they are unlikely to introduce the newcomer to amateur radio.

SOMETHING TO BEAT

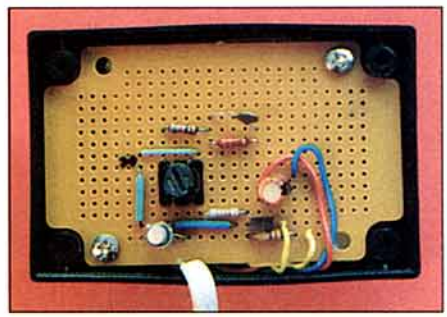
ASSUMING THE RADIO has an IF in the usual range 455-470kHz, the little circuit in **Fig 1** should do the trick. The biasing adjustment on RV1 has the effect of varying the oscillator frequency by about +/- 3kHz. With the rather wide IF bandwidth of most cheap broadcast radios, RV1 works rather like a bandspread control. Make sure that the connections to pins 4 and 6 of the IF transformer are correct to make the circuit oscillate. Alternative transistors may require some experimentation with the value of R3 for best results.

Any general purpose NPN transistor should be suitable for TR1, and the circuit is easily built on a small piece of prototype board. Components should be easy to obtain, either from the ubiquitous 'junk box', or stores such as JAB Electronic Components or Maplin. The BFO should be constructed in a small plastic case, which will usually give enough coupling to the IF stages of the radio when placed alongside.

EASY TO TEST

AVID CONSTRUCTORS will be relieved to discover that a spectrum analyser and digital storage 'scope are *not* required to align this unit. Just switch it on and set RV1 to the halfway position. Next, place the BFO near to the receiver and having found a suitable SSB station, slowly tune the inductor core until the speech is intelligible. If the oscillator signal is insufficient, a short length of insulated wire connected to TR1 collector should increase it to give satisfactory operation. Twist the wire round the set's telescopic aerial.

This little unit is just placed alongside your radio.



A convenient method of construction uses a small matrix board.

Having done this, alignment is complete and your BFO is ready for use. Tests with *D-i-Y Radio* readers (see the advertisement below) showed a high level of user satisfaction. Here's your chance to recruit a newcomer to our hobby!

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Resistors
All 0.25W 5%

R1 27k
R2 4k7
R3 1k0
R4 2k2
RV1 4k7 linear variable with switch.

Capacitors
C1 100nF ceramic
C2 47nF ceramic
C3 10µF 25V Electrolytic

Additional items
TR1 2N2222A transistor (or similar).
IFT1 Toko YHCS11100 Intermediate Frequency transformer

Plastic box approx 100 x 70 x 45mm
Matrix board to fit box
Battery connector for PP3 battery
Control knob

Component Sources:
JAB Electronic Components, The Industrial Estate, 1180 Aldridge Road, Great Barr, Birmingham B44 8PB. Tel: 021 366 6928.

Maplin Electronic Components, PO Box 3, Rayleigh, Essex SS6 8LR.

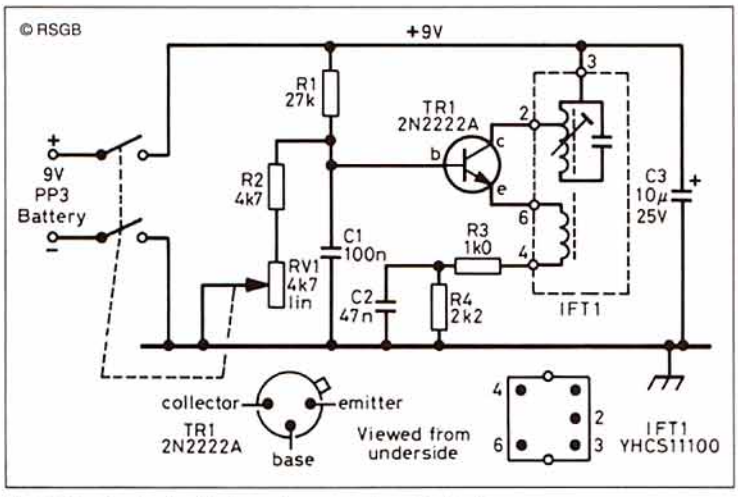

Fig 1: The simple circuit above has proved most effective.

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Technical Topics

THE CLASSIC G2DAF LINEAR

IT IS NOW 30 YEARS since the late GRB Thornley, G2DAF, as part of his series of constructional designs for an HF receiver and HF SSB/CW transmitter, described a 400W linear amplifier (*RSGB Bulletin*, April 1963) based on the passive-grid technique and suitable for use with an SSB exciter/transmitter of around 50W PEP. The original model used two 4-125A (Mullard QY3-125) or two 813 tetrode valves, operated under zero bias conditions, and with the screen voltage derived by rectifying a small portion of the input signal in a voltage-doubler arrangement. This configuration avoided the complication of the carefully regulated screen supply required for many linear amplifiers.

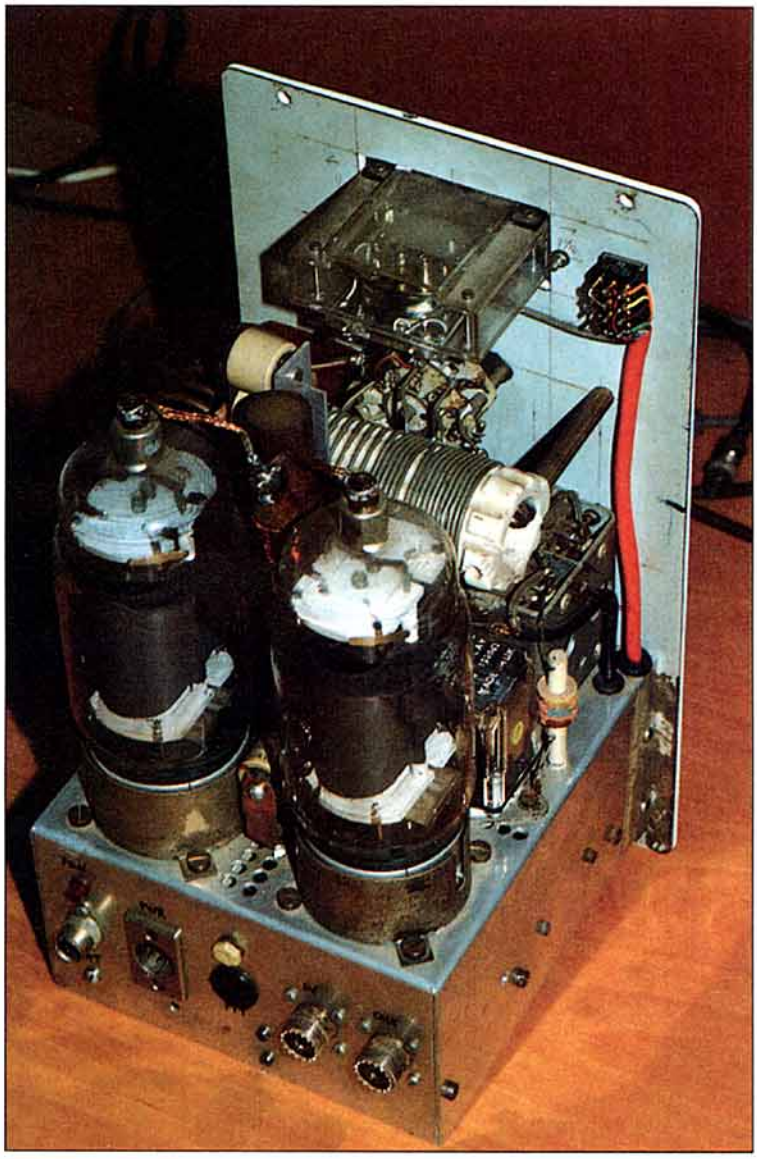
The basic G2DAF design has proved its worth down the years, and in *TT*, September 1991, p33 and again in *TT*, February 1992, p37, some modifications, including the use of silicon diodes instead of diode valves to provide the screen voltage, were described, stemming from the work of ZS2PL, ZS6AOZ, F6IDC (G4ZU) etc.

Now Mike Hall, G3USC, writes: "Many of the modifications to the original G2DAF design that have been described over the years in *TT* I have incorporated with very beneficial results in my amplifier: **Fig 1.** Voltage quadrupling rather than voltage doubling and a grid leak resistor certainly improved both the efficiency and linearity. My amplifier dates back some 25 years and is still going strong with the original valves, although these were probably already some 25 years old when I acquired them!

"However, when modifying my amplifier, lack of space prevented me from using the specified 6U4 or EY81 screen rectifiers. Two small 6AL5/EB91 signal diodes with independent heater supplies have coped quite adequately. In a voltage quadrupler arrangement they supply 400V to the screens when fully driven. I did not use semiconductor diodes because at that time I was worried about their reliability for this application. The data sheet maximum PIV for the EB91 is 420V with the peak current rating 54mA, so I do not feel I have abused them unduly.

"Readers may be interested in a modification that did not prove successful. Wanting to drive the amplifier from an exciter that had only a single 6146 output valve, I spent much time investigating trifilar-wound input transformers to give a 50-Ω match to a 470-Ω grid resistor (actually ten 4k7 resistors in parallel). I tried many types and sizes of toroidal cores, even high permeability ferrite, in order to try to reduce the number of turns needed for 3.5MHz, but there was no way I could get the leakage inductance down to an acceptable figure for the 21 and 28MHz bands. The input capacitance of the valves was just too high. In the end, to my annoyance, I was forced to use a separate bandswitched L-network in the grid circuit.

"My amplifier has been quite stable with this relatively high grid resistor. Its disadvantage is that there is a lack of swamping which is apparent on a scope trace when driven with a two-tone generator; a definite kink in the waveform occurs, I believe, where the screen diodes begin to conduct to a significant degree. However, on-air reports have always been very complimentary.



G2DAF-type linear amplifier built by G3USC, one of many satisfied users.

"I also concur with an earlier contributor to *TT* that the anode stoppers are unnecessary; indeed, like his, mine disappeared in smoke on 28MHz.

"Another point. I wound the RF choke as suggested by G2DAF but found it very difficult to avoid a resonance in one of the bands. After several burnouts, the successful attempt used sections of winding spaced $^{3}/_{16}$in and consisted of 68 + 19 + 16 + 13 + 10 turns of 24SWG wire on a $^{13}/_{16}$in former. It does not appear to overheat and a GDO shows it to be free of in-band resonances, including the WARC bands, though there is one just above 24MHz which might mean that a little pruning would be necessary for an amplifier used on that band.

"Finally, I originally designed the amplifier pi-tank to provide a proper match when used with a lower than normal supply voltage (1.8kV). There were two reasons for this: I had a suitable transformer and I felt that the tank circuit Q could be controlled better on 21 and 28MHz. It worked with this voltage but the efficiency and power gain were low as might be expected. Matters improved significantly when I returned the bottom of the screen multiplier (only a doubler in those days) to +70V instead of zero volts. I now run the amplifier on 2.6kV (quiescent) with the bottom of the screen quadrupler at zero volts, accepting a high pi-tank Q on 21 and 28MHz.

"Partly as a result of the high tank Q, I find that the available linear output on 28MHz is quite a lot lower than on 14MHz and below, but I am still able to push a reasonably clean 250W up the feeder on this band. The other reason for this low output and lower linearity, I guess, is due to electron transit times in these big valves and the series inductance of their internal, and necessarily long external connections. [The original 813 valves were specified for full output power only up to 10MHz – *G3VA*]. A couple of 4CX250s would probably have done the job a lot better, though not without some plumbing.

"It would be fun to attempt a survey of how many of these amplifiers have actually been built and how many are still in use today. Better still, if it were possible, to run a Christmas draw and donate a prize of a couple of 813s to the lucky entrant, with a 10V, 10A, centre-tapped filament transformer to the runner-up. I shudder to think what the latter would cost today as a bespoke item. I have contacted quite a few owners of these G2DAF linears, and know of someone who is still collecting the bits together to join the existing satisfied users!"

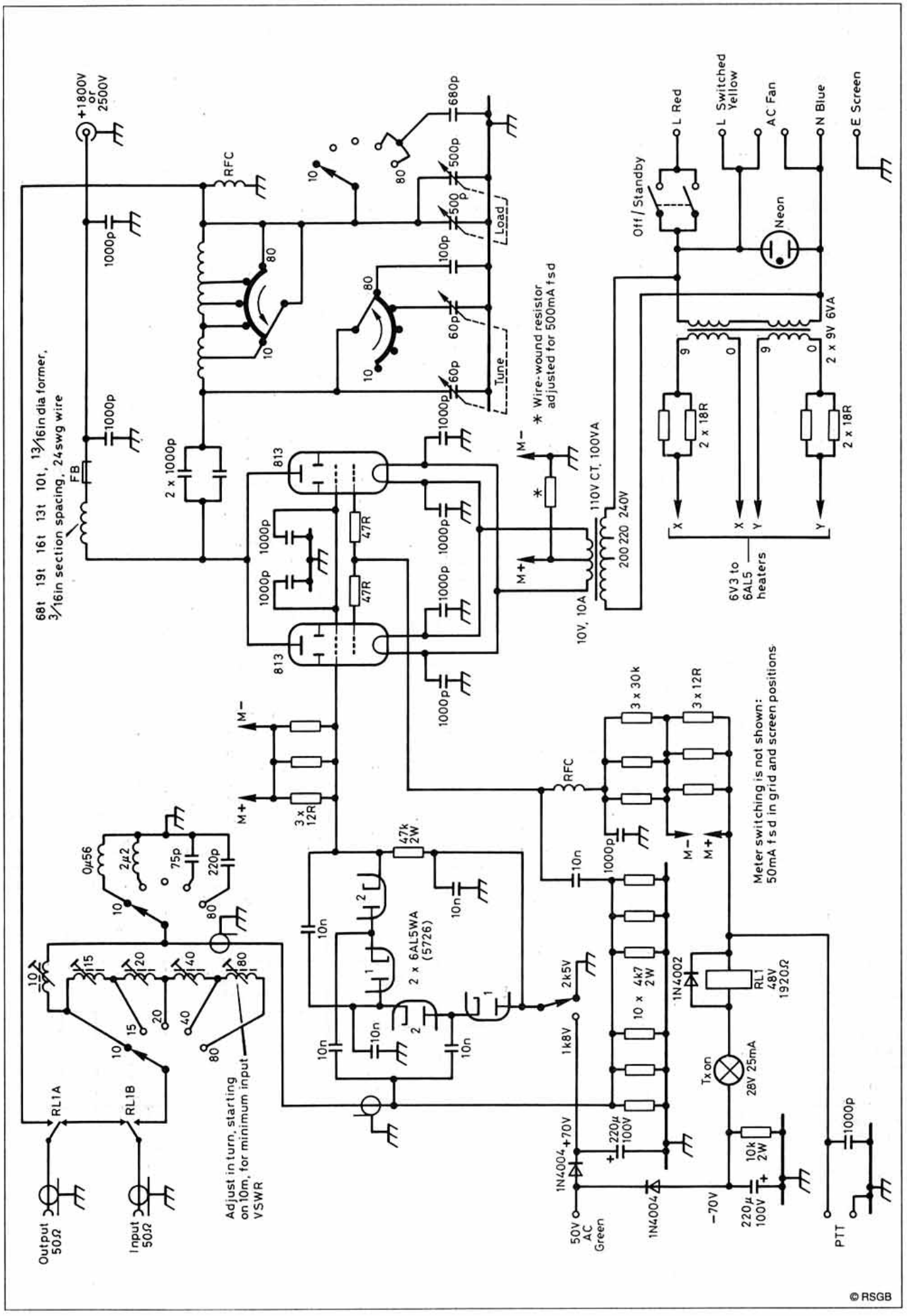


Fig 1: Circuit diagram of G3USC's HF linear amplifier based on the 1963 G2DAF design but incorporating some modifications.

SUPER-LINEAR HF RECEIVER FRONT ENDS

NOTES IN THE February *TT*, drawing on the long article 'Recent advances in shortwave receiver design' by Dr Ulrich L Rohde, KA2WEU/DL2JR (*QST*, November 1992) and the IEE's book 'Radio Receivers' edited by Dr W Gosling, drew attention to current thinking on advanced, high-performance, HF receiver front-ends. It referred, in particular, to mixers and associated circuitry capable of providing excellent dynamic range. This was followed in the April *TT* by information on 'An ultra low distortion HF switched FET mixer' designed by Eric Kushnik (*RF Design*) that required significantly less oscillator power than is generally needed for mixers having a very high third-order intercept point.

The subject also crops up in 'A high-dynamic range MF/HF receiver front end' by Jacob Makhinson, N6NWP, (*QST*, February 1993, pp23-28 with correction note *QST*, June 1993, p73). In this article, N6NWP, shows that "By properly applying known design principles, radio amateurs can construct a high-performance front-end which combines a very high intercept point with excellent sensitivity. Used with a low-noise LO, the front-end described in this article achieves a wide dynamic range even with its pre-amplifier stage in-line. A receiver incorporating such a front-end can provide strong-signal performance that rivals or exceeds that of most commercial equipment available to the amateur."

Fig 3 shows the essentials of the N6NWP, 14MHz mixer (with 9MHz IF) based on a Siliconix Si8901/SD8901 DMOS FET quad device together with a 74HC74 dual flip-flop to provide square wave LO injection from a VFO operating at about 10.5MHz. The mixer is followed by a simple diplexer network; N6NWP, also provides details of suitable high-performance pre- and post- mixer amplifiers. The mixer can be used either with or without the input pre-amplifier which, like the post-mixer amplifier, uses two MRF586 transistors in push-pull.

Colin Horrabin, G3SBI, has been investigating in depth the N6NWP mixer (with some modifications) and finds that it is possible to achieve extremely high third-order intercept points. In fact other parts of the circuitry, such as the diplexer or crystal filter rather than the mixer itself, tend to be the limiting factor. The following is a short summary of G3SBI's interim report on the measured performance of his implementation of the N6NWP mixer:

"The excellent Siliconix Si8901 device (which has been replaced by the identical SD8901 available from Calogic Corporation) contains four DMOS FETs already configured for use as a commutation (switching) mixer. N6NWP utilises this device with square wave drive to the gates of the FETs from a high speed CMOS D-type bistable device operating somewhat unusually from a 9-volt supply. Although the intercept point as usually defined would be about 2dB less than the +41dBm claimed (this is acknowledged in the correction note), this is still an excellent performance.

"It was decided to construct a mixer (**Fig 4**) based on the ideas of N6NWP, but utilising the more widely available Siliconix SD5000 quad DMOS FET array (batch 9042). Unfortunately, this array has gate-protection diodes, so the substrate must be negative biased to prevent gate conduction in certain conditions; however the array has the advantage of very close matching of drain-to-source on-resistance.

"A test board of the arrangement shown in Fig 4 was made using earth-plane construction, with all transformers and ICs fitted into turned-pin DIL construction, so that they could be changed easily. With the test set-up of **Fig 5** it was possible to achieve a true input intercept of +42dBm on 14MHz using a 5MHz local oscillator injection. An input intercept of +45dBm was obtained on 3.5MHz with a 5.5MHz local oscillator frequency. It was found that with a local oscillator running at 23MHz the 14MHz intercept was a few dBm down compared with the 5MHz LO.

"For this reason an advanced CMOS 74AC74 was used as the LO squarer, and gave a near-perfect 50-50 square wave. To reduce ringing on this, only one D-type in the chip was used and stopper resistors were connected to the FET gates – a single ferrite bead in series with the Vcc pin also proved useful. It is important for the injection to be a clean square wave if the results indicated above are to be obtained . . . . The results were excellent with input intercepts of at least +42dBm on all HF bands and +46dBm on 1.8 and 3.5MHz.

"On 7MHz, no intermodulation distortion was visible on the spectrum analyser (**Fig 6(a)** with **(b)** showing the 7MHz input) even with a bandwidth of 10Hz, representing an input intercept of +50dBm. These figures were achieved with both 2kHz and 20kHz tone separations at an input level of +7dBm on the HF band under test. A substrate bias of –7.5V and a gate bias of about +4.5V were used. Conversion loss was 7dB. These are extremely good results.

LOW-COST CALIBRATED DIALS

THE ITEM IN THE July *TT* (p53) stemming from G4XPP on using transparent plastic school protractors as calibrated dials has attracted some alternative suggestions.

John Levesley, G0HJL, finds that the type of self-adhesive clear compass rose (**Fig 2**) intended for use with aviation and marine maps makes a very good scale on equipment cases. Mounted on plastic or metal discs they make equally good calibrated dials. They have a useful advantage over most protractors in having a smaller diameter which is more appropriate for smaller equipment cases. He writes: "I purchase them from my local pilot-supplier shop for about 25p each, and I think chandlers probably also sell them. There are advertisers in magazines for pilots which offer such compass roses by mail order."

Dick Biddulph, G8DPS, suggests a cheaper version of G4XPP's idea is to use 'polar coordinate graph paper' (eg Chartwell Graph Sheet No 7506). However I notice that these are quite large sheets (8.5 x 11in) so that they would need to be cut down to size and then the calibration markings (printed at the edges of the sheet) would need to be added. I suspect that for most purposes the small compass roses would be more appropriate.

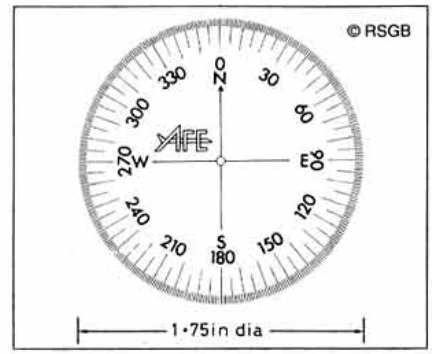


Fig 2: Example of the appearance of a self-adhesive clear compass rose as sold for use with aviation and marine maps. G0HJL finds they make excellent calibration scales on equipment cases and mounted on plastic or metal discs make very good calibrated dials.

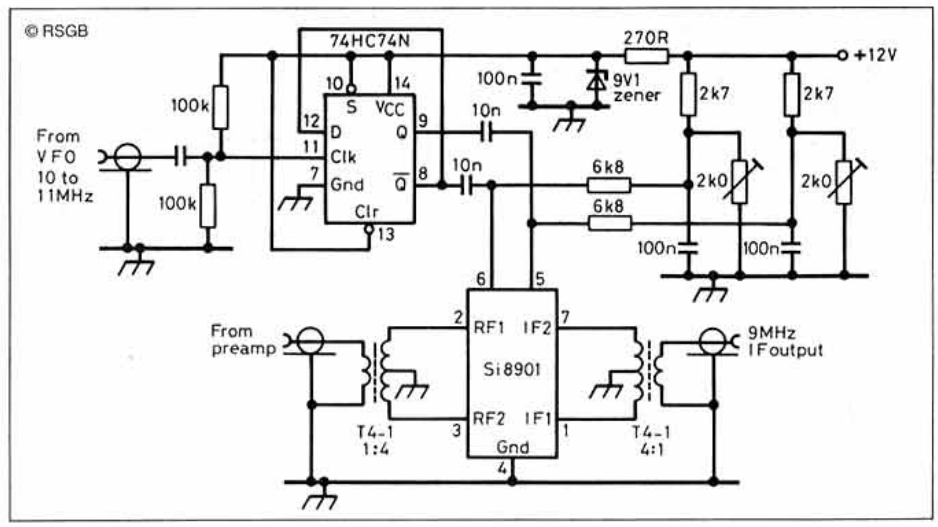


Fig 3: The basic high-dynamic-range MF/HF receiver front-end mixer circuitry as developed by N6NWP and described in the February 1993 *QST* using the Si8901 DMOS FET ring.

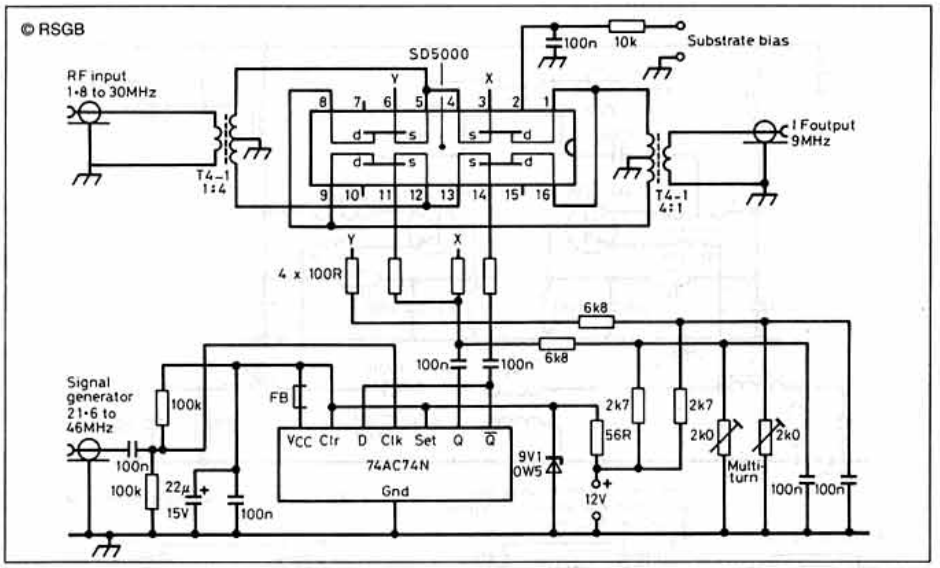


Fig 4: G3SBI's modified N6NWP-type mixer test assembly using the SD5000 FET array and 74AC74N to provide square-wave injection from a high-quality signal generator source with output at twice the required frequency.

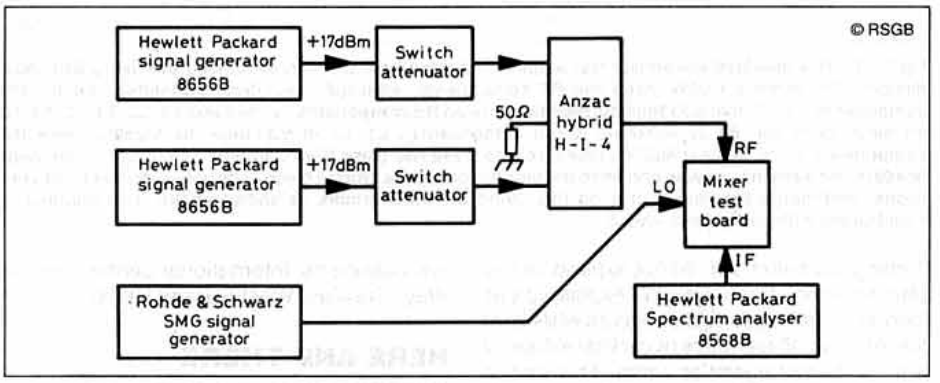


Fig 5: The test instrumentation set-up used by G3SBI for intermodulation tests on the mixer.

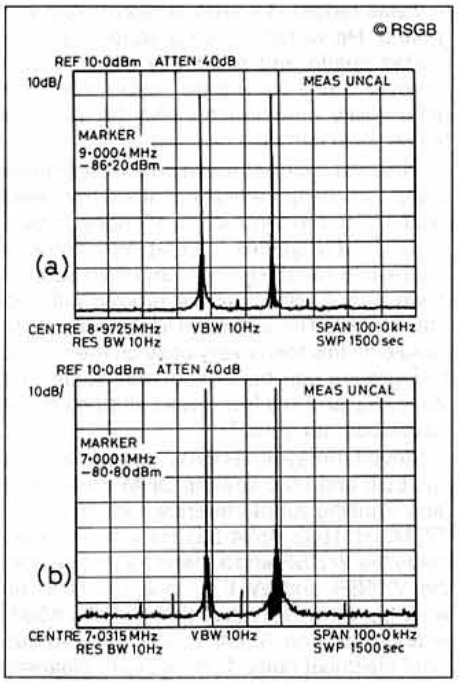


Fig 6: Spectrum analysis of the mixer performance. (a) Mixer spectrum output at 9MHz. (b) Input to mixer at 7MHz +7dBm/tone. Note that one of the signal generators had some low-level 10kHz modulation to cause the larger spurious signal in (b) and this appears after up-conversion to 9MHz in (a). The third-order distortion is on the baseline at the output of the mixer indicating a mixer input intercept point of +50dBm.

"However (now the bad news) the intercept point degrades sharply as soon as the input signal exceeds +7dBm (0.5V) which is still a big signal. It is thought that the reason for this is that the FETs that should be 'off' in the commutation ring see a negative drain-to-source signal voltage greater than –1.7V and start to conduct. The situation can be recovered by dropping the gate bias voltage, but it is then no longer possible to achieve the super intercepts of greater than +45dBm . . . An alternative arrangement is being assembled that should make it possible to handle very large input signal voltages without degrading the intercept points."

For the post-mixer amplifier, G3SBI uses basically the same circuit as N6NWP but with some subtle changes (**Fig 7**) that have improved performance in terms of gain and output intercept point, and has a noise figure of 0.5dB. "An important change was the use of the MRF580A transistor instead of the MRF586 since this should give a lower noise figure at a collector current of 60mA." Measured performance of the amplifier gave gain as 8.8dB, output intercept +56dBm, noise figure 0.5dB. G3SBI points out that with intercepts of this magnitude it is important to remember that the measuring equipment is being pushed to the limit, and transformers must be looked upon as possible sources of limitations in overall linearity. Also that, unfortunately, the measurements are for operation into a resistive load. In practice, the crystal filter driven by the post-mixer amplifier would present a complex impedance to the amplifier. Particularly on the slope and near the stopband, this would seriously degrade the amplifier performance.

G3SBI has also investigated the performance of quadrature hybrid 9MHz crystal-filter combinations and finds that the performance of budget-priced crystal filters is a serious limitation. He found that this can be reduced by eliminating the post-mixer amplifier, with the mixer going immediately to a quadrature hybrid network 2.4kHz-bandwidth filter, followed by a low-noise amplifier. In this case, the 2.4kHz filter is, in effect, used as a roofing filter. With such an arrangement, assuming the effective noise figure to be 5dB due to the filter and amplifier, another 7dB from mixer loss, and a further 1.5dB loss due to the antenna input bandpass filter, this gives an overall noise figure of about 13.5dB [sufficient sensitivity up to at least 14MHz – *G3VA*]. The intercept point on 7MHz would then be about +51.5dBm. Nevertheless, G3SBI comments that "This is not the ideal solution since slightly better intercepts could have been obtained by the conventional (post-mixer amplifier) arrangement with a filter having an intercept figure of +55dBm."

In conclusion, G3SBI writes: "One might ask the question does one need input intercepts of +50dBm? For amateur purposes the answer has to be the higher the better. [But note that the April *TT* quotes G3RZP as believing that 'a +20dBm third order intercept appears adequate, even on 7MHz at night' – *G3VA*]. The name of the game is to be able to copy a sub-microvolt signal in the presence of a heavy hitter a few kHz away from the desired signal. In addition, on 7MHz the proximity of the broadcast band is a problem with antenna signals greater than –10dBm present at times. Extreme linearity is thus desirable if a sub-microvolt signal is to be copied in these circumstances.

"The fact that the intermodulation performance of the crystal filter can be a serious problem at these intercept levels was not completely unexpected. The effects of this can be minimised as described by omitting the post-mixer amplifier, but filters with +55dBm intercepts would enable the construction of a high-performance front end with a post-mixer amplifier. It may be worth considering the use of home-made crystal ladder filters as part of a quadrature hybrid arrangement since no transformers are used, suggesting that the intercept figure could be high, although this has not yet been checked. In addition the low insertion loss of some ladder filters (about –2dB) would permit higher IF-stage noise figures.

"The mixer remains the most critical device if input intercepts of +50dBm are to be obtained on 7MHz. This performance has been achieved with all SD5000 chips of batch 9042 that were available; one from batch 9024 did not meet this figure on 7MHz, achieving +44dBm.

"To summarise, Jacob Makhinson, N6NWP, has pointed the way ahead for home construction of very high-performance HF receivers using a 9MHz IF. Given that, at a price, high-intercept filters are obtainable, the linearity of the mixer itself is still the limiting factor."

G3SBI next draws attention to published information on quadrature hybrids, including an article 'Twisted-wire quadrature hybrid directional couplers' by Reed Fisher, W2CQH, that appeared in *QST*, January 1978, pp21-23 with the sub-heading: "That title scare you off? Well, don't let it. Just read this and we'll make believers out of you." In the article, W2CQH points out that 3dB directional couplers or quadrature hybrids for parallelling UHF amplifiers or for achieving circular polarization are commonly implemented in strip-line but that "unfortunately, the UHF strip-line models cannot be scaled down to the HF bands since their dimensions become prohibitively large." His article shows how compact, low-cost, lumped-element, quadrature hybrids can be easily constructed for use in the HF amateur bands.

G3SBI then considers N6NWP's method of controlling the impedance seen by the post-mixer amplifier. A 6dB attenuator between amplifier and mixer has a significant effect on the system noise figure as seen at the input to the post-mixer amplifier. This is especially so with the 5dB or 10dB insertion loss of a narrow-band CW crystal filter. He believes that a better solution (if the additional expense is acceptable) is to use two identical filters, in addition to quadrature hybrids. His experimental work shows that satisfactory results can be obtained in this way with 9MHz narrow-band filters. But the use of two commercial crystal filters would represent a significant additional cost although this approach, using home-built ladder filters, might be feasible for someone determined to achieve +50dBm intercept points range on all bands. It must be stressed that performance of the standard being investigated by G3SBI calls for high-quality (although not necessarily high-cost) components and diode-ring mixers. Development work also involves measurements close to, or beyond the limits of, professional-standard test equipment.

Since the above was written, G3SBI has developed an alternative SD5000 mixer configuration capable of intercept points greater than +50dBm (limit of measurement) on all HF bands. More on this later.

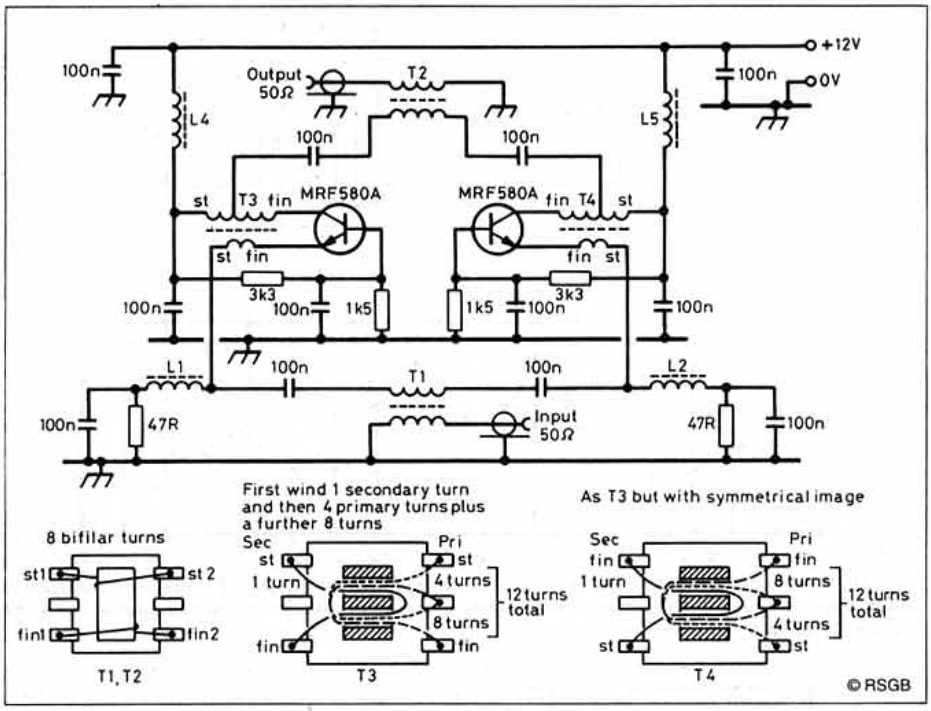


Fig 7: G3SBI's modified post-mixer test amplifier adapted from the N6NWP design but using MRF580A devices. All resistors 0.25W metal-film RS components. All 0.1µF capacitors monolithic ceramic RS components. L4, L5 4t of 0.315mm dia bicelflux wire on RS components ferrite bead. L1, L2, T1, T2, T3, T4 on balun core fair-rite 28-43002402 (Cirkit components). L1, L2 6t 0.315mm dia bicelflux wire RS components. T1 to T4, user 40SWG bicelflux wire. Take two glass fibre Cambion 14-pin DIP component headers, cut each in two parts and bend the tags 90° outwards. Stick a piece of double-sided tape onto the header and mount the balun cores on this. Wind the transformers as shown above. The amplifier is constructed with earth-plane layout.

MORE ON ANTENNA CORROSION

THE JULY *TT* ITEM 'Fighting antenna corrosion' based on the *QST* article (April) by Scott Toleson, KC7CJ, made a brief reference to 'fretting corrosion' but did not expand on this phenomenon. A panel in *QST* explained it as follows: "Fretting corrosion occurs whenever there is a small repetitive or cyclical motion at a metal-to-metal joint or seam. This motion can be either a make-break or sliding action. Basically, joint flexing or sliding exposes clean, fresh metal to the air, and an oxide begins to form. This oxide is broken or scraped away with each reconnection or flex, but begins to reform when it is exposed again.

"Over time, the oxide builds up at the joint, and eventually the reconnection or scraping won't remove all the oxide at the point of contact. Joint resistance gradually increases, and the joint eventually becomes intermittent. How long a joint or contact lasts before it becomes a problem depends on joint pressure. It also depends on how oxidation-prone the metals at the joint are, and other conditions such as temperature, humidity and the existence of surface contaminants."

Dick Biddulph, G8DPS, stresses that "fretting corrosion needs only the slightest movement of one surface relative to the other. It is prevented, as implied by KC7CJ, by preventing either the movement or the ingress of water or, preferably, both."

On other aspects of antenna corrosion raised by KC7CJ, G8DPS, writes: "The use of 'star washers' is only OK if the metal can't flow or creep. Lead and solder both creep at room temperature. Another point is that RTV (room temperature vulcanising) silicone rubber has a very good resistance to sunlight and whatever the weather can throw at it. There are some which do not give off acetic acid fumes when used and are therefore less likely to cause corrosion. Dow Corning 'Silastic 744' is one and is available from; Industrial Silicones and Lubricants, International Centre, Spindle Way, Crawley, West Sussex RH10 1TG."

HERE AND THERE

EMERSON M HOYT, WX7E, in *QST*, June 1993, p75 reports having found a simple way to install radials in a lawn or reasonably soft ground. He writes: "I use a square tip, flat-bladed spade and a Stanley No 10-T nail remover. I use No 8 bare copper wire, but other husky wires (such as No 10, 12 or 14 house wire) can also be used.

"I use the spade to make an approximately 2 to 3-inch-deep vertical cut along the radial location, and widen it into a V-shaped notch by rocking the spade back and forth. The wire can be laid into the groove, and then pushed down to the bottom of the groove with the Stanley tool. The large and very comfortable handle on this tool is very easy on the hands. The groove can be closed with some foot stamping, and in a few weeks all signs of the installation are gone."

Steve Ortmayer, G4RAW, reports that he has built and tried several QRM eliminators (see 'Phasing out interference – another look', *TT*, March 1993, pp34-35). He writes: "I have made the VK5BR and a friend has made both the VK5BR and W1ETC null steerers. All work, but with reservations! I have the VK5BR arrangement on 3.5MHz and it eliminates local electrical noise from vacuum cleaners and the like; it will also deal with computer noise from my boy's computer in the next room. The problem is where the QRM or QRN arises some way away so that the pick-up on the auxiliary antenna is not sufficient. My friend has tried using a 20dB pre-amplifier on the noise antenna, and also tried it just before the toroid. " ***G3VA***

PRODUCT NEWS

Note: Product news is compiled from press releases sent in by the manufacturers and distributors concerned. Details are published in good faith but *Radio Communication* cannot be held responsible for false or exaggerated claims made in the source material.

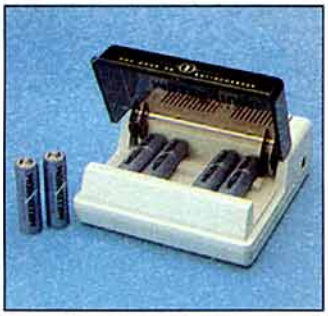
NOW HERE'S SOMETHING that will really smarten up your shack! From VK-land comes the **Zone View Global Clock**. These highly attractive 10" quartz timepieces have a World map which rotates every 24 hours. The result is a constant view of local times in 30 colour-differentiated time zones. The Orbit 24 is a similar 24-hour clock, but without the map display. Prices (sterling) are £39 for the Zone Clock (illustrated) and £29 for the Orbit 24. Carriage and other details on request.

Available from: Research Engineering Co, 1319 Main Road, East Eltham, Victoria, Australia 3095. Tel: 010 61 3439 5825.

IF YOU'RE IN the market for a **VHF beam antenna** then you may be interested to know that the Jaybeam range is now being handled under the name 'JB Antennas', by SMC Ltd of Eastleigh. We are assured that technical spares and sales support will be well up to the high standards achieved over many years.

Contact: South Midlands Communications Ltd, School Close, Chandlers Ford Ind. Est., Eastleigh, Hants SO5 3BY. Tel: 0703 255111.

MILLENNIUM, ONE OF the worlds largest manufacturers of rechargeable power products, has launched a new range of **Power Cells, Rapid Chargers and Power Packs** in the UK. The makers claim that they have up to 40% longer running time than traditional rechargeables. Sounds just the thing for VHF/UHF handhelds!



The Power Cells are available in five sizes - AA, AAA, C, D, and 9V ranging in price from £4.49 for an AA cell 2-pack to £7.99 for a D Cell 2-pack. The Millennium 1-Hour rapid charger (see photo) is priced at just £16.99, and there is also a 3-hour version.

Contact: Oakes-Bacot Ltd, 58 Queen Anne St, London W1M 9LA Tel: 071 224 0994

RADCOM CONSTRUCTION FEATURE

Adjustable Beam for 14-28MHz

by L J Smith, G3HJF

HERE'S A THREE element Yagi which can be constructed as cheaply as possible and re-configured, reasonably quickly, for operation on the amateur bands from 14 to 29MHz. Before readers get too excited and think that this is some magic piece of ironmongery let me explain in more detail.

Having installed a telescopic, tilt-over mast I resisted the temptation to remount the tribander which had been in use for some years. It worked well enough but even the most enthusiastic users concede that a tribander is a compromise and only a mean substitute for the real thing.

With easy access to the mast head, I could attach almost any sort of beam. At first I toyed with the idea of a separate beam for each band. The manufacturers catalogues were not encouraging! A three element 20m beam was well over £200 and not much less for beams for 10 and 15m. And what about the 17 and 12m bands?

For some years, I have used CB verticals in a variety of HF band antennas. Now two of these, laid horizontally end-to-end at full extension, produce a neat, lightweight tapered element over 36ft long – quite long enough for a 20m reflector and yet easily telescoped down to around 16ft or so for a 10m director.

CB antennas can be obtained cheaply now. I got a good price from a dealer at a rally for six of them, brand new and boxed, enough for a full sized three element 20m beam. The same dealer also gave me a good price for four 5ft lightweight mast sections which, fitted together would form the boom. Finally, at the same rally, I found a superb heavy-duty mast-to-boom bracket. Yes, there are still real bargains to be found at rallies!

CONSTRUCTION PROCEDURE

I AIMED TO MAKE the conversion from CB antenna to HF beam as simple as possible. The detailed construction of CB antennas tends to differ from one make to another but whether it is drilling out pop rivets or removing screws or bolts, the procedure is essentially the same.

Each antenna is shifted off its lower insulator, from which is removed the matching device, usually a tapped coil. Also removed is the SO239 coaxial socket. Each pair of CB mast mounting brackets are then drilled ready to be bolted together end to end. Plated 'roofing bolts', available in most DIY shops are used, three being sufficient for each pair of brackets. There is now a choice to be made: whether to dispense with the lower insulators altogether and join the ends of the elements with a short length of aluminium tubing, or to remount the insulators, reinforcing them with a short length of rod or tube passing from one to the other **Fig 1**.

In either case the idea is to strengthen the element union to take the additional strain put upon it by the horizontal elements. If the element is to be electrically continuous, joining the elements with a short length of tube is the strongest method. The holes vacated by the SO239 sockets can be reamed out to take the new tube section. A really top notch job can be made if you have access to aluminium welding equipment.

To strengthen the element support further, another hole is drilled in each 'top' insulator, through the element and a stout self-tapping screw or small bolt passed through to lock the element and stop it sliding as the mounting flexes. In my case I remounted the lower insulators using countersunk-head screws

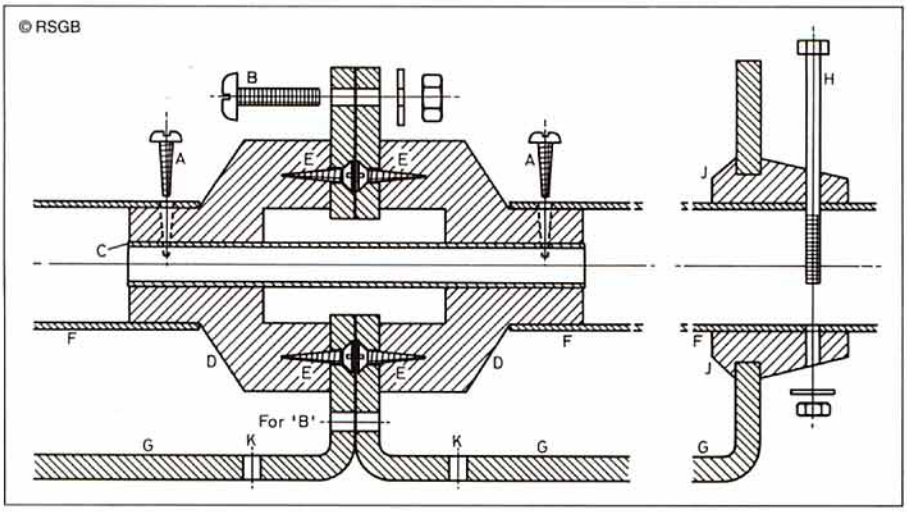
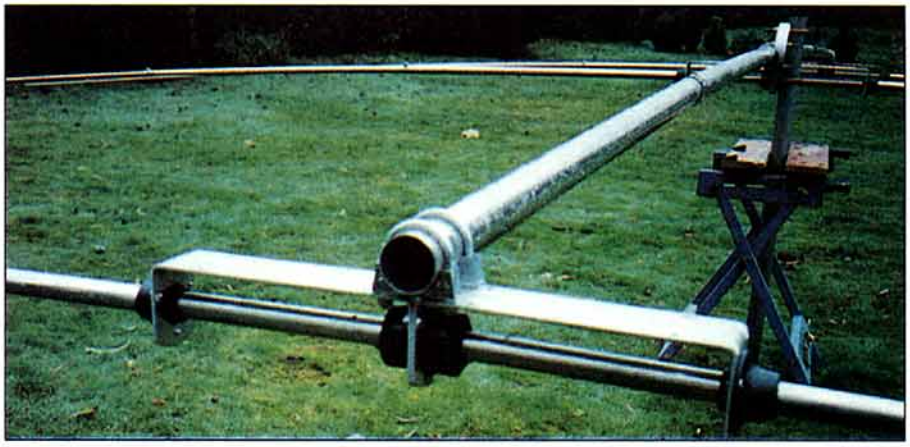


Fig 1: Cross-section through element (entire assemblies): A - S/T screw fastens element to insulator D and tube C. (Not used if split driven element. Hose clips instead); B - Plated bolt (with washer and nut) fasten mast brackets together (3 off); C - Thick wall tube reinforces insulator and provides electrical connection between elements F, via bolts A; D - Lower insulators; E - C/S screws fastening Ds to brackets G; F - CB antenna elements; G - Mast mounting brackets; H - Bolt, locks element to J to prevent element sliding in J; J - Top insulator and K - Holes for boom brackets (2" car exhaust clamps).

so that the ends of each of mast mounting brackets could be butted up flush and bolted together.

I chose to retain the lower insulators for convenience so that I had the option of a split driven element. A piece of thick wall aluminium tube, about ½in. in diameter and 6in long, is pushed through one insulator to the other to act as a strengthener. This also allows an electrical connection to be made by replacing the original self-tapping screws which had connected each element to the matching coil. If a split driven element is required then these screws are omitted and the ends of the elements are slit and clamped to the insulators with hose clips.

The brackets for each element are mounted to the boom by pairs of U bolts (2in exhaust clamps from a car parts shop).



The beam at ground level showing the neat method of joining two CB antennas together.

BOOM AND ELEMENT SIZE

THE 5FT SECTIONS are used to form the boom. To prevent the sections coming apart the ends are slit for a couple of inches and clamped by 2in diam hose clips. The lengths and spacing of the elements for each band can be obtained from the usual handbooks. Lengths for the higher frequency bands can be marked with paint or scribed with a sharp pointed tool. Don't use PVC tape or it will be scraped off or jam the joints when the elements are telescoped.

For those who love to tinker, the book *Yagi Antenna Design* by Jim Lawson, W2PV, provides a wealth of information on element lengths, boom sizes and spacings to optimize gain, bandwidth and Front to Back ratio. Using dimensions 'from the book', a gain of at least 6dB with 20-25dB F/B ratio can be expected. Generally, by altering the lengths and spacings greater gain can be obtained at the expense of reduced F/B ratio, and vice versa.

The complete antenna, assembled and ready to be fitted to the mast head weighs approximately 32lbs (14.5kg).

Finally, to keep the whole antenna looking shiny new it was given an application of silcone car polish from a spray can at the final assembly.

FEEDING AND MATCHING

THERE ARE MANY WAYS of feeding a Yagi beam, the most popular being the Gamma Match and Bill Orr's, W6SAI, 'Inducto-Match' or Hairpin. An entirely separate article would be needed to discuss them all fully. The methods described here are the ones that I've tried.

a) **Delta Match:** Probably the simplest system is the Delta Match **Fig 2(a)**. This involves taking open wire line up to the beam, the ends being splayed out and joined to the (continuous) driven element at points equidistant from the centre. The triangle so formed should have roughly equal sides: I found that sides as short as 1/20th wavelength (ie just under 4ft at 20m) worked well. When changing bands one can opt to reduce this but in practice these dimensions are very uncritical. I have used this matching system for many experimental beams and found it excellent. However some form of antenna tuner is required and though this has many benefits it must be admitted that most operators prefer coax and no ATU. In addition open line does not like being wrapped around the mast when the beam is rotated nor dumped on the ground when the antenna is lowered.

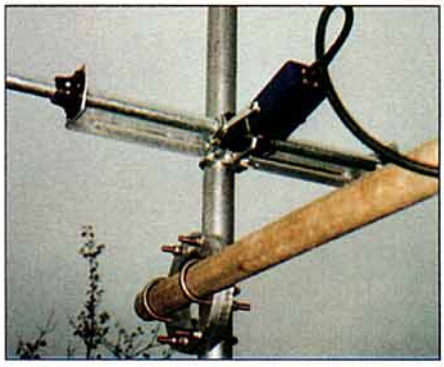
b) **Balun:** Alternatively if coax is preferred then the cable could be run up to a 4:1 balun and thence straight into the Delta section. But this implies that a low SWR is to be sought for each band and this means that there is a lot of experimentation to be done to find the right Delta lengths and spacings. In my trials with this system I could rarely get the SWR below 6:1, 10:1 being the most common. For open wire line and an ATU this is no problem, but for coax it is. Altogether I found this method of coax/balun/delta match more trouble than it was worth.

c) **Quarter Wave Transformer Match:** Bill Orr, W6SAI, once wrote that he had climbed more masts to measure the feed impedance of Yagi arrays than he cared to remember and that in every case this impedance was found to be in the range 18 to 20Ω. If this is so then another very feasible feed system would be to use 50Ω coax terminating in a ¼-wave transformer of 35Ω impedance and a 1:1 balun into the split driven element. The transformer section can be made up from two lengths of 70Ω coax (¼ wavelength long allowing for the velocity factor of the cable) in parallel. Since changing bands with this antenna involves dropping the beam down to alter element lengths, it can be no great trouble to have pre-cut ¼-wave transformers ready and to swap those over at the same time. However I found that obtaining a low SWR with this system is not quite as easy as it may appear as one has to be quite sure what the feed impedance of the beam is and select the transformer accordingly. In the end it seemed easier to settle for an SWR of 1.5-1.8:1 and a 'Coax Line Flattener' (ie an ATU!)

d) **Hairpin Match** ('Inducto-Match'): This method enables a good match to be obtained to coax on each band with the minimum of re-adjustment. The cable is run up to the centre of the (split) driven element and a choke balun consisting of 8 – 10 turns of light coax around a ferrite rod, inserted between it and the element. At the same connecting points some shunt inductance is added, taking the form of a pair of ½in dia aluminium tubes, about 2ft long and spaced a couple of inches apart and running back along but insulated from, the boom.

A shorting strap between the rods enables the value of the inductance to be varied. Adjustment is made by shortening the driven element from its design value by some 4 – 6 inches (at 20m) and checking the SWR whilst adjusting the position of the shorting bar. Once the right position for each band has been found it should be marked so that the shorting bar can be reset to the right position when changing bands.

The snag with this method is that finding the setting for minimum SWR can become very fiddly and it will certainly change to some extent when the beam is lifted to its operating height.



The 'Bit Match' box.

e) **The 'BIT Match':** All of the above methods are frequency sensitive and need readjustment every time the beam is set to a new band. Although element lengths for each band must be changed I confess that I didn't want to do more work than is really necessary. If W6SAI is right and the impedance of the driven element is around 20ohms then a transformer will do the job. A linear matching section as mentioned above is one such. But there is no reason why a 'Broadband Isolating Transformer' should not give just as good a match. Hence the 'BIT Match'. Such a transformer is very easily made.

The BIT Match shown in **Fig 2(b)** consists

of two windings on a large ferrite ring. I used a stack of three of the 38mm type available from the RSGB for EMC purposes [see BookCase pages 94/95 – *Ed*]. Two 10in lengths of 18SWG PVC covered copper wire are used. One is wound for three turns, evenly spaced, around the ferrite ring. The ends go to a SO239 socket for connection to the feeder. The other wire is now wound for two turns through the ring (making the transformer turns ratio 3:2), evenly spaced, taped and the ends taken to the (split) driven element of the beam. Because there is now some small value of inductance at the centre of the driven element its overall length should be reduced by three or four inches. The transformer is housed in a small plastic utility box and located right at the centre of the driven element.

Initial trials of this method gave an SWR of 1.5:1 or better across all of the bands. This can easily accomodated by the auto-ATU in many rigs these days. There is clearly room for experimentation here. The acid test seems to be to check the SWR and then run the rig at full power for half a minute or so. If the SWR starts to climb suddenly then switch off – the core is overheating!

A side benefit of this method is the reduction of interference from local broadcast stations. The BIT Match acts as very effective high-pass filter.

PERSONAL PREFERENCE

FOR EXPERIMENTATION I have a preference for the Delta match with open line and an ATU. Despite its mechanical drawbacks, electrically it works superbly! Otherwise the BIT Match described above is quite adequate for all normal operation and far less trouble than any other system.

CHANGING BANDS

THIS IS ONLY A few minutes work with practice and a little help from the an assistant! The mast is lowered and tilted over until the director is flat on the ground. At this position both it and the driven element are adjusted to pre-marked lengths. The beam is then hoisted high enough to allow it to be rotated through 180 degree and then lowered again to get at the reflector. I prefer to telescope the inner sections of each element rather than remove sections. This way no section gets lost! Al-

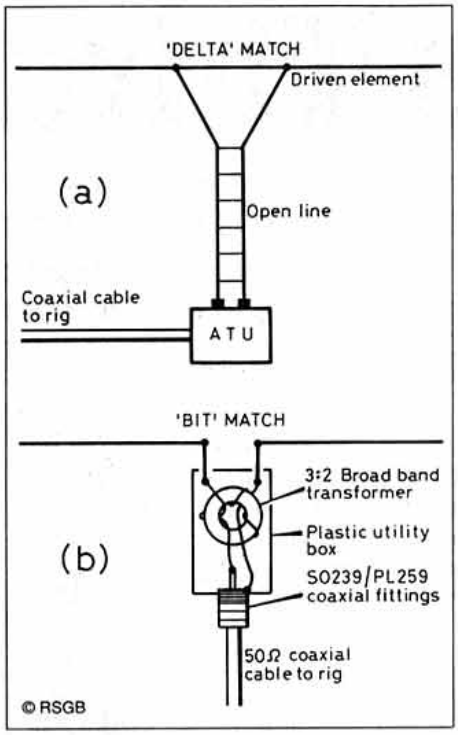


Fig 2: Preferred feed methods.

though the position of the elements on the boom should be changed for each band, the Yagi is not particularly critical as to element spacing. Wider spacings will give a greater gain but reduced front-to-back ratio. Experience with this antenna has shown that the spacing is so uncritical that I now no longer bother to change it. As a wide spaced beam on the 10 metre band it has proved to be excellent.

CONCLUSIONS

THE COST OF THE ANTENNA hardware was well under £100. The performance is excellent on all of the HF bands.

To those used to instant bandswitching the necessity of lowering the antenna and adjusting the elements may seem to be too much trouble. I will leave them to the expense of separate antennas and masts or a tribander. Perhaps because it takes a little time to change the antenna configuration, one is encouraged to stick with a band for a few days or even weeks. This is particularly rewarding on the HF WARC bands. It is remarkable the DX that lurks on these bands, away from the pile-ups and contests!

This use of CB antennas to make a Yagi is surely not unique. Someone, somewhere must have tried it before, but if they have and had it published, then I have not come across it. However, I will gracefully concede precedence.

If you would like to try a full-size, tuned-on-the-nose monobander then this must be about the cheapest way of doing it. But be warned, if you do you will find it hard to go back to anything else!

YAGI DESIGN FORMULAE

DESIGN FORMULAE for Yagi antennas vary only slightly from one reference book to another. I followed the data given in Bill Orr's 'Beam Antenna Handbook' [see BookCase p94 to order this informative book – *Ed*].

His formulae are:

Driven element length (feet)	=	473/F(MHz)
Director length (feet)	=	445/F(MHz)
Reflector length (feet)	=	501/F(MHz)
Element spacing (feet)	=	140/F(MHz)

Like most Yagi dimensions these are not particularly critical. One does not need to measure slavishly the lengths to fractions of an inch. I have found that setting the driven element to the formula above and then making the reflector some 3 – 5% longer and the director the same amount shorter worked just as well!

To allow the mast-to-boom bracket to be fitted at the point of balance the driven element was shifted 12 inches towards the director.

ACKNOWLEDGEMENTS

IT WOULD BE UNFAIR of me to conclude this article without a mention of the root cause of it! I would not have been tempted to design and build this antenna had I not had easy access to the top of my mast, in this case a 40ft Standard Plus (guy-less) model from Tennamast (Scotland). Holding aloft a beam of this size with over 120ft of aluminium tubing is no mean requirement. I can recommend this firm both for its products and the helpful advice of its proprietor, Norrie Brown, GM4VHZ.

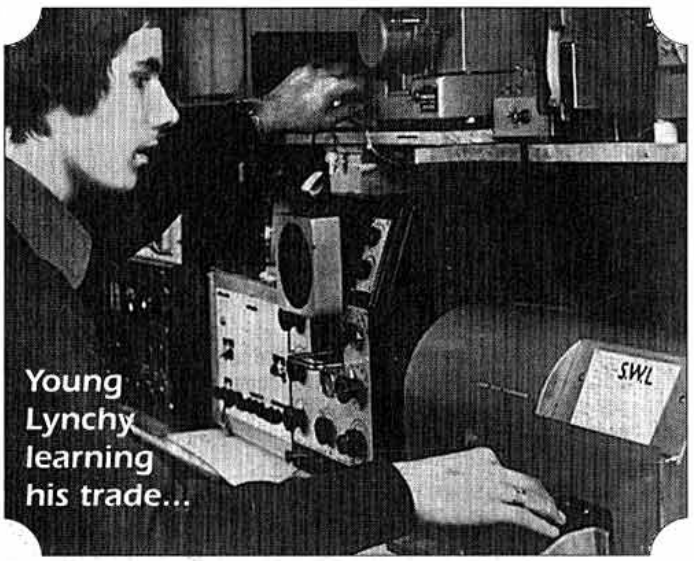
Stop Press...See the 'Lynch Mob' at these great summer events...
Bristol - 5th Sept...Telford - 5th Sept (yes, we're at both events)...

Lynch's Third Year At

To celebrate the third year at our Northfields showroom,we're having the biggest sale ever offered by a Radio Retailer. Very LOW DEPOSITS ON INTEREST FREE, (isn't it funny how everyone seems to have caught on to this one!), or CASH purchase, (TRADE-IN's still welcome), the savings on all NEW & USED AMATEUR RADIO EQUIPMENT will be offered during SEPTEMBER ONLY and will not be available at these prices again.

Thanks to all my loyal U.K. and Overseas customers, MARTIN LYNCH has had another successful year. Over TEN THOUSAND customers have poured through the front door or telephoned to place an order. Even more important is that you keep coming back to support your "Independent Retailer", realising that we really can offer objective and unbiased advice, giving you the very best in customer care.

More recently, you may have had a call from Brian, G3THQ. He's the latest member to join my sales team, his role being somewhat unusual. His job isn't to make sales, (albeit I'm the last to stop him!), it's actually to liaise with you **AFTER** the sale is made. Without landing you in it with the other half, Brian's role is to make sure you're satisfied with the purchase and ensures that nothing is left out of the transaction. In other words, if you're delighted with the service you've received from MARTIN LYNCH, then he is satisfied. So am I. How many other retailers contacted you - after the sale?



Young Lynchy learning his trade...

Massive Cele

...and now, with John Tett GØOID. The first U.K. TS-50S owner.

The NEW KENWOOD TS-50S Mini HF Transceiver.

Deposit only £99.95 & Twelve payments of £75 Interest Free

John Tett, G0OID near Dorking in Surrey has been a long standing customer of MARTIN LYNCH. When he phoned me and said he wanted the new TS-50S from Kenwood the day of issue, he wasn't kidding! When we said how about being the VERY FIRST owner of one in the U.K., he said great!

Just how long will Kenwood have to wait until the other manufacturers catch up. Word is, a very long time. The ultimate Mobile h.f. OR THE IDEAL BUDGET base rig, the TS50s really fit the bill. Look at the LOW LOW deposit this month...

AMATEUR RADIO STATION LOG

Date	Time (GMT) Start	End	Station Worked	MHz	Mode	Pwr W	Report Sent	Report Rcvd	Remarks
16-3-93	1500	1507	G3XKM	3.7	F3E	20	58	59	Jim Woking Surrey
16-3-93	1509	1520	G3GMN	3.7	F3E	20	59+20	59+10	Terry Worcester
16-3-93	1658	1710	G6OHC	3.7	F3E	20	59+10	59	Raymond Hereford
16-3-93	1947	2001	K2IH	18	F3E	20	59	58	George Massachusetts
17-3-93	0210	0225	ZL4DJ	18	F3E	20	57	56	Ken Small Island
17-3-93	0730	0745	VK7GK	18	F3E	20	58	55	Jerry Hobart Tasmania
18-3-93	0804	0809	G6GCM	3.7	F3E	20	59	57	Bob Clacton Pier
18-3-93	1530	1549	W4YJ	18	F3E	20	59	58	Arni Tennessee
18-3-93	1549	1600	W2AMY	18	F3E	20	55	55	Bob Long Island
16-5-93	0805	0829	9H1KK	18	F3E	20	59	58	Allan Malta Bay
20-3-93	1810	1817	I8NAR	18	F3E	20	55-56	59	Arnaldo Lerongo
21-3-93	0803	0825	UK2AHL	14	F3E	20	52-53	55	Leo Riga 1850
23-3-93	1240	1242	GW2HMT	3.7	F3E	20	59+	59+	Tom

John's impressive first log using the TS-50S.

The NEW ICOM DELTA ONE

World First Triple Band Handie
It had to come, all three bands in one neat & robust unit. Full coverage of 2, 70 23cm, three separate displays, three volume & squelch controls, this is 3 radio's in one small box.

Deposit only £159. Twelve payments of £50 INTEREST FREE.

The NEW ALINCO DJ-Z40

Not another handheld I hear you cry! Yep. But one with a difference. The guys at Alinco have given you a PANORAMIC DISPLAY showing you three channels either side of your operating frequency! Remote Digital Microphone, (wonder where they got that idea from?), throw in receive on 2 metres plus all the usual features of scanner-wide frequency coverage, Nicads, charger and the rest, and you'll see why ALINCO is good value for money.

Price ? Haven't a clue - PHONE FOR UPDATE!

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G4HKS

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M-400

As featured in August Short Wave Magazine, the NEW UNIVERSAL M-400 decoder is a must for those who want a serious RTTY, SITOR, FEC, WEATHER FAX plus much more CODE CONVERTOR at a sensible price. Available from stock.

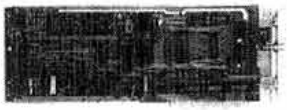
£379.95 incl. VAT
PSU extra at £19.95.

M-900

Similar in features to the M-400, the M-900 has a powerful FAX-to-SCREEN processor built in, enabling weather and other 'picture' transmissions to be viewed by a simple video monitor, before dumping to printer.

£499.95 incl. VAT

M-1000

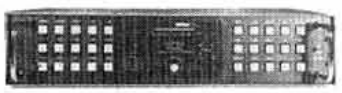


Got a PC and want a powerful decoder using your own computer as part of the system? The UNIVERSAL M-1000 is a complete CODE CONVERTOR on a single card, ready to slot into an IBM compatible PC. Full colour on screen graphics are at your disposal. This one IS fully recommended - our Chief Engineer uses one!

£379.95 incl. VAT

M-8000

The ultimate in all mode code converters. Mainly used by commercial organisations throughout the world, UNIVERSAL have managed to engineer the package at a price within reach of the true hobbyist. A true colour VGA output is given to enhance the incredible definition obtainable in all modes by this advanced piece of hardware. It's easier to use than you think - a few hours will soon bring decoded data to your own screen from around the world. Open your eyes to a new world just waiting for you to explore. Put your NRD535 or R5000 or Drake R8E to real use today!



&1199.95 incl. VAT. A 10" VGA HIGH RES COLOUR Monitor is available for only £179.95

bration Sale!!

The Yaesu FT736RDX -
the best selling VHF/UHF Base Station

Since the introduction of the muTek RDX Front-End boards replacing the originals, sales of the transceiver have gone through the roof! Hundreds of engineering hours by both Mike Dorset, (if muTek who designed the boards) & Graham my Chief Engineer, who carefully fits each one individually, have helped make the YAESU FT736RDX the best performance, most economically priced Base Station available today.

To celebrate the MARTIN LYNCH THREE YEAR CELEBRATION, I will actually PAY YOU £100 towards your deposit, on Interest Free, over a whole twelve months!

PHONE TODAY FOR A TAILOR MADE QUOTATION

The NEW ICOM IC737
H.F. Base Station Transceiver

Reviewed in September Radcom, Icom have given you a top flight H.F. Rig, with all the frills at a sensible price, (They obviously shot the chap who usually prices ICOM kit!!). Mr HENRY LEWIS G3GIO, or "MR FAMOUS" for short, reviewed this in the LYNCHY Spring newsletter and comparing it with his TS950SD, reckoned it stacked up very well. Not bad seeing the Kenwood is more than DOUBLE the price!! The auto atu is simply staggering, so is the display, electronic keyer, receive performance and Icom quality "feel". Come on lads, get those eight year old IC735's in on Part-Exchange. I'll give you a silly trade-in offer you can't refuse!!

Deposit £295.00 & Twelve payments of £100 INTEREST FREE

The NEW YAESU FT530R
Dual Band Handie

It's the most expensive, but it is, in our opinion, probably the best. Capable of dual receive on ONE BAND, full duplex on 2/70, digital remote speaker microphone, yes it actually has a display BUILT IN, plus payment over a whole year, interest free gratis?

Deposit only £53.00 & twelve payments of £39.75 Interest Free. Or with Digital Mic. Deposit £61.00 & twelve payments of £45.75

The NEW KENWOOD TH-78E

I remember when these were as rare as price reductions in Ham Gear, they were just unobtainable! Now KENWOOD U.K. are here doing the biz on distribution, I've got a wall of them! Dave, or "RAVE" Wilkins at Kenwood thinks that life wouldn't be worth living without caressing his little '78 each morning. I wouldn't know, but it is the most popular Dual Band Handie next to the Alinco DJ-580. I've knocked the deposit to a minimum and thrown in FREE CARRIAGE to anywhere in the U.K. next day, GUARANTEED!!

Deposit only £46.95 & twelve payments of £35.25 INTEREST FREE

That TWO YEAR WARRANTY...

Several telephone enquiries have bought about the topic of 2 year warranties being offered at present. This was an old selling tactic introduced years ago and every now and again, it re-appears. Quite frankly, we can all start offering 2 years, indeed why stop there, why not 3 or 4 or even 10? Without wishing to preach to the converted, you know as well as I do, most faulty electronic equipment goes wrong within seconds of pulling it out of the box. This is usually due to insufficient test before dispatch. Alternatively, a malfunction can happen a few hours or even weeks after use. Generally, todays manufacturing methods & design have pushed the MTBF, (mean time between failures), so far down the road, that offering a Two Year warranty is relatively meaningless.

What's far more important is how your retailer responds to a problem with your faulty purchase. For example, will he:

a. Collect your faulty transceiver, (within the U.K.), the same day, (if phoned through before 12:00), for rectification - at HIS EXPENSE?

b. Offer a replacement if the equipment is in as new condition and only recently purchased?

c. If a repair is required, get it fixed within 10 working days (subject to spares), & return it to you at HIS EXPENSE? Most companies lead times to their workshop is 4-6 WEEKS - then it gets repaired!

d. Keep you informed of the progress with your warranty claim?

e. Out of warranty claims charged at a minimum - our servicing charges are one of the lowest in the country.

Who else offers a "MENU" fixed price repair service for most equipment?

If the answer is YES to all of the above, then you're probably using me already! If not, there's always that 10 year warranty available.....

The complete range of AMATEUR RADIO PRODUCTS held by the showroom is on special offer and O.T.T. trade-in prices will be offered for clean equipment. Anything over £200 can be bought on INTEREST FREE, no catches, just free interest loans. If you want a particular product that's not listed then get dialling, or call in.
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OKI MSM6322 SPEECH PITCH CONTROLLER

- 16 Pitch-conversion ratios
- Input and output LP filters
- Microphone amplifier
- Line amplifier
- 5V analogue & digital supplies
- On-chip oscillator
- Serial or parallel digital input

ORIGINALLY MARKETED for creating 'monster voices' in children's toys, the MSM6322 acts as a digital audio frequency multiplier and divider. This has surprising potential applications for communications. For instance, connected to the output of a 500Hz audio filter (giving CW audio over, say 300 - 800Hz), it can spread the audio spectrum over 1kHz (ie 600 - 1600Hz) which could reduce operator fatigue or allow an audio filter to reduce the bandwidth further without ringing. Tests by *RadCom* staff have shown this to have a remarkable effect, particularly in combatting wideband QRM.

Alternatively, imagine dividing speech audio by two so that it can be received in a 1.5kHz bandwidth, prior to using the MSM6322 to multiply by two to restore the audio band - or even cascading two or more! There is huge scope for experimentation and we'd be interested to hear of your results.

MANUFACTURER'S DATA

THE OKI SEMICONDUCTOR MSM6322 converts in real time the pitch of an audio signal by up to one octave upward or downward. Available solely in surface mount (with a package size of only 16 x 12mm), the IC contains a fourth order low-pass input filter and 8-bit A/D converter. In addition it has a 9-bit D/A converter, third order low pass output filter, as well as a microphone preamplifier.

Fig 1 shows the IC pinout and **Table 1** gives typical electrical characteristics for the device.

IC DESCRIPTION

THE BLOCK DIAGRAM of the MSM6322 is shown in **Fig 2**. Analogue and digital power supplies to the chip are completely isolated to reduce the chance of digital noise introducing itself into the analogue signal path.

Two operating modes are available:

1) With the mode select (MS) pin set to logic low (0V) the MSM6322 is placed in the 'UP/DOWN' mode. Pulses to the 'UP Conversion' (UP.C) and 'Down Conversion' (DW.C) pins raise and lower the pitch of the signal by one step per pulse. 17 steps are available in this mode.
2) With the MS pin set high (5V), the device is placed into 'BIN' mode. P0-P3 become binary inputs selecting one of 16 stages of pitch conversion.

Table 2 shows the relationship between scale

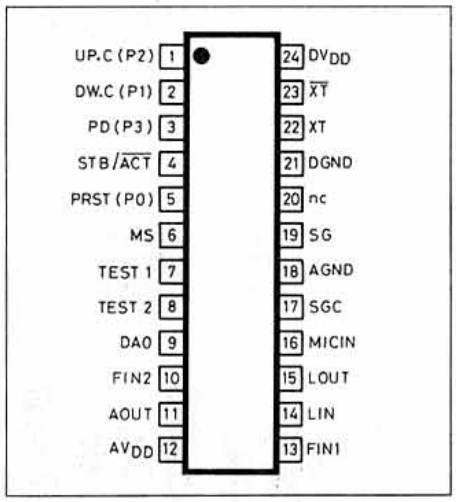

Fig 1: Pin connections for the MSM6322.

stage, D/A sampling cycle, and low pass filter cut-off frequency.

The circuit diagram of **Fig 3** refers to component values and pin connections for a module available from Maplin Electronics. The microphone amplifier gain is set by resistors R1 and R2, with the values of Fig 3 giving approx 42dB. RV1 sets the line amplifier gain between 0 and 100 (40dB). If using the microphone preamplifier, link LK2 must be installed to route the pre-amplifier output into the line-level preamplifier.

The output of the D/A converter is brought out to pin P16. This is *before* any output filtering has taken place. Note that this output has a +2.5V DC offset and will therefore need to be capacitively coupled to any external equipment. Link LK3, when installed, routes the D-to-A output through the IC's low pass filter, to pin P18. The functions of P11 to P14 vary depending on the mode of the MSM6322, as shown below.

Pin No.	Up/Down Mode	Bin Mode
P11	UP.C	P2
P12	DW.C	P1
P13	PRST	P0(lsb)
P14	PD	P3(msb)

As the MSM6322 does not boast a very high signal-to-noise ratio it may be beneficial to route the audio signal through a compander (compressor/expander). The NE571 would be a suitable device for this application.

AVAILABILITY

THE MSM6322 IS AVAILABLE from OKI Semiconductor distributors, such as Highland Electronics Ltd (tel: 0444 236000) or a complete controller board (circuit as shown in Fig 3) can be obtained from Maplin Electronics, PO Box 3, Rayleigh, Essex SS6 8LR Tel: 0702 554161. Prices are as follows:

MSM6322 kit (order code LP58N) . £12.95
MSM6322 PCB (order code GE78k) £1.65
MSM6322 Assembled board
(order code AM21X) £17.95

Prices include VAT but a handling charge of £1.20 must be added for mail order.

NOTE: Device characteristics and application notes in *Simply Silicon* are compiled from manufacturers' published data. Circuit diagrams are included for experimental purposes only, and have not been proven by *Radio Communication.* Transmitting equipment must be operated in accordance with national regulations. All data is copyright of the device manufacturer.

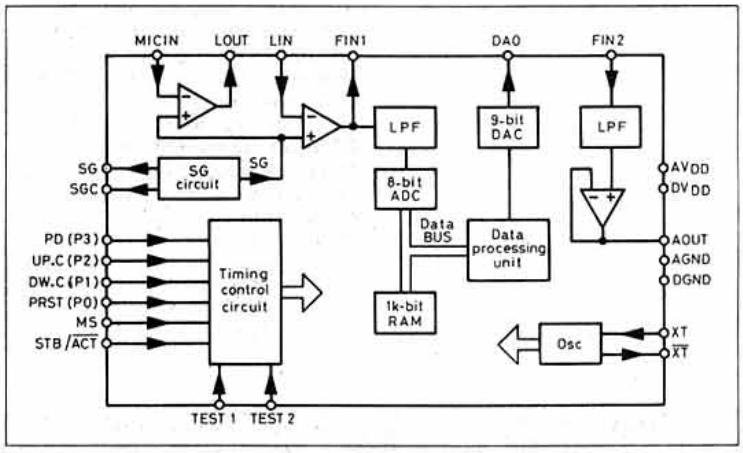

Fig 2: Digital and analogue stages in the MSM6322.

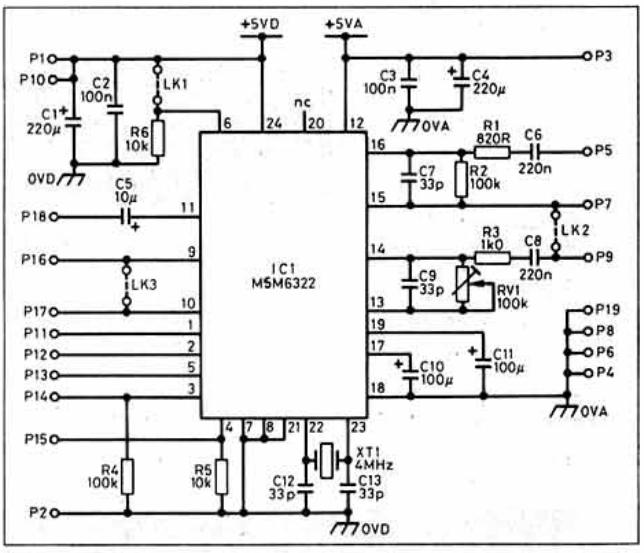

Fig 3: Practical application in 'BIN' mode.

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Digital supply voltage	DV_{DD}	For D_{GND}	4.0	5.0	6.0	V
Analogue supply voltage	AV_{DD}	For A_{GND}	4.0	5.0	6.0	V
Operating current	I_{DD}	4MHz oscillator			10	mA
Power down current	I_{DP}	PD = 'H'			1	mA
A/D converter precision		$A_{DD} = V_{DD} = 5V$			40	mV
D/A converter precision		$A_{DD} = V_{DD} = 5V$, No load			40	mV
Input impedance MICIN	RI_{MICIN}			100		MΩ
Input impedance LIN	RI_{LIN}			100		MΩ
Operating frequency	t_{CMAX}			4.0	4.5	MHz
Time between UP.C and DW.C pulses	t_{RUD}		30.72			ms
Pulse Width of PRST, UP.C, DW.C pulses	t_{UDPW}		30.72			ms

TABLE 1: Electrical and timing characteristics for this versatile device.

'BIN' mode settings P3	P2	P1	P0	Scale Stage	DA sampling cycle (uS) frequency (kHz)	LPF cut-off frequency (kHz)	Pitch Change
1	1	1	1	15	71/14	7.60	Nine semi-tones up
1	1	1	0	14	76/13.1	5.70	Eight semi-tones up
1	1	0	1	13	80/12.5	5.70	Seven semi-tones up
1	1	0	0	12	90/11.1	5.70	Five semi-tones up
1	0	1	1	11	95/10.5	5.70	Four semi-tones up
1	0	1	0	10	101/9.90	4.56	Three semi-tones up
1	0	0	1	9	113/8.84	4.56	One semi-tone up
0	0	0	0	8	120/8.33	3.80	No pitch change
0	1	1	1	7	127/7.87	3.80	One semi-tone down
0	1	1	0	6	143/6.99	3.26	Three semi-tones down
0	1	0	1	5	151/6.62	3.26	Four semi-tones down
0	1	0	0	4	160/6.25	3.26	Five semi-tones down
0	0	1	1	3	180/5.55	2.85	Seven semi-tones down
0	0	1	0	2	190/5.26	2.53	Eight semi-tones down
0	0	0	1	1	202/4.95	2.53	Nine semi-tones down
0	0	0	0	0	227/4.40	2.07	One octave down

TABLE 2: A frequency increase of one semitone corresponds to approx + 5.95%.

RADCOM NEWS FEATURE

The Camel Challenge

A Tale of Rovers and Radios, Crocodiles and Communications by Mike Devereux, G3SED

THE CAMEL TROPHY is an annual four-wheel-drive event staged in remote parts of the world. It is about adventure, expedition and competition, and is an opportunity for the man in the street to escape daily routine and discover a little more about himself.

This year it was staged in Sabah, Eastern Malaysia, where a convoy of some 30 Land Rovers tackled a gruelling 1,000km course in one of the world's last uncharted regions of jungle. Communications play a vital part in such a venture – VHF/HF Radio, Satellite and Data systems must be installed and operated in difficult surroundings round the clock. Richard Diamond, G4CVI of South Midland Communications, the comms contractor, also saw the opportunity to put an amateur radio station on the air.

Richard assembled a five-man team, Mike Devereux, G3SED; Richard Mumford, G8SVC; Andy Cook, G4PIQ and Adrian Collins (SMC engineer). Adrian, for the second year running, manned the communications car which travelled with the convoy. His job was by far the toughest – during the day the three-man crew would overcome a variety of natural obstacles, such as fallen trees, washed out bridges, river crossings and heavy mud. They endured crocodiles, leeches and many other 'creepy crawlies' in their efforts to stay with the main convoy. Once the convoy camped his main work began, linking journalists to the outside world via satellite and HF radio or passing messages back to the headquarters situated in a hotel at Kota Kinabalu, the capital of Sabah, Eastern Malaysia.

PHOTOGRAPH: LEE FARRANT

The communications team: Back row (l to r) – Mike Devereux, G3SED; Richard Mumford, G8SVC. Front row (l to r) – Adrian Collins, SMC Engineer; Richard Diamond, G4CVI; Andy Cook, G4PIQ.

Aerial Farm

FOR THE REST OF us arriving at Kota Kinabalu after 21 hours of travelling, we managed to grab a few hours sleep before the mammoth task of fitting out 30 Land Rover vehicles with a mixture of satellite communications, HF, VHF, navigational and airband communications. In all, we took 3.5 tons of radio equipment!

The job duly completed, our attention turned to the operations room in the hotel itself, where we erected an 80ft trailer-mounted tower on which a variety of beams were supported – a 3-element trapped yagi for 11, 15 and 20MHz for commercial links via Portishead Radio in the UK, a 3-element 14/21/28MHz beam (TB3), a 6-element NBS yagi for 50MHz and a 2-section 169MHz collinear, all mounted on a 20ft pole protruding from the top of the tower. From a cross-arm we supported a 1.8–28MHz trapped dipole, inverted-vees for 9 and 5MHz and a trapped dipole for 5, 7 and 9MHz, quite an accomplishment in the blazing sunshine, high humidity and 35°C temperatures.

Our main communications room used two FT-1000s for the commercial HF station, configured for general coverage and capable of watching four channels simultaneously. One of these was connected to an Alpha 86 to produce 2kW output. A custom-built unit enabled us to operate these transceivers with voice scrambling, telephone patch, digital voice recording and editing and remote control. An Icom IC-761 stood by as the reserve HF unit. For the amateur bands we used a Yaesu FT-990 driving a Tokyo Hi-power HL1K and for 6m a Yaesu FT-650. We were granted the amateur callsign of G4SMC/9M6 and given permission to operate on 50MHz, a band not normally available to the Malaysians – on the understanding that we caused no interference.

Ideal Location

OUR OPERATION started on 22 April and the first contacts were on the 50MHz band with JA0GLM/0TU, XU0UN and V85PB plus

PHOTOGRAPH: LEE FARRANT

The well-equipped communications vehicle sending a press release on fax via Inmarsat A.

PHOTOGRAPH: G4CVI

One of the Land Rover vehicles attempts to cross a wash out on the improvised bridge erected by the teams.

PHOTOGRAPHS: G4CVI

Installing antennas on the 80ft trailer-mount tower at the Tanjung Aru Resort Hotel in Kota Kinabalu.

Mike Devereux, G3SED operating the Yaesu FT77 manpack on Mount Kinabalu some 50 miles from base camp.

Richard Diamond, G4CVI, operating on 6 metres with a Yaesu FT650 and a pile of JAs.

numerous JAs – not bad for our first day on 6m.

Our location was ideal – we were situated on a peninsula with the tower less than 100ft from the water's edge with a clear take-off for over 270° out across the sea. To our surprise, 9M6 was still very much in demand on the HF bands – we were frequently asked to QSY to CW operation running huge pile-ups on the short path to Europe on 15m from around 1400 to 1700GMT and 20m from 1700 to 2100GMT. We noticed a definite peak around 1900. Propagation at that time of year favoured the more northerly stations, with the OHs and GMs being the first to be audible.

We had frequent spells of operating on 40m, making many CW contacts into England, peaking around 2000. It was very interesting how different 40m sounded from Malaysia – there were none of the usual commercial signals and during the day the band was virtually deserted.

Dead Bands

80M PROVED to be the biggest disappointment – the band appeared to open for only ten minutes just before our sunrise but heavy thunderstorm static made contacts very difficult. During daylight hours, most bands were virtually dead, presumably as activity in that area was limited and the nearest centres of high activity were thousands of kilometres away. On 20m the long path into Europe opened around 1000, with many Gs being audible at good strength. Unfortunately, at that time of day we were unable to respond because of our heavy commitment with the event itself. We ended the amateur operations with approximately 1,000 6m contacts and 5,000 HF contacts, not a bad total considering that our time to operate on the amateur bands was severely limited.

10W to Chile

THE MAJORITY of our commercial traffic was on the 5MHz band with occasional shifts to 9MHz. The convoy was usually 80 – 170 miles away with 14,000ft mountain ranges in between.

One of the more interesting links set up was when event director Iain Chapman was heading the team on a walking expedition into the 'lost world', an area of jungle in a valley surrounded by 5,000ft ridges. Iain was operating a battery-powered Yaesu FT-70 Man Pack at 10W output into a low slung dipole. We managed to patch Iain through to Paul Simons, G4CCZ, who was located in Chile as part of the Camel Trophy '94 pre-scout team. Paul was in a remote location with a generator and portable satellite phone. We patched Paul through to our HF system using a Yaesu LL2 phone patch unit. Iain was then able to converse directly with Paul. It may not have been the greatest technical achievement but to Iain, located in thick jungle with a low-powered battery driven radio, it was impressive.

6m Beacon

AFTER THIS event was over and we were packing away the tons of equipment we were fortunate to cross paths with the South China Sea DX Group who stayed several nights near our hotel whilst en route to 9MS (Spratly Island). A dinner had been arranged – the two Richards, G4CVI and G8SVC, were invited to be guests of honour. During the after-dinner speeches it was announced that SMC would donate a 6m beacon to Sabah together with their log of 50MHz operation. The licensing authority agreed to issue the callsign 9M6SMC for a new beacon at 50.014MHz and that in view of our operation it was quite likely that 50MHz permits would be available to the 9M6 amateurs in the near future.

The Camel Trophy event was a great success, with the USA winning the overall trophy. From our point of view everything worked exceptionally well. We had over 5,000 amateur contacts and came away having established a 6m beacon for another country. For next year's event we will travel to Argentina, Paraguay and Chile. G4CVI has already left for the pre-scout visit and no doubt amateur radio will once again be a part of the operation.

PHOTOGRAPH: LEE FARRANT

RADCOM TECHNICAL FEATURE

Spread Spectrum in Action

the second of a two part article
by James A Vincent, BSc (Hons) C.Eng MIEE, G1PVZ

LAST MONTH, I explained the principles behind frequency hopping and direct sequence Spread Spectrum transmissions. Also the circuit elements required for a practical implementation.

Fig 9 is a spectrum analyser plot showing a Spread Spectrum signal and the associated despread spectrum. These plots were obtained from the first practical amateur direct sequence system used in the UK. The direct sequence system can use conventional analogue modulation such as amplitude or frequency modulation, but as discussed for frequency hopping this has disadvantages which are even more pronounced with a direct sequence signal.

INTERFERENCE REJECTION

AS HIGHLIGHTED EARLIER there are several advantages in using Spread Spectrum techniques, and one of the most important is interference rejection. As the carrier is spread over many megahertz of bandwidth the receiver has to 're-map' the bandwidth used for transmission down to a narrowband signal for subsequent filtering and demodulation. As can be seen from Figs 3 and 8 (last month) there is essentially little difference between the spreading and despreading circuitry on a Spread Spectrum transmitter and receiver (whether direct sequence or frequency hopping).

If a narrowband interfering signal is received on a direct sequence receiver the interference will be 'spread' over the spread bandwidth of the system. This is achieved by the biphase shift modulator, used to despread the wanted Spread Spectrum transmission as shown in **Fig 10**. This has the effect of diluting the power of the interfering signal over a wider bandwidth whilst the wanted Spread Spectrum signal is concentrated by despreading into a narrow bandwidth signal. Thus the interfering narrowband signal has less energy after the IF filtering to interfere with the wanted transmission.

For a frequency hopping system it is somewhat simpler to visualise the interference rejection properties. As a frequency hopper hops over many frequencies a narrowband signal will only cause interference should the frequency hopper hop onto that particular frequency. In other words the transmission would be jammed only if the hop set included that interfering frequency and then only for the dwell time of the frequency hopper. The greater the hop speed (ie the shorter the dwell time) and the greater the bandwidth the system can hop over, the less significant is the effect of narrowband interference.

PROCESS GAIN

WE WILL NOW CONSIDER a very important and fundamental concept in Spread Spectrum systems; process gain (Gp). The process gain indicates the gain or signal to noise (S/N) improvement exhibited by a Spread Spectrum system by nature of the spreading and despreading process. Process gain can be estimated by the following empirical relationship:

$$\text{Process gain} = Gp = \frac{BW_{RF}}{R_{info}}$$

$$\text{Process gain} = 10\log_{10}\left(\frac{BW_{RF}}{R_{info}}\right) \text{ dB}$$

Where BW_{RF} = 3dB bandwidth of transmitted Spread Spectrum signal (Hz), and

R_{info} = data rate of the information transmitted, in bits per second

For a direct sequence signal BW_{RF} is assumed to be equal to the 3dB bandwidth of the spectrum (which is 0.88 times the pseudo-random code clock rate for a biphase shift keyed direct sequence system). For a frequency hopping system BW_{RF} is equal to m times the channel bandwidth where m is the number of frequency channels available.

Although the process gain is directly related to the interference rejection properties a more indicative measure of how a Spread Spectrum system will perform in the face of interference is the jamming margin (Mj).

JAMMING MARGIN

THE PROCESS GAIN OF A system will always be greater than its jamming margin.

$$\text{Jamming Margin (Mj)} = Gp - [L_{system} + (S/N)_{OUT}] \text{ dB}$$

Where

L_{system} = system implementation losses, and

$(S/N)_{OUT}$ = signal to noise ratio at the information output.

A Spread Spectrum system with a 30dB process gain, a minimum required output S/N ratio of 10dB and system implementation loss of 3dB would have a jamming margin of 30 – 10 – 3dB, ie 17dB. The Spread Spectrum system in this example could not be expected to work in an environment with interference more than 17dB above the desired signal.

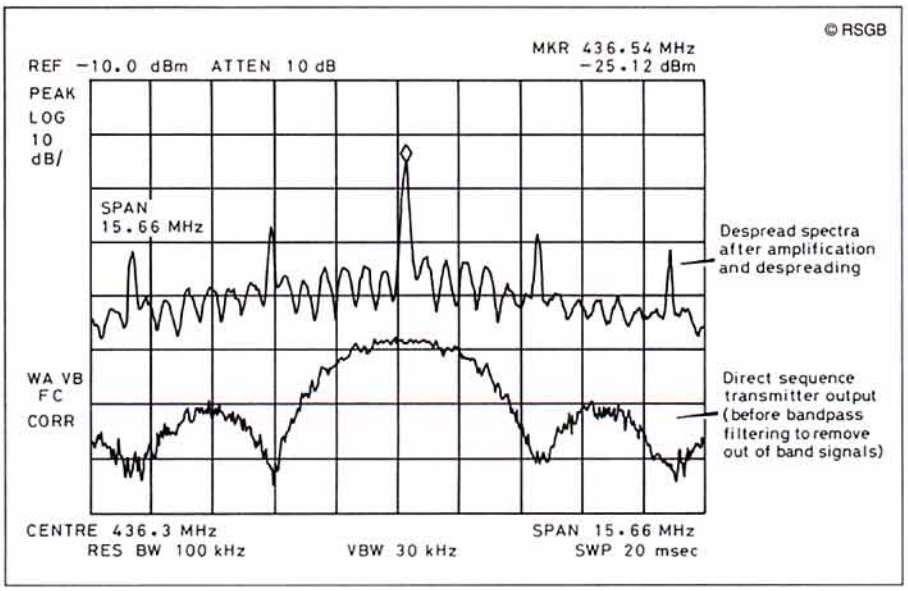

Fig 9: The transmitter output and despread spectra as displayed on a spectrum analyser.

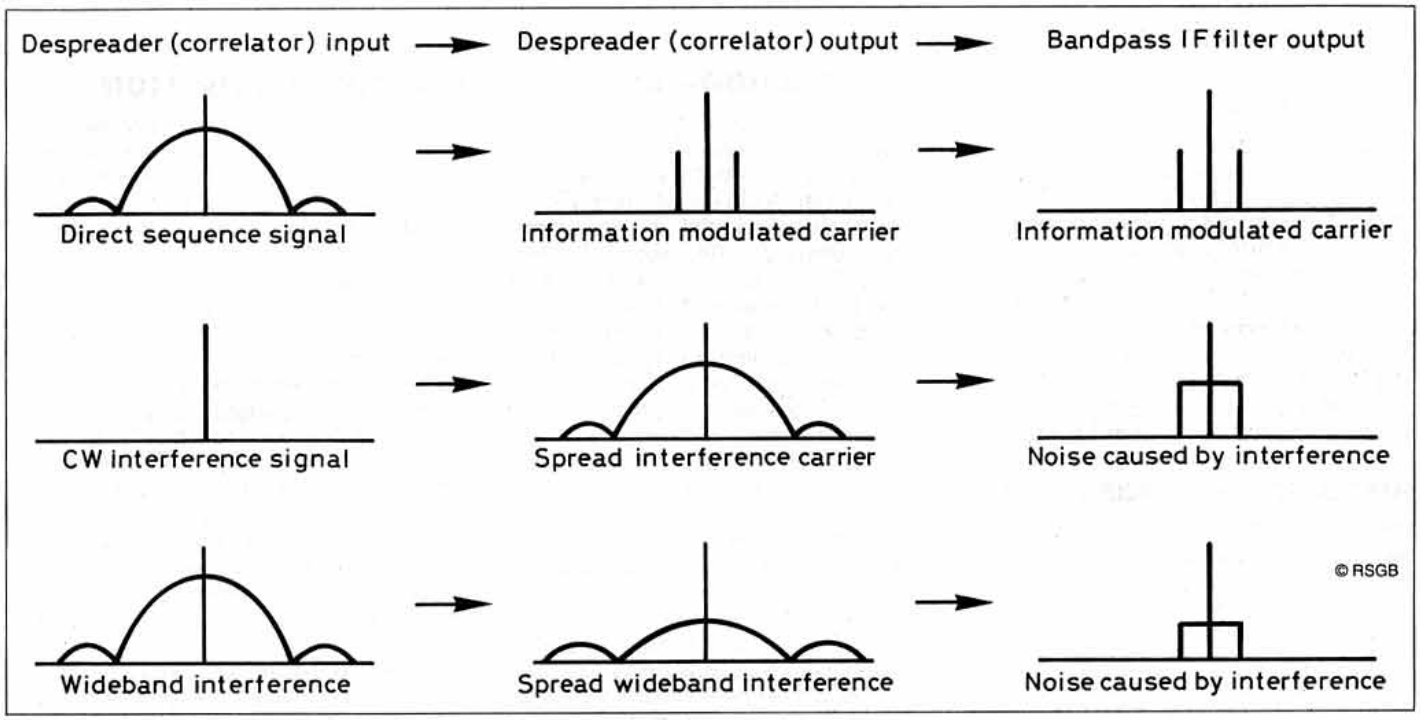

Fig 10: Effect of narrowband and wideband interference on a Spread Spectrum signal.

CODE DIVISION MULTIPLE ACCESS (CDMA)

AS ALL SPREAD SPECTRUM systems use a code to determine the transmitter's output, it is possible to have multiple usage of frequency and selective addressing by using different spreading codes for differing user groups. A Spread Spectrum receiver will see another Spread Spectrum signal as interference and reject it as it would a narrowband signal. However for a high degree of co-user rejection, spreading codes must be carefully chosen to minimise cross-correlation (See Appendix B). Cross-correlation is a measure of the 'match' between two different spreading codes. When there is only one transmitter and receiver the spreading codes are chosen such that the correlation is at a maximum when the two codes are in synchronization, that is the receiver and transmitter are both at the same point in the code sequence.

MATCHING USER CODES

WITH MULTIPLE USERS, multiple spreading codes will obviously be in use. Since a spreading pseudo-random code consists solely of binary '1's and 'O's there will be time in the code sequences where there will be a degree of matching or 'cross-correlation' between different user codes. This cross-correlation limits the number of users that can use the frequency at any one time.

It is possible to select mathematically, groups of spreading codes which work well together. Careful selection of spreading codes is essential for multiple use of frequencies whether they are used in direct sequence, frequency hopping or hybrid Spread Spectrum systems.

LOW POWER SPECTRAL DENSITY

BY NATURE OF THE 'SPREADING' process, the output power of the Spread Spectrum transmitter is spread over typically many megahertz of bandwidth. The spectral density is measured in how many watts of ratio frequency power are present per Hertz of bandwidth. Thus for a direct sequence transmitter of 1W output and a spread bandwidth of say 8MHz the power spectral density is:

$$\frac{1}{8{,}000{,}000}\ \text{Watts/Hz} = 125\text{nW/Hz}$$

For a conventional narrowband AM transmitter the power spectral density is around:

$$\frac{1}{6{,}000}\ \text{Watts/Hz} = 167\mu\text{W/Hz}$$

(around 1,300 times or 31dB greater)

The advantage to military users is that the signal strength apparent on a conventional narrowband receiver is very, very low and would probably not be recognised as a communications signal, hence the expression 'Low Probability of Intercept' (LPI) and 'Low Probability of Recognition' (LPR).

ADVANTAGES TO AMATEURS

FOR RADIO AMATEURS, the major advantage of the low power spectral density is the possibility of simultaneously using frequencies for both conventional narrowband and Spread Spectrum communications. The Spread Spectrum system rejects the narrowband communications as interference by nature of the process gain. The narrowband communications system would merely experience a reduction in their signal-to-noise ratios proportional to their proximity to the Spread Spectrum transmitter.

In the case of a frequency hopper a short interruption to the narrowband communication link would be apparent should the hopper hop onto the narrowband frequency in use. If this is not acceptable then the hop set could be selected so that discrete frequencies (eg repeater inputs) are excluded.

HIGH RESOLUTION RANGING

BY NATURE OF THEIR digitally coded carriers, Spread Spectrum systems particularly direct sequence techniques lend themselves to precise ranging. In fact the global positioning satellite (GPS – Navstar) system depends upon direct sequence modulation and high stability clocks to enable a user's receiver to determine its position and velocity in three dimensions over the vast majority of the earth's surface. The operation of GPS is not explained in this article as it has been exhaustively discussed elsewhere, [5], [6] and [7].

PRACTICAL SPREAD SPECTRUM

SINCE 1986 THE US Federal Communications Commission has permitted US radio amateurs to use Spread Spectrum techniques on amateur bands on or above 70cm. Much ground-breaking work has been carried out by US amateurs, in particular by members of AMRAD (The Amateur Radio Research and Development Corporation), a non-profit making international group of radio amateurs interested in advanced communication techniques.

During 1987, I built a Spread Spectrum demonstration system as a final year undergraduate project at Plymouth Polytechnic. It did not freely radiate and the synchronization and tracking circuit was not implemented as the transmitter and receiver circuits shared the same code generator. The system was built to examine the signal characteristics and jamming resistance afforded by direct sequence modulation.

THE US EXPERIENCE

WHEN IT WAS LEARNT that US radio amateurs were experimenting with Spread Spectrum, I approached the Radiocommunications Agency for permission to test such a system on a UK amateur band. The current UK amateur licence does not permit the use of

Spread Spectrum modulation. The agency staff were most helpful and after technical discussions, I was authorised to experiment on the 70cm allocation with a maximum output power of not more than 1 Watt EIRP.

Having gained this essential permission a design was constructed based upon the work of André Kesteloot, N4ICK, in his *QST* design of May 1989 [8], but a number of modifications were made to 'Anglicise' the design. The transmitter used conventional analogue NBFM to carry the voice signal and direct sequence modulation to spread the carrier. The receiver consisted of a wideband preamplifier, a de-spreading circuit and a conventional 435MHz FM receiver to demodulate the despread carrier. (**Fig 11**, and [9]).

HISTORIC TRANSMISSIONS

PROLONGED AND EXHAUSTIVE bench testing was followed by what is believed to be the first UK amateur Spread Spectrum transmissions. these were first attempted on 19 January 1992. The transmitter was sited on a hill overlooking Yeovil, Somerset, and the Spread Spectrum receiver was located at the 'laboratory' of Dave Page, G0TIJ. By manual adjustment of the signal locking and tracking clock oscillator the receiver's clock was brought into synchronization with the transmitters and the direct sequence signal was despread and demodulated on the 435MHz FM receiver.

The trial was successful with the receiver remaining locked during the test. As output powers were very low (less than 100mW) the range was limited to around half a mile but the test indicated that the simple Spread Spectrum technology worked. Unfortunately the first UK amateur Spread Spectrum test had to be prematurely terminated as both the battery pack voltage and the rain started to fall!

SIGNIFICANT DEVELOPMENTS

AFTER THE INITIAL EUPHORIA it was decided that the best way forward was to incorporate some additional features into a new design. This would use digital modulation to transmit voice and require no operator intervention to gain and maintain lock. The current system uses 16kbits^{-1} delta modulated digital speech to digitally code-modify the pseudo-random spreading code in the transmitter.

The receiver synchronises and tracks an incoming direct sequence signal using a delay-locked loop (as previously discussed) and the narrowband despread signal (with digital voice modulation impressed on it) is digitally demodulated to give the analogue voice output. This system is currently operating at low powers in a laboratory set-up and full field trials are planned. Since the signal is totally digital it will be necessary for regulatory reasons (as with the first system) to announce the transmission in clear voice (ie FM) on the centre frequency before and after Spread Spectrum test transmissions.

TO THE FUTURE

PERHAPS WE CAN LOOK forward to all UK amateurs being able to experiment with this fascinating mode, and its challenging mix of wideband analogue radio frequency techniques and high speed digital design. Radio amateurs could then advance practical Spread Spectrum technology in the same way as great strides were made in packet radio – a true expression of the real aims of amateur radio.

APPENDIX A: PSEUDO-RANDOM CODES AND GENERATION

PSEUDO RANDOM CODES CAN be categorised as being linear or non-linear codes. Linear codes are generated using linear operations (which for binary pseudo-random codes is solely modulo-2 addition or subtraction). This essentially means only EXOR gates are used in the shift register feedback path. A pseudo-random generator which does not use such techniques is termed non-linear. The most commonly used group of pseudo-random sequences used in Spread Spectrum are the maximal linear code sequences (sometimes called M-sequences or pn codes). Maximal codes are the longest codes that a shift register of specified length can produce and have mathematical properties well suited to Spread Spectrum communications.

A maximal shift register pseudo-random generator consists of a shift register with selected outputs being exclusive – ORed and fed back into the shift register input. The circuit goes through a number of states (determined by the bits in the shift register at each clock pulse) before it repeats itself after a set number of clock pulses.

The maximum number of states for a shift register of length m is 2^m, ie for a 10 stage shift register $2^{10} = 1024$ states. However the all-zero state is not allowable as the pseudo-random generator would 'lock-up' as 'exclusively ORing' two logic '0' results in yet another logic '0' at the input.

Therefore a maximal length pseudo-random code generator can produce a pseudo-random sequence 2^m-1 bits long before repeating itself. To obtain a maximal sequence the correct shift register outputs (tap points) must be found. These could be found by experimentation but this would be very time consuming! Fortunately, tables of feedback connections are available [3]. A 10 stage (ie 10 flip flop) shift register can produce a maximal code of length $2^{10} - 1 = 1023$ bits long (bits are known as 'Chips' in Spread Spectrum terminology).

The feedback tap points may be taken from the following stages: [10,3], [10,8,3,2], [10,4,3,1], [10,8,5,1], [10,8,5,4], [10,9,4,1], [10,8,4,3], [10,5,3,2], [10,5,2,1] and [10,9,4,2]. As the simplest circuit implementation is often desired, the first option of tapping the tenth and third stages is selected (see Fig 4). To avoid the all zero – lock up problem, inverting stages are inserted at the shift register input and output.

When the shift register is switched on, a reset pulse is initiated. This pulse initiates all shift register outputs to logic '0', this would normally lock up the pseudo-random sequence generator. However the input inverter injects a logic '1' so that the maximal sequence can commence. The output inverter ensures that maximal code output is inverted negating the effect of the 'anti-lock-up' inverter at the input. The maximal code is also available at the output (A) of the modulo –2 adder, but the second inverter output is normally used to permit direct drive of the DBM in a ds system. Such a maximal linear pseudo-random code generator can be built from as little as two TTL logic family integrated circuits.

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[6] 'Principle of Operation of NAVSTAR and System Characteristics', RJ Milliken and CJ Zoller, *Navigation – Journal of the Institute of Navigation*, Vol 25 No 2, Summer 1978.

[7] 'Navigation for Everyman, and his bomb', John Bell p40. *New Scientist*, 11 October 1984.

[8] 'A Practical Direct-Sequence Spread Spectrum UHF Link', André Kesteloot, N4ICK, *QST*, May 1989. (Also in the ARRL *Spread Spectrum Sourcebook* p8.47 to 8.54).

[9] 'A Practical Spread Spectrum System', *Technical Topics* p38 *RadCom* March 1992.

FURTHER READING

Spread Spectrum Systems Second Edition, Robert C Dixon, Wiley Interscience, ISBN 0-471-88309-3.

The ARRL Spread Spectrum Sourcebook, Edited by André Kesteloot, N4ICK, and Charles Hutchinson, K8CH, ARRL, ISBN 0-87259-317-7.

Spread Spectrum Communications Vol 1, 2 and 3, Marvin K Simon, Jim K Omura, Robert A Scholtz and Barry K Levitt, Computer Science Press, ISBN 0-88175-017-4 (Set).

Coherent Spread Spectrum Systems, Jack K Holmes, Wiley Interscience, ISBN 0-471-03301-4.

The books by Dixon and Kesteloot are the best for an introduction to the theory and practical implementation of Spread Spectrum (especially Kesteloot). The other two books are considerably more mathematical in their treatment of the subject.

ACKNOWLEDGEMENTS

I WOULD LIKE TO THANK my wife Charmaine and colleagues at Communication Systems, Westland Helicopters for their assistance and perseverance during the design and testing phase and preparation of this

APPENDIX B: AUTO-CORRELATION AND CROSS-CORRELATION

THE PRINCIPAL THEORETICAL basis of spread spectrum communication are the correlation functions. These correlation functions are a measure of the similarity of functions. For the auto-correlation function

$$\psi_A(\tau) = \int_{-\infty}^{+\infty} f(t) \times f(t-\tau)\, dt$$

A time dependent function (such as sin *wt*) is compared with an identical replica time shifted by a magnitude τ, and summed (integrated) for all values of t. This function has a maximum at $\tau = 0$ which shows that obviously a function is most similar to itself when it has not been phase-shifted. For periodic functions, further maxima appear for a multiple of this period. The response of the correlation function at other values than $\tau = 0$ determines how well the original function f(t) can be found again by variation of the time shift τ.

It is also possible to compare various function f(t) and g(t) with the cross-correlation function.

$$\psi_K(\tau) = \int_{-\infty}^{+\infty} f(t) \times g(t-\tau)\, dt$$

This cross-correlation function is a measure of amount of agreement between functions. Since the functions to be compared are different $y_k(\tau)$ may never achieve the maximum value of $y_a(\tau)$. It is an indication that the functions are different when a certain threshold (–1 in the case of a binary sequence) is not exceeded. In the correlation of binary code sequences, the result for cross-correlation will be +1 if the functional values coincide, and the value –1 if they do not. The integration then forms a summing of all bits of the code. The correlation value for a certain phase-shift can thus be simply calculated by placing the bits over one another and comparing them bit by bit. The correlation rate is the sum of agreements and disagreements.

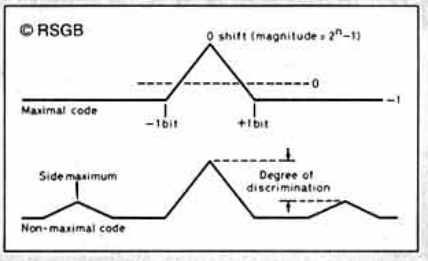

Fig 11: See text.

For example, the maximal code sequence 1110010 is compared with itself in the seven possible phase-shifts. See **Table 1**.

As can be seen, the auto-correlation value is always –1, except for the case of coincidence, where it is a maximum. The greater the length of the code, the higher the amplitude and the greater the code discrimination or cross-correlation response.

The auto-correlation function for maximal and non-maximal codes are shown in **Fig 11**.

As can be seen in the auto-correlation function maximal codes have only one maxima, whereas non-maximal codes have side maxima. When non-maximal codes are used, it is important to ensure that a sufficiently large spacing exists between the main and side maxima. Despite these disadvantages, non-maximal codes are often used to exploit their main advantages of rapid synchronization and message security.

Shift	Sequence	Agreements (A)	Disagreements (D)	A – D
0	1110010	–	–	–
1	0111001	3	4	–1
2	1011100	3	4	–1
3	0101110	3	4	–1
4	0010111	3	4	–1
5	1001011	3	4	–1
6	1100101	3	4	–1
7	1110010	7	0	+7

Table 1: The auto-correlation value is always –1, except for the case of coincidence.

article. Also, André Kesteloot, N4ICK, and Chuck Phillips, N4EZV, for technical advice, encouragement and information on Spread Spectrum research in the United States Amateur Radio Service.

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This Month's Book Choice

by Rev George Dobbs, G3RJV

THE ANTENNA EXPERIMENTER'S GUIDE,

by Peter Dodd, G3LDO

DD Publications

Although not really a book specifically written for QRP operators, an interest in effective antennas is close to the heart of anyone using low power on the HF bands. I am not an avid reader of antenna books but this is one that I enjoyed reading. Peter Dodd is an active QRPer with years of experience in communications with the RAF and the police in West Africa. He lists his main interests as building radio equipment and experimenting with antennas and this shows in the book. It is essentially a practical book for practical people.

A lot of the book deals with the practicalities of objective antenna measurements for the amateur. Peter not only describes such measurement methods but also gives buildable designs for simple homemade instruments. Although technical in nature, the book is far from complex, the author claims that anyone with RAE standard knowledge should be able to follow the book. This seems true with the possible exception of parts of the chapter on mathematical modelling which he suggests is optional material for the reader, A chapter deals with the materials and techniques of practical antenna building and a final chapter describes a range of interesting antennas, most of them designed by the author.

I enjoyed this book because I was carried along by the author. I usually give up on antenna books as it is not my special interest. I also learned from this book. Several 'pennies dropped' and several 'aah, yes' realisations came to me as I read it. I can commend it for any amateur radio book collection or shack library. The book is available from the RSGB publications £8.29 (special members price) or £9.75 (non-members). See page 95 for how to order.

EXPERIMENTERS PLEASE NOTE

IN VIEW OF the wide bandwidth involved that may affect other users, amateurs interested in conducting spread spectrum experiments are strongly advised to contact the appropriate RSGB spectrum manager before proceeding with experiments. It would help if copies of correspondence were sent to the Chairman of the RSGB Licensing Advisory Committee (LAC).

- VHF Manager: Dave Butler, G4ASR, Yew Tree Cottage, Lower Mascoed, Hereford HR2 0HP.
- Microwave Manager: Mike Dixon, G3PFR, Woodstock, Gaze Bank, Norley, Warrington WA6 8LL.
- LAC Chairman: John Bazley, G3HCT, Brooklands, Ullenhall, nr Henley in Arden, Warwickshire B95 5NW.

Satellites

ARTHUR GEE G2UK
21 Romany Road, Oulton Broad, Suffolk
NR32 3PJ

BACK IN APRIL the French amateur radio satellite ARSENE was successfully launched on an Ariane-V-58 rocket. The launch site was ESA Kourou in French Guiana. A delayed launch resulted from the usual snags that seem to overtake such projects. Once in orbit a further complication became apparent. The 145.975MHz VHF downlink signal was very weak. The firing to put it into its final orbit had to be delayed so that the ground controllers in Toulouse could investigate the problem. Two possibilities were formulated; the first being that vibration during launch might have damaged the local oscillator crystal, the second that during the launch, the coaxial cable between the power amplifier and the VHF aerial was damaged or a connection failed.

Fortunately the 'S' band telemetry was working correctly from which it was clear that the power amplifier was consuming its expected amount of power when ground control sent commands to turn on the VHF transmitter and evidence was available indicating that RF was flowing from the VHF exciter. This seemed to indicate that it might be a crystal fault. The ground controllers therefore asked all radio amateurs interested in ARSENE, to scan between 140 and 150MHz, whenever the satellite was within their range. Preliminary Kepler's Elements were produced to give them something to work on.

ARSENE in the course of construction.

ARSENE was commanded to transmit on both 'S' band and 145.975, so that those amateurs equipped for 'S' band could have some indication of when ARSENE was in range. At the time of writing no useful reports have been forthcoming.

The name ARSENE stands for 'Ariane Radio amateur Satellite pour l'ENseignement de l'Espace'. Ten years in the making, it has been constructed through cooperation with the French Space Agency. It was designed after studies by nearly 300 students in different Engineering Schools and Space Industry in France. The project manager was Michel Danvel, F8YY, of the CNES French Space Agency. Jean-Pierre Redon, F8IC, CNES Engineer headed the team along with F6FAO, F6ABJ, F8FV and F6GXY, for the latter part of the project. Many of the parts incorporated into the satellite, such as the apogee motor tanks, were given by space industry companies. The solar cells and panels came from parts of former satellite programs such as the Galileo Space Craft, with the main funding coming from the French Ministry of Space and Industry. The main frame structure was made by a team at Aerospatial managed by F8IC.

ARSENE will provide radio amateurs with a number of features never found before on earlier satellites. It is the heaviest and largest amateur radio satellite with a launch mass of 200kg (157kg after separation from the Ariane rocket). It has a volume about one cubic metre. The apogee motor is made of carbon fibre – a new technology never tested before in space, and the solar panels are made up with AsGa solar cells which have never been used previously to power a satellite. The six solar panels will provide up to 60 watts of electric power. The satellite is spin stabilized with an active Attitude Control System with two pairs of nozzles, used to maintain correct orientation. This system uses nitrogen gas, in four pressure tanks.

There are two operating modes. Mode B is a packet transponder with three uplinks and one downlink channel which will be an AX25 FM 1200Bd standard digipeater. The other will be Mode S which is a linear transponder. The orbit chosen for ARSENE is unusual. It is equatorial, ie an inclination of 0°. The period is 17h30 at 20.00 to 36.000km with an average visibility of 50 per cent of the time for stations +/– 40°. The Mode B VHF downlink is on 145.975MHz with a nominal power of 15 watts. There are three UHF uplinks: 435.050, 435.100 and 435.150MHz.

The Mode S linear transponder's SHF downlink has a telemetry beacon on 2446.470MHz. Traffic is on 2446.540MHz and the UHF uplink is on 432.100MHz. Antenna polarisation is: VHF – vertical; SHF – horizontal; UHF – vertical.

At the time of writing, ARSENE is spinning about 70RPM and is inclined about 15° from what is referred to as the 'orbital-plane'. In due course, ground controllers will reduce ARSENE's spin rate to about 5RPM and adjust the space-craft's attitude so that it is 45° with respect to the 'orbital-plane'. This last move will be done to optimize the antenna patterns for the VHF and S-band antennas for users on the ground. Also, this attitude re-adjustment is necessary to keep the solar panels fully illuminated.

Once this re-adjustment is completed, users will be encouraged to start using ARSENE's S-band linear transponder for traffic. Circular polarisation is recommended and a 2m diameter dish with a low-noise preamp should be sufficient to receive ARSENE's 0.8W S-band output. The recommended uplink power of 1kW EIRP will be plenty due to the excellent sensitivity of the UHF receiver. Ground station control FF1STA is currently using 10W into a 21-element F9FT UHF antenna to send commands to the satellite without any problems. Mode S is said to be functioning well.

STS-57/SAREX NEWS

SAREX, AND AMATEUR RADIO in general, received a big boost recently when USA President Clinton had a telephone conference with the STS-57 crew. During his address to the astronauts the President commended the crew, the SAREX team and the amateur radio community for their outstanding support to students around the world. Clinton said: "I understand that later in the mission Janice (Voss) and Brian (Duffy) are going to be talking with school-children around the world." He continued: "But I want to tell you how much I appreciate the fact that you're making an international education project out of this mission. That's very important to me."

Pilot Brian Duffy responded: "Mr President, we find that using amateur radio is an excellent way of communicating with children all around the world, and we're also able to excite them by using space and science. And letting them see space and science in action, we're able to excite them and hope they'll study harder."

The President finished: "You have no idea – you may be on this mission creating thousands of scientists for the future just by the power of your example and by this direct communication. I think sometimes we underestimate the impact that human contact in an enormously impressive setting like this can have on children all across the world – not only those with whom you'll talk, but millions of others who will just see it and know that it happened."

This is the fourth flight of Space Shuttle Endeavour and the 56th flight of the Space Shuttle system. Thanks for this information to Frank H Bauer and *SpaceNews* packet system.

RS 12 DX

PAT GOWEN, G3IOR has drawn my attention to the DX possibilities of RS12. He has worked all continents on RS12, Japan, Brazil and most US amongst others. He states that if, after an 'overhead' pass, you continue listening, you'll hear signals reappearing as the satellite passes over the Poles. There seems to be sufficient ionisation there to deflect signals down to give communication again. He bemoans the lack of activity on RS12 as more activity on it should produce some good DX contacts.

Microwaves

MIKE DIXON G3PFR
'Woodstock', Gazebank, Norley, Warrington, Cheshire WA6 8LL

TECHNICAL CORNER

THIS FEATURE HAS been held over this month as I have quite a lot of outline information from HB9MIN on the design of his world-record breaking 47GHz equipment. As this runs to several diagrams plus the explanation, and there are a lot of other matters which need airing, I felt it would be better to concentrate on these rather than the technicalities of 47GHz narrowband!

BEACON NEWS

TWO ITEMS OF POSSIBLE bad news on the beacon front this time. It seems that two of the better known 23cm beacons may disappear due to "lack of demand". The beacon keepers and their groups, in the presence of hard times and in the absence of reception reports want to try to quantify the service provided before (I quote) "devoting effort and money" to keeping them going.

The first beacon is the Cornish beacon, GB3MCB (1296.860MHz, IO70OJ), recently removed from the South West Gas site after many years service, because of concerns about the number of beacons running on the site. There are five in all, in the 50, 70, 144, 432 and 1296MHz bands. If there is sufficient demand for the beacon, the group is prepared to reinstate the beacon, possibly elsewhere. Comments please to Ted Warne, G3YJX, QTHR.

I suspect the reason why the Telford group, responsible for the Clee Hill beacon, GB3CLE (1296.910MHz, IO82RL), wants to conduct a survey of users may be similar: not loss of site, but rising costs. The group secretary Margaret Blakeley, G4YKX (also QTHR), has also asked to hear from amateurs who regularly monitor this beacon as a propagation indicator. Location and signal strength reports would be useful to their survey.

All I can say to both groups is that there may not be much reporting going on, but rest assured, both beacons are regularly heard, under lift conditions, over wide areas of the UK and sometimes Europe. GB3CLE was a 'regular' at this QTH and, indeed, is the only 23cm beacon I could hear regardless of conditions (my antennas are down at the moment, so I can't comment on the performance). I would miss it, just as I missed GB3VHF when that went off air for a considerable time. I can understand the frustration of beacon keepers when it appears that no-one uses them: the matter of support for beacons has been discussed by the Microwave Committee in the past and will, no doubt, be discussed again! I wonder whether users would be more prominent if either of these well sited devices were to be turned into cross-band or in-band voice or data repeaters? It might just provide that extra bit of income to keep the beacons going.

OPERATING NEWS

Table 1 shows the current position in the All-time 10GHz Squares Ladder, not taking into account the EME contacts featured this month! **Table 2** shows the final positions in the Annual Microwave Operating Ladder. You may ask why 1.3GHz results are not included: simply because (rightly or wrongly), although a microwave band, the results are regularly reported in the *VHF/UHF News* column and are not reported to me or the editors of the

Pos	Call	Locator	Sqrs	DX(km)
1	G3WDG	IO92RG	24	1,008
2	G4DDK	JO02PA	16	626
3 =	G3BNL	IO92KA	15	1,027
3 =	G8KQW/P	IO91GA	15	390
5 =	G8AGN/P	IO93EH	12	330
5 =	G3PHO/P	IO93EH	12	330
5 =	G3JMB/P	IO90TV	12	247
5 =	G8LSD/P	IO90TV	12	247
9 =	G4FCD	IO91JV	11	1,039
9 =	GW4MAP/P	IO82JG	11	311
11	G8BRK/P	IO91FN	10	234
12	G3ZME/P	IO82QL	9	292
13	G0API/P	IO90UU	8	277
14	G3UKV	IO82RR	7	242
15	G0API	IO80XS	5	184
16	G3JMB	IO91WA	4	48
17	G3NWU/P	IO94MJ	3	290

Table 1: 10GHz All-time Squares

	Posn	Callsign	Best DX km (A)	Stations worked (B)	Multiplied score (AxB)
2.3GHz					
	1	G4EQD	900	19	17,100
	2	G4PMK	720	13	9,360
	3	G0API	392	17	6,664
	4	G4DDK	398	6	2,388
3.4GHz					
	1	G4PMK	661	8	5,280
	2	G4EQD	110	3	330
5.7GHz					
	1	G4PMK	480	3	1,440
	2	G4EQD	200	3	600
10GHz					
	1	G3WDG	1,008	63	63,504
	2	G3BNL	1,027	52	53,404
	3	G4FCD	1,039	38	39,482
	4	G4DDK	626	43	26,918
	5	G8KQW/P	390	56	21,840
	6	G3FYX/P	364	50	18,200
	7	G3PHO/P	338	50	16,900
	8	G3ZME/P	292	43	12,556
	9	GW4MAP/P	311	38	11,818
	10	G3FYX	535	22	11,770
	11 =	G4JNT/P	295	36	10,620
	11 =	G0API/P	295	36	10,620
	13	G4PMK	739	13	9,607
	14	G4BRK/P	234	39	9,126
	15	G8AGN/P	338	26	8,788
	16	G3PYB/P	362	17	6,154
	17	G3FNQ/P	330	18	5,940
	18	G3JMB/P	245	24	5,880
	19	G4EQD	311	17	5,287
	20	G8LSD/P	245	20	4,900
	21	G3JMY/P	211	23	4,853
	22	G4DKK	276	16	4,416
	23	G3UYM/P	188	22	4,136
	24	G3UKV	242	16	3,872
	25	G4JNT	215	17	3,655
	26	2E1AJE	246	14	3,444
	27	G3NWU/P	410	8	3,280
	28	G3NKL/P	340	7	2,380
	29	G3JMY	157	14	2,198
	30	G0API	184	12	2,208
	31	2E1AYB/P	170	12	2,040
	32	G3GRO	143	10	1,430
	33	G8AYY/P	84	4	336 (WB only)
	34	G4KNZ	99	3	297
	35	G4KNZ/P	85	3	255
	36	2E1AIZ	70	3	210
	37	G3JMY	7	2	14 (ATV only)
24GHz					
	1	G4KNZ/P	136	22	2,292
	2	G3PHO/P	136	7	952
	3	G3NKL/P	102	7	714
	4	G3FYX/P	102	5	510
	5	G8AYY/P	86	5	430
	6	G3FNQ/P	59	6	354
	7	G8AGN/P	86	2	172
	8	G3ZME/P	90	1	90
	9	G3UYM/P	45	1	45
	10	G0DJA/P	8	1	8

Table 2: 1992 Annual Microwave Operating Ladder, Final Positions at 31/12/92

Mike Walters, G3JVL, overall winner of the 10GHz Cumulatives, received the G3RPE Memorial Trophy at the VHF Convention.

Peter Chadwick, RSGB President, presents the VHF Contest Committee Trophy to John Quarmby, G3XDY, overall winner of the 1.3GHz Trophy Contest.

RSGB *Microwave Newsletter*. Results, particularly on the higher bands, are getting steadily better with the widespread adoption of narrowband techniques, although the Microwave Committee would dearly like to see far more entries for the lower bands and, indeed, more wideband entries for 10 and 24GHz! How about it in '93?

1993 OPERATING LADDERS

ENTRIES TO THE 1993 Operating Ladder have now started to accumulate to the point where there is something to report, at least on the 10 and 24GHz bands. As far as I know at the moment there have been no entries for any of the other bands - remember, in the last column, that I had a gripe about making entries for bands other than 10 and 24GHz. Nothing has been reported so far, so if it sounds like a 10GHz column again, you only have yourselves to blame!

Anyway, here is the first of the Operating Ladder tables (**Table 3**), courtesy of the RSGB *Microwave Newsletter*, and it shows, yet again, the effectiveness of narrowband home station operation on the 10GHz band. I can remember the days, not all that long ago, when to work a dozen stations during the Cumulatives was considered good going, especially if any of them were beyond the 150km mark. The entries, of course, run from 1 January to 31 December 1993. Congratulations to all the entrants on some magnificent results.

Table 4 gives the 10GHz All Time Squares position. Remember, that for entry to this table, all contacts must be made from one location, unlike the Operating Ladder where entries can be made from any location, fixed or portable (the only thing being, please keep the fixed and /P entries separate!).

There has been news of some more 10GHz EME contacts since I last reported activity on this mode some time ago. ON6JZ worked SM4DHN and WA7CJO on 27 April this year and immediately these contacts were finished, the gear was transported to the QTH of PA3CSG who worked the same two stations in quick succession. It is of interest that the contacts were made using 20W to a 6ft dish, this bringing EME capability well within the reach of many UK operators. In May the G4KGC/G3WDG duo worked two more countries by EME: G3WDG was reported as working DJ7FJ and I4CHY and getting his own echoes back from as little as 7W, even though he now has 35W available.

Three band portable microwave operation, Danish style! OZ1UM advertises his presence on 10, 24 and 47GHz under clear blue skies, a little different to much UK portable mountain-top operation, where the rule is "tie down your tripod lest it blow away"!

BEGINNERS CORNER

THIS MONTH I CAN REPORT that I've built the two band wavemeter described by Sven Weber, G8ACC, in the August issue of *RadCom*. It just so happened that I had one of the Eddystone butterfly-style 'Microdensers' in my junk box, together with some low-barrier Schottky diodes and a small die-cast box. I can recommend the design to any beginner needing a wavemeter covering the VHF and UHF bands. With a little gentle squeezing of the VHF coil, I managed to get the VHF coverage to about 95MHz to 230MHz and the UHF coverage from 230 to a little under 500MHz. Now this is a very useful range for setting up some of the stages in the well-known G4DDK designs. Incidentally, I picked up the butterfly tuners for about 50 pence each at a local rally not much more than nine months ago: some older surplus PMR transmitter strips contain similar capacitors, albeit with short spindles. These can with a little care be used, thereby saving the considerable cost of the new capacitors.

Another, aperiodic (untuned), microwave detector was described in the July issue of *Electronics Today International*. Although primarily designed for checking microwave cooker leakage, this device is inherently broadband and could be useful for RF 'sniffing' around low power circuits or antennas. It is based on the principle of increasing the sensitivity of microwave Schottky diodes by applying a forward DC bias to the detector diode and amplifying the rectified RF by means of a CA3103 integrated circuit. Dimensions are given for a 2.4GHz dipole (since microwave ovens operate at about 2450MHz) but suggestions are made for antennas for other, lower frequencies. Just as an aside, I used a 50μA meter, microwave diode and small, untuned hairpin loop as a frequency independent 'sniffer' for many years, and very useful it was too!

OPERATING LADDER 1993

Band GHz	Posn	Callsign	Stns Wkd	Best DX, km	Multiplied Score
10	1	G3JVL	34	717	24344
	2	G4KGC	44	391	17204
	3	G4RFR/P	33	413	13629
	4	G3JMY	27	278	7506
	5	G3PHO/P	21	303	6363
	6	G4KNZ	19	214	4066
	7	G3GNR	7	510	3570
	8	G8AGN	17	303	3551
	9	G4BRK	16	221	3536
	10	G3UKV	12	242	2904
	11	G4JNT	7	236	1652
	12	G4BRK/P	12	119	1428
24	1	G4KNZ/P	4	156	624

Table 3: Reproduced from the *RSGB Microwave Newsletter*.

10GHZ ALL-TIME SQUARES WORKED

Posn	Callsign	Locator	Squares Wkd	Best DX (km)
1	G3WDG	IO92RG	24	1008
2	G3BNL	IO92KA	16	1027
2 =	G4DDK	JO02PA	16	626
4	G8KQW/P	IO91GA	15	390
5 =	G3PHO/P	IO93EH	12	330
5 =	G8AGN/P	IO93EH	12	330
5 =	G3JMB/P	IO90TV	12	247
5 =	G8LSD/P	IO90TV	12	247
9 =	G4FCD	IO91JV	11	1039
9 =	GW4MAP/P	IO82JG	11	311
11 =	G4PMK	IO93GT	10	739
11 =	G4BRK/P	IO91FN	10	234
13	G3ZME/P	IO82QL	9	292
14	G0API/P	IO80UU	8	277
15	G3UKV	IO82RR	7	242
16	G0API	IO80XS	5	184
17	G3JMB	IO91WA	4	48
18	G3NWU/P	IO94MJ	3	290

Table 4

Data Stream

RICK STERRY G4BLT
1 Wavell Garth, Sandal Magna, Wakefield,
West Yorkshire WF2 6JP

THANK YOU TO THOSE readers who have contacted me. I do very much appreciate your feedback and suggestions.

I simply do not have the space to thank individually all those amateurs who make valuable contributions to this column, or who have carried out technical vetting. Please accept this as my tribute to you all!

MANY A TRUE WORD

MANY A TRUE WORD is spoken in jest, and this was indeed the case with a remark I made in the July column. In referring to the lack of evidence that the 'memory ARQ' function on my PacComm PacTOR controller was working, I jokingly suggested that "perhaps the green Error LED is faulty, HI".

Well, following a tipoff, I contacted Tim, G0ETP, who had observed the same problem, and had written to PacComm. In our opinion, the drive circuit for the green section of the dual red/green Error LED, is poorly designed, and had resulted in component failure. The green LED is a PacComm addition to the original German design, and some minor modifications may be needed. There aren't many of these units around, and they are under warranty, but if anyone else has the same problem then I can provide modification details on receipt of an SASE. However, if you see the Traffic LED light at the same time as the red Error LED, then you can be sure that a packet has been reconstructed.

LOCATOR SOFTWARE

THERE ARE STILL A few people having problems with the NGR to Locator program published in the May and July columns. If you are getting 'Division by zero' errors, then you need to define PI in line 20 by removing the word 'REM'. The reason for the error is that undefined variables are assumed to be zero.

For those with an IBM-compatible PC, or PC emulation capability, a suite of useful and user-friendly locator and contest-scoring programs is available from Andy Talbot, G4JNT. The locator program will convert to and from most formats, including the old five-character QRA locator, and will be of especial interest to microwave operators. Anyone wishing to have copies should send a covering letter and any size/capacity formatted DOS disc, (two in the case of 360kbyte (k) capacity), to Andy at 15 Noble Road, Hedge End, Southampton, Hants, SO3 4PH. Remember to include sufficient return postage and a self-addressed label or outer wrapper.

TNC/CONTROLLER UPDATES

THE KANTRONICS KAM HAS been joined by the KAM-PLUS, which is a dual-port multimode controller, now featuring PacTOR as standard, together with 128k RAM (see Product News p. 57) expandable to 512k. With the standard 128k version, you can have up to 107k of PMS space! The original KAM can be upgraded to virtually the same specification with a change of firmware and an additional PCB. Being able to upgrade TNCs and controllers merely by changing an EPROM, or adding a little extra hardware, is very gratifying in these days of built-in obsolescence. The initial firmware versions featuring PacTOR for the KAM and AEA PK232 were not without certain little undesirable 'features', but apparently the problems have been ironed out and updated EPROMs issued.

An issue-2 PacTOR firmware is on the cards for the PTC and licensed PacComm units, but as far as I can find out the changes will only be minor refinements and bug fixes, (and make it more friendly I hope). Even more interesting, is the proposal to produce a Pactor level 2, which will be a very significant advance on the present protocol, but this isn't likely to be available before next year.

Version 3.1 of the PacComm PMS firmware has now been released. However, I have held over a mini-review of this, pending further testing.

DCD MODIFICATIONS

YOU MAY HAVE COME across various references to DCD (Data Carrier Detect) modifications to packet TNCs, and wondered what it was all about. Phrases used include 'True DCD', 'soft DCD', and 'state-machine DCD'. I shall attempt to explain.

The purpose of the DCD circuit is to detect when there is 'traffic' on the channel, and this should inhibit the TNC from transmitting, (unless it is a link operating in split-frequency duplex mode). Simple circuits are unable to distinguish between actual data, and noise or other interference. So, the squelch control must be adjusted on the receiver, with the danger that rain static, vehicle ignition interference, weak carrier signals etc, will cause it to stay open for long periods, inhibiting transmission. This can be a problem even on VHF/UHF, but on HF it is even more so, except perhaps for 10m. Wrestling with the squelch and/or TNC threshold control can be rather a fiddly business on HF! Also, older VHF/UHF equipment with squelch circuits that are slow to respond can be a problem. If the squelch is very slow to open, the start of an incoming packet will be lost, unless the TXdelay of the transmitting station is set very long.

The purpose of what I call 'true' DCD is to detect when a packet tone is present, but to ignore anything else. The receiver can then be run unsquelched, ie with the squelch fully open all the time. I carried out some simple hardware modifications to my BSX2 TNC, suggested by Pieter, G0BSX, and Alan, G8IPG, and I'm very pleased with the results. Anyone interested in the details should contact me via packet. In the case of commercial TNCs, add-on boards are sometimes available to achieve the same result. This is the hardware approach.

Later Kantronics firmware uses a different approach; the decision as to what is data and what is not, is carried out within the software instead, hence the title 'software DCD'. I've tried it, using the command CD SOFTWARE, and it seems to work very well, despite a rather daunting section in the manual entitled 'Calibration/Equalisation'!

SERIAL INTERFACING

ONE FIRM CONCLUSION I have come to, is that it is the serial port interfacing which gives a great deal of the grief when first getting to grips with a TNC or multimode controller. Apart from the cable wiring, achieving the correct match of baud rate and protocol causes much wailing and gnashing of teeth, and anything that makes life easier must be welcome. The problem can be worse with a secondhand TNC, as one cannot be sure that the parameters for the serial port are the manufacturer's default settings. Also, some TNC firmware used 7-E-1 protocol, (7 bits, Even parity, 1 stop bit), whereas some used 8-N-1, (8 bits, No parity, 1 stop bit). Fortunately, 8-N-1 seems to be becoming the standard, and even the new PacComm v3.1 firmware defaults to it. In general, if you you get some characters appearing correctly, and others missed or wrong, it is usually due to a protocol problem. If you get complete garbage, or nothing at all, it is more likely to be due to incorrect baud rate.

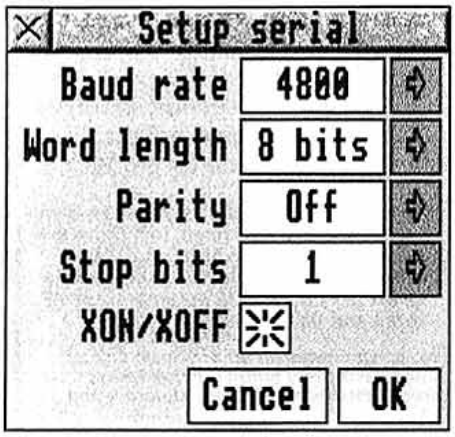
Baud rate can be a particular problem if it is set in software as a parameter, and not in hardware by means of DIPswitches. Some TNCs go through an 'autobaud' routine, the idea being that you type an asterisk '*' in response to a message from the TNC. The message is sent at different baud rates, in a repetitive cycle, the idea being that sooner or later the correct one will cause the message to appear on screen.

Does your TNC communicate successfully with your computer? Don't despair.

DON'T PANIC!

IN THE MEANTIME, IF you are having problems getting your terminal and TNC, (or other data controller), to communicate with each other, and are beginning to despair, try this:

1. Are you absolutely 100% sure that the serial cable is wired up correctly? Do not assume that a cable specially supplied for the job will be correct. Check the manual carefully, and double check; use a continuity tester to make sure the connections are sound over the full length of the cable. Be very wary of using 9-way to 25-way adaptors to match the lead to your TNC or computer; not all the connections required



Getting the terminal program serial baud rate and protocol to match the TNC settings can be a rather frustrating experience for the beginner!

may be used. Check with a continuity tester, or take it apart if it isn't a sealed type.

It is usually best to wire up for 'hardware handshaking', of which more later, so wire up the CTS and RTS as well as the TXD, RXD and Gnd. You may also need to link some of the pins together on the connector at the computer end of the link, (usually DSR, DCD and DTR), but disregard them at the TNC end. (DCD from the TNC may be used to indicate connect status, but it's not normally essential.) Also, some TNC2 clones such as the BSX2 use DTR for handshaking rather than RTS, in which case link RTS to DTR in the connector at the TNC end, to make sure.

Remember that when wiring a TNC or modem to a terminal, you connect like to like; CTS to CTS, TXD to TXD, etc . . . . (It is only when connecting two terminals together that you have to cross the connections over.) Also, beware of the fact that TXD is pin 2 on a 25-way connector, and RXD is pin 3, whereas it is the opposite way round on a 9-way connector!

2. Make sure the TNC is fully reset to the default condition. In some cases this involves moving a link on the circuit board, and then switching the unit on and then off again. In other cases, you may have to disconnect or remove the internal backup batteries, and even short-circuit the empty battery-holder terminals for a few moments, and then switch on and back off before refitting the batteries. In extreme cases, on BSX2 boards used as network nodes, I have even had to remove the RAM chip and place it on cooking foil to short-circuit all the terminals!
3. Set your terminal to the appropriate default baud rate for the TNC, usually 1200 baud but sometimes 300; check the manual. (If the baud rate is set by dip switches, then 4800 is a good compromise setting to use). Set the appropriate protocol, usually 8-N-1 but sometimes 7-E-1, (eg on earlier TAPR/PacComm firmware).
4. Now switch on the TNC and watch for any message on the screen. If invited to type an asterisk, do so promptly. Some TNC driver programs will not send the asterisk until you press the <Return> or <Enter> key afterwards. Although units like the Kantronics KAM accept the <Return> (CR) character appended to the asterisk, I do seem to remember that early PK232s don't like it. In that case, it's best to use the most basic and simple general-purpose comms program you can find, as these will usually send each character immediately. Once you've set the TNC, you can use a more sophisticated program.
5. Set up the TNC baud rate that you wish to use in future, (unless it's done on DIP switches), and the protocol, (I recommend 8-N-1), and switch the TNC off; the changes will not be put in place until the next restart. Alter the terminal settings appropriately, and switch the TNC back on. You should then see the standard start-up message.
6. If you still have no joy after trying all the above, see if you can find someone with the same TNC who can try yours with their own lead and software. They might be able to establish if the TNC or lead is faulty, and if not then they can set up some sensible starting parameters for you. See if you can get your TNC and lead to work on the other persons's computer; if possible, take a copy of your own driver program to prove that it works OK.

CONCLUSION

Occasionally, serial ports on computers can become faulty, but I have rarely come across a ready-built TNC that was faulty to the degree that it couldn't communicate with a terminal. In most cases, the user had become confused about baud rates etc., or was unfamiliar with over-complicated driver software, or the serial cable was faulty or incorrectly wired .

SERIAL FLOW CONTROL

There is one further point associated with serial interfacing that is worth making. Most TNCs and controllers support hardware handshaking protocol, sometimes referred to as RTS/CTS flow control. This means that the TNC and terminal use the RTS and CTS lines to signal to each other when they are able to receive data, thus avoiding one sending to the other more data than can be dealt with in one go, or at times when it is otherwise engaged. However, the parameters in the TNC almost invariably default to software handshaking, where the stopping and starting is controlled, not by connections between the two, but by codes sent within the data. This is often referred to as XON/XOFF flow control. Unless the terminal program itself can handle software handshaking, there is a danger of 'losing' characters in a stream of data, particularly when uploading a file off disc and into the TNC. You should therefore set the TNC parameter Xflow OFF.

In general, it is best to use hardware handshaking, with the benefit that parameters associated with software flow control can be disregarded, eg XON, XOFF, TXFlow etc.... The computer handles all handshaking, without the programmer having to make provision in software. However, I am told that some computers such as early Apricots can only handle software flow control.

A few controllers do not support hardware handshaking, either because the hardware to do so is not present, or because the firmware does not support it. You would ideally need to use a driver program that supports software flow control, and many do not.

SERIAL CONNECTIONS

Now for some comments about the actual wiring, starting with the Gnd (Ground or 0v) connections. The important connection is the Signal Gnd, (pin 7 on a 25-way connector and pin 5 on a 9-way). You must connect this at both ends of the cable, and if you are short of cable cores then you can use the braid. The Frame Gnd, only available on 25-way connectors, is merely a chassis earth. If you don't need the braid for the Signal Gnd, then you can connect the braid to the Frame Gnd instead if you wish. (There is a school of thought that says you should connect it to Frame Gnd at one end of the cable only, preferably the computer end). If you are using 9-way connectors at both ends, and don't need the braid for the Signal Gnd, I would suggest connecting the braid to the Signal Gnd at both ends, ie in parallel with the internal core. Also, some leads are made up with the braid soldered to the metal connector shells, (I don't mean the protective cover, which is usually plastic), as these are sometimes connected to Frame Gnd; again, some say that it should only be at one end. Do not connect the Frame Gnd (or connector shell) to the Signal Gnd, even though they may be commoned inside the equipment.

Finally, there are non-standard serial ports on some computers, which cause concern. The earlier Acorn/BBC machines were fitted with an RS423 port. This is merely a cut-down RS232 working at reduced voltages, and is fully compatible with the RS232 port on TNCs etc . . . . Only TXD, RXD, RTS, CTS and 0v (Signal Gnd) are provided, and the connector used is a 5-way DIN 'domino' plug which can be inserted either of two ways. Since there seems to be no convention as to which is the 'right' way up, make sure you mark the connector clearly for future reference.

Some machines, like the Commodore C64, have a serial port with TTL levels. This merely means that the voltage levels shift between 0v and +5v (nominally), rather than -12v and +12v (nominally), and the signal protocol is otherwise the same as a 'normal' RS232. Many TNCs have provision for switching to TTL levels, in which case a direct connection is possible. If no such provision is made, it becomes necessary to use a simple TTL<>RS232 interface circuit, which can be bought as an option or else home constructed.

YAPP PROTOCOL HINT

JACK, G3NAO, TELLS ME that you must use hardware handshaking when running software that uses the YAPP file transfer protocol. (YAPP stands for 'Yet Another Packet Program', by the way.) Therefore, you should set Xflow OFF, as mentioned before, and also STREAMDb OFF to avoid a bug in the 'Transparent mode' of some TNC firmware, which causes YAPP file transfers to be aborted. (This parameter might be called CHDouble on some TNCs.)

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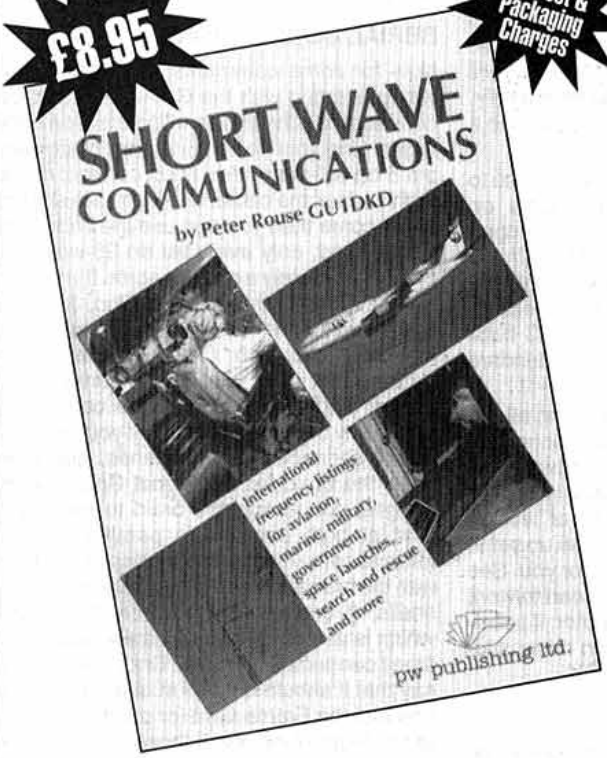

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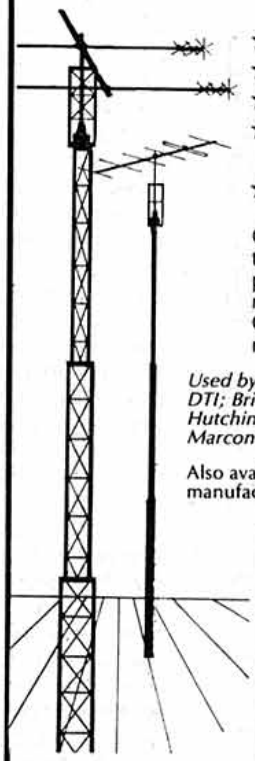

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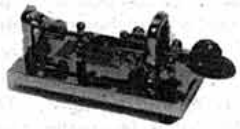

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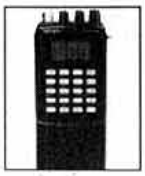

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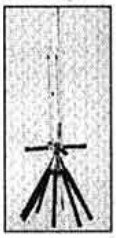

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All rules should be read in conjunction with the General Rules published in *Contest News* January 1993

HF RULES

7MHZ DX CONTEST

TRANSMITTING SECTIONS

1. General: The General Rules for RSGB Contests, published in the January 1993 issue of *Radio Communication* will apply to UK participants.

2. Eligible entrants: Overseas (including EI) - all licensed amateurs. British Isles - as per General Rules. Single- and Multi-operator entries will be accepted in all transmitting sections.

3. When: 1500GMT Saturday 26 February to 0900GMT Sunday 27 February 1994.

4. Sections: (a) British Isles **(b)** Europe including EI **(c)** North America **(d)** South America **(e)** Africa **(f)** Asia **(g)** Oceania.

5. Frequency/Mode: 7.000 - 7.030MHz CW only.

6. Contest Exchange: RST and serial number, commencing with 001. UK stations must also send their County Code as printed in the January 1994 *Radio Communication* and other current RSGB publications.

7. Scoring:

British Isles stations contact only overseas stations for points. Each completed contact with a station in section (b) will count 5 points, in sections (c), (d), (e) and (f) fifteen points and in section (g), thirty points. Multipliers as per General Rules.

Overseas stations contact only British Isles stations. For each completed QSO, stations in section (b) score five points, in sections (c), (d), (e) and **(f)** score fifteen points, and in section (g) score thirty points.

Multipliers: 1 for each British Isles County worked.

The **final score** is the total of QSO points times the number of Multipliers worked.

8. Logs: Overseas entrants are invited to use the stationery provided by their National Society. British Isles entrants are referred to the General Rules. Check-lists ('Dupe Sheets') are requested where more than 80 QSOs are made and please don't forget the list of multipliers.

9. Address for logs: RSGB HF Contests Committee, c/o S V Knowles G3UFY, 77 Bensham Manor Road, Thornton Heath, Surrey, CR7 7AF, ENGLAND.

10. Closing Date for logs: British Isles entrants, 21 March 1994; Overseas entrants, 18 April 1994.

11. Awards: Single-operator: The Thomas (G6QB) Memorial Trophy to the leading British Isles station. Certificates of merit to the second- and third-placed British Isles stations, and to the leading entrants in each overseas section.

Multi-operator: Certificates of merit to the leading groups in each section.

Additional certificates may be awarded at the discretion of the HF Contests Committee.

RECEIVING SECTION

Single-operator entries only will be accepted. Rules as for the transmitting section except where specified below. Holders of transmitting licences for frequencies only above 30MHz may enter the receiving section.

7. Scoring: British Isles SWLs should log only overseas stations in contact with British Isles stations participating in the contest. Overseas SWLs should log only participating British Isles stations in contact with overseas stations. Scoring and multipliers as for the transmitting section.

8. Logs: Columns to be headed: time GMT; callsign of station heard; report and serial number sent by that station; County Code sent by that station (if applicable); callsign of station being worked; multiplier (if new); points claimed.

NOTE. In the column headed 'station being worked' the same callsign may only appear once in every three contacts except when the logged station counts as a new multiplier.

11. Awards: Certificates of merit to the leading entrants in each section.

HF RESULTS

SSB AFS 1993

The second SSB AFS saw a 7% increase in the number of logs submitted but the number of clubs entering stayed the same as 1992. The Lichfield ARS is to be congratulated on repeating its win by a comfortable margin over the Mid-Beds Contest Association.

There was some difficulty in finding a reasonably clear frequency within the contest sub-band and the HFCC will consider expanding the allocation for the 1994 event while trying not to upset the regular users of 80m.

The table includes the equipment coding (described in the General Rules in January *Radcom*) which gives, for comparison purposes, an indication of the power and antennas that other competitors are using. Most of the stations shown as '3C' had simply entered on their cover sheet 100W (or 20dbW) and the ubiquitous G5RV.

It is a shame that so few reveal how high their antenna is. Especially on 80m, antenna height is of great importance: the most successful stations seem to have antennas up at least 35ft in the centre, but don't go higher than 55-60ft. Although it is only a short contest, it is apparent that skip conditions are continually changing over the four hour period and it seems likely that the mixed polarisation of an inverted-vee has greater versatility than a flat-top antenna. Several people pressed smaller antennas into service such as multi-band groundplanes or half sized G5RVs, and one person used just 26ft of coax fed via an ATU (quarter size G5RV?). For a short single band contest such as this it is worthwhile trying to get as close to 132ft centre fed as possible: with ingenuity it can be done in a 30ft square garden by folding back sections of each leg of the antenna. Such a lash-up is still going to perform better than a ground plane for inter-G working. Perhaps we should introduce an antenna code letter of Z meaning 'zig-zagged around a post-age-stamp garden' but for the moment, please tell us the antenna height on your cover sheet.

As always, the quality of entries varied and fellow adjudicators G4DUS and G4BKI spent a disproportionate amount of time on a few logs. Most points were lost for incorrectly copied callsigns or even worse, callsigns that were properly copied at the time but wrongly transcribed onto the log sheet afterwards. Well over 50% of logs were accompanied by dupe sheets and this is a great help to the adjudicator. Do not make the mistake of thinking that if you submit a dupe sheet we assume there can't be any dupes in the log: each one is re-duped and checked for 'busted' calls but this process is quicker if a dupe sheet has been submitted. One entrant must have been on a different planet (or in a different contest) as a third of the calls in his dupe sheet could not be found in his log entry. Sadly one log omitted all received serial numbers and had to be excluded from adjudication.

This event is certainly here to stay and it is not too soon to start training your club's SSB operators for the 1994 event. Remember it is a club competition and each of the three (or more) competing stations may be multi-operator. Spread the operating duties around between your club members and let's see if we can dislodge Lichfield from the top spot in 1994! *G4BUO*

SSB AFS 1993 - INDIVIDUAL SCORES

Posn		Call	Score	Eqpt
1	*	G3NLY	2724	4C5
2		G3NAS	2527	4C
3		G4PIQ	2460	4C4
4		G3VHB	2405	4C3
5		G4BJM	2340	4C6
6		G3OZF	2324	4C8
7		G3SJJ	2314	4C5
8	=	G4CBQ	2210	4C5
8	=	G4MBC	2210	4C5
10		G5LP	2080	4C
11		G4CNY	2060	4C
12		G4BUO	2010	4C4
13		G3TCQ	1984	4C5
14		G3XTT	1930	4C4
15		G3ZVW	1770	4C
16		G0HSD	1768	4C6
17		GW4BLE	1720	3C4
18		G3WGV	1710	4C6
19		G2UG	1701	4C
20		G4APV	1660	4W4
21		G3SVW	1577	4C3
22		G4OGB	1560	4C5
23		G4AAL	1480	4C
24	=	G3WHK	1470	4C
24	=	G0CBJ	1470	3C2
26		G3MXH	1467	3C2
27		G4WEY	1450	4C3
28	=	G4OFR	1440	4C5
28	=	G4JBH	1440	4C
30		G4APD	1430	3C
31		G3OLX	1407	3C
32		G3BZU	1397	3C
33		G3NBI/P	1387	3C
34	=	G3LRS	1380	3C6
34	=	G0IVZ	1380	4C5
36		G3FFH	1361	4C5
37		G0FDX	1360	4C3
38		G0GQT	1344	3C
39	=	G3FNM	1320	4C3
39	=	G4ALE	1320	4W3
41		G3EPV	1297	3C
42		G3RSD	1294	3C
43		G0SDX	1264	3C
44		G3JFF	1257	3C
45		G3HYH	1230	3C4
46		G0CXJ	1227	3C
47		G3LIK	1220	3C
48		G0HZX	1170	3C
49	=	G4SSW	1130	3W3
49	=	G8TB	1130	3C
51		G0ADH	1110	3C
52	=	G2AFV	1107	4C
52	=	G3MA	1107	3C
54		G0ARF	1090	3C
55		G3YYF	1080	3C
56		G3SVL	1037	3W3
57	=	G4ZYP	1030	3C2
57	=	G0PPO/P	1030	4C
59		G4YTV	980	4C
60	=	G4EBK	910	4C3
60	=	G0AXA	910	1C
60	=	G0DVE	910	3C3
63		G2IC	890	3C
64		G3OPL	850	4C
65		G0AIZ	850	3C3
66		G3CQR	848	3C
67		G3LHJ	847	3W
68	=	G4ZYN	810	3C
68	=	G0NUM	810	3C3
70		G3HFG	804	3C
71	=	G3ZGC	790	3Q
71	=	G0DID	790	3C4
73		G3VMO	787	4C4
74		G0OPB	780	3
75		G3ENI	778	3C
76	=	G4FBS	770	4C
76	=	G0CTQ	770	3C
78	=	G0GCI	760	4C
78	=	G4MET	760	3C
80	=	G0ASZ	750	3Q
80	=	G3RKH	750	3C
82		G4DBU	740	3C
83		GW0ARK	740	3C4
84		G3GHN	730	3C3
85		G0KUC	720	3C
86	=	G4OYY	690	3W2
86	=	G4IVJ	690	3W
88	=	G4SJX	680	3C3
88	=	G0HDV	680	3C
88	=	G0KOC	680	3C
88	=	G0GVA	680	4C
92	=	G3WQK	670	3C
92	=	G0BZF	670	3W2
92	=	G0CGG	670	3C4
92	=	G4SJZ	670	3C
96		G3GC	660	3C3
97		G3DWQ	657	4W
98		G4PLB	650	3C2
99		G0NOA	640	3C
100		G0PDZ	607	3Q2
101		G0OLS	580	3C
102	=	G0PUB	560	3G0
102	=	G8NT	560	3C2
102	=	G3AGF	560	3C
105	=	G3VNG	557	4C
105	=	G0MWO	557	4C
107		G3DJE	551	4C
108		G0OXT	550	3C
109	=	G0DAS	530	3C
109	=	G4RFC	530	4G0
111	=	G0NEI	520	3W
111	=	G4DRV	520	3C
113	=	G3HZM	510	3W/C
113	=	G4DNB	510	4W
113	=	G0RHD	510	3C
116		G3DQY	497	3W
117	=	G3KQY	491	3C
117	=	G3OZY	470	3C
117	=	G8CA	470	3C2
120	=	G0FQT	460	3C
120	=	G0MEE	460	3C
122		G0IJM	450	3C3
123	=	G3YCH	430	3C
123	=	G4YHX	430	4C
125		G3SBV	410	4G
126		G0NVC	407	3W
127		G4RUW	400	3W
128		GW0JMJ	390	3G0
129		G0PNV	380	4W
130		G4TUB	370	3C
131		G3WEB	337	3C
132		G3VGG	330	3C
133		G4BLS	320	3C
134	=	G4GUD	310	3G0
134	=	G4DTA	310	4C
136	=	G3ZDW	300	3G0
136	=	G3JXA	300	3W
138		G0IQW	290	3C
139		G0JWY	270	3C
140		G3WWT	270	4G0
141	=	G0NIF	260	3C
141	=	G3NVO	260	3C
143		G0LBT	250	3C
144		G4GOG	240	3W1
145		G0MKF	210	3G0
146		G3VYI	187	3G3
147		G3KDB	120	4W3
148		G0LGE	30	2C

Checklogs gratefully acknowledged from G4KTW, G0NRM

SSB AFS 1993 CLUB SCORES

Posn		Club	Score	Stations Contributing		
1	*	Lichfield ARS A	7656	G3NLY	G3NAS	G3VHB
2	*	Mid Beds CA	6630	G4BJM	G4MBC	G5LP
3	*	Lichfield ARS B	6184	G3SJJ	G4CBQ	G4APV
4		Chiltern DX Club	6102	G3OZF	G4BUO	G0HSD
5		Hereford ARS A	4447	G4CNY	G3EPV	G0ARF
6		Reading & D ARC A	4420	G3XTT	G3WGV	G0OPB
7		South Manchester RC A	4367	G3SVW	G0CBJ	G3FNM
8		Stratford on Avon & DRS	3958	G3MXH	G0SDX	G0CXJ
9		RNARS Portsmouth	3874	G3BZU	G3JFF	G3LIK
10		Halifax & D ARS	3838	G2UG	G3NBI/P	G3RKH
11		Sutton & Cheam RS	3787	G3WHK	G3OLX	G0AXA
12		Leicester RS A	3460	G3LRS	G3HYH	G0AIZ
13		Flight Refuelling A	3147	G4WEY	G0DVE	G3VMO
14		Clifton ARS A	3104	G0GQT	G0PPO/P	G3GHN
15		Rugby ATS	3140	G4APD	G4SSW	G0OLS
16		RAF N Luffenham	3004	G3TCQ	G0KUC	G3ZDW
17		Yeovil ARC	2948	G4JBH	G3COR	G3GC
18		Grimsby ARS	2874	G3RSD	G4EBK	G0CGG
19	=	Blackwood ARS	2850	GW4BLE	GW0ARK	GW0JMJ
19	=	Central Lancs ARC A	2850	G0FDX	G4ZYN	G0GVA
21		Plymouth RC	2820	G4OFR	G0IVZ	
22		Southgate ARC	2690	G3ZVW	G0FQT	G0MEE
23		Axe Vale ARC	2521	G3FFH	G4OYY	G8CA
24		RC of Thanet A	2510	G2IC	G3OPL	G0CTQ
25		Bromsgrove & D ARC	2500	G4AAL	G4IVJ	G3VGG
26	=	Martlesham RS	2460	G4PIQ		
26	=	Hereford ARS B	2460	G4ZYP	G4MET	G4SJZ
28		Southdown ARS A	2267	G3SVL	G3WQK	G3AGF
29		Scunthorpe ARC	2240	G4OGB	G0HDV	
30		Torbay ARS A	2201	G3LHJ	G3HFG	G0OXT
31		RAFARS York	2168	G2AFV	G3DJE	G4DNB
32		Echelford ARS A	2110	G0HZX	G0BZF	G3WWT
33		Preston ARS	2047	G4DBU	G3DWQ	G4PLB
34		Horndean & D ARC A	2030	G4FBS	G0ASZ	G0RHD
35		Addiscombe ARC	1917	G4ALE	G3SBV	G3VYI
36		AERE Harwell	1790	G0ADH	G0KOC	
37		Clifton ARS B	1694	G0PDZ	G0MWO	G4RFC
38		Thames Valley ARTS	1608	G3ENI	G0DAS	G3JXA
39		RNARS London	1550	G3YYF	G3OZY	
40		Crowborough & D ARS	1540	G0NOA	G4DRV	G0PNV
41		Newbury & D ARS	1450	G3ZGC	G4RUW	G3NVO
42		RNARS Lowestoft	1350	G0DID	G8NT	
43		Central Lancs ARC B	1261	G0NEI	G3KQY	G0LBT
44		Hornsea ARC	1250	G4YTV	G0JWY	
45	=	Leicester RS B	1130	G4SJX	G0IJM	
45	=	SRCC	1130	G8TB		
47		Gloucester ARS	1107	G3MA		
48		RC of Thanet B	1054	G0NVC	G3WEB	G4DTA
49		Southdown ARS B	817	G3DQY	G4BLS	
50		Flight Refuelling B	810	G0NUM		
51		West Kent ARS	760	G0GCI		
52		Torbay ARS B	640	G3YCH	G0MKF	
53		RC of Thanet C	630	G4GUD	G0IQW	G0LGE
54		Hereford ARS C	610	G4TUB	G4GOG	
55		Reading & D ARC B	560	G0PUB		
56		RNARS Plymouth	557	G3VNG		
57		South Manchester RC B	510	G3HZM		
58		Horndean & D ARC B	430	G4YHX		
59		Echelford ARS B	260	G0NIF		
60		Lichfield ARS C	120	G3KDB		

* Certificate of Merit

7MHZ DX 1993

Congratulations to Fred Handscombe, G4BWP, for winning the UK section of the 7MHz contest for the second year running, and to the winners of the other sections.

Conditions seemed to be quite good, with the leading stations making large numbers of QSOs with DX stations, particularly in Japan and North America: indeed 61% of G4BWP's contacts were with stations outside Europe. UK entries were slightly up at 40, but the number of overseas entrants was nearly 30% up. A number of overseas stations commented that they were running out of Gs to work before the end of the contest.

Once again beam antennas, at heights up to 100' were used by the majority of the leaders, with 6 out of the top 7 UK stations so equipped. For those with wire aerials, half wave slopers were a popular and effective choice.

Logs were generally well presented, with exactly half the UK entries being computer produced; however unmarked duplicates have still not been eliminated and a number of entrants will find their scores lower than expected! The continuing political instability in Eastern Europe resulted in some doubt as to what counted as a multiplier and what did not. Accordingly a small degree of rescoring was undertaken to ensure a common standard across all UK logs. Similarly some rescoring of overseas logs was carried out because of some of the non-standard county codes appearing. A number of overseas logs had their scores calculated according to the old (Prefix Multiplier) rules - where possible these were rescored correctly. Unfortunately some did not contain the full contest exchange (eg county codes missing) and these were taken as check logs. G3WRR

UK

Posn		Call	QSO Pts	Mult	Total	Eqpt
1	*	G4BWP	8203	95	779285	4Y27
2	+	GW8GT	8028	86	690408	4Q28
3	+	G3VHB	7907	84	664188	4Y39/4C4-
4		G0IVZ	6628	81	536868	4Y36
5		G3VER	6169	82	505858	4Y37
6		G4ODV	5528	85	469880	4C14 (x3)
7		G3NKC	5763	78	449514	4Y26
8		GM3POI	3315	85	281775	4G13
9		G3TBK	2929	74	216746	4W1-
10		G3IGW	2981	69	205689	4Q2-
11		G3UFY	3156	61	192516	4W13/4Q14
12		G2QT	2488	61	151768	2C2-
13		G5MY	2562	54	138348	3G10
14		G2AFV	2185	60	131100	4C14
15		G3PJT	2175	60	130500	4G40
16		G0IDE	2343	52	121836	3Q1-
17		G3VYI	2205	51	112455	4W13
18	+#	G0FDX	1883	51	96033	4C1-
19		G3GLL	1645	49	82305	4C13
20		G3YEC	1645	49	80605	3Q1-
21		G4ZFE	1398	46	64308	3G10
22		G3MPB	1310	47	61570	3C1-
23		G4IQM	1383	43	59469	4C1-
24		G0LZL	1220	47	57340	3C13
25		G4CZB	1230	41	50430	4C12
26		G0KKG	900	39	35100	3C1-
27		GM3CFS	855	40	34200	3W13
28		GW3HGJ	735	38	27930	3G10
29		G3BPM	775	34	26350	4C1-
30		GW4HBK	620	37	22940	3C14
31		G3GMM	610	37	22570	3C1-/3 G10/3Q1
32		GW3JI	680	33	22440	3C1-
33		G4KGK	615	32	19680	3C13
34		G3ZDW	568	31	17608	4Q1-
35		G3TXF	545	26	14170	4C16
36		G3LIK	390	22	8580	3C12
37		G6QQ	375	21	7875	3C1-
38		G3WRR	325	20	6500	4W11
39		GW3SB	270	21	5670	3W11
40		G3NKS	210	15	3150	4Q10

NORTH AMERICA

1	+	K2SX/1	1215	44	53460
2	+	N4AR	1155	44	50820
3	+	W3GH	1170	42	49140
4		VE3YBH	580	30	17400
5		VO1AH	535	29	15515
6		W6UZ/4	405	22	8910
7		K7CW	135	9	1215

SOUTH AMERICA

1	+	HP1AC	75	11	825

ASIA

1	+	UH8EA	1430	48	68640
2	+	UA9OA	1015	40	40600
3	+	JA1LZR	460	18	8280
4		JK1OPL	340	14	4760
5		RI7A	230	13	2990
6		JA9CWJ	205	10	2050
7		HS0AC	175	10	1750
8		JE6IBJ	155	9	1395
9	*#	JA9YAV	115	5	575
10		JA3UWB	75	5	375
11		JG3CQJ	45	3	135
12		JF2MVI	10	1	10

AFRICA

1	+	ZD8LII	1095	40	43800
2	+	CT3FT	640	33	21120
3		EA8AS	170	6	1020

OCEANIA

1	+	VK3APN	420	12	5400
2		VK8AV	260	8	2080

EUROPE

1	+	HA1ZN	497	46	22862
2	+	HA8FK	473	42	19866
3	+	HA5NK	435	45	19125
4	+	DF0CG	336	38	12768
5		LA2HFA	288	39	11232
6		LZ2GS	291	37	10767
7		UA2FP	293	36	10548
8		4K2MAL	285	36	10260
9		HA4FV	263	33	8679
10		UB5FAN	288	30	8640
11		HA0LG	255	33	8415
12	=	DF4QW	235	33	7755
		DK5JAN	235	33	7755
		SP1AEN	235	33	7755
15		DL1ASZ	233	33	7689
16		DL4XU	225	35	7650
17		HB9DX	235	31	7285
18		DL4JYT	226	32	7232
19		DL7VMM	216	33	7128
20		LA8NC	226	31	7006
21		DL3BRA	213	31	6603
22		DL1OO	205	32	6560
23		PA0DIN	208	30	6240
24		OK1DMS	211	29	6119
25		HA5BWJ	201	29	5829
26		LY2BFN	205	28	5740
27		YU7SF	195	29	5655
28		LY1CN	201	28	5628
29		DF5DK	208	27	5616
30		SP2BKF	190	29	5510
31		RA3LB	153	34	5202
32		HA5MY	173	30	5190
33		S51WA	198	26	5148
34		HB9BNB	186	26	4836
35		DL1ZQ	174	25	4350
36		SP7DTP	165	24	3960
37		UT5UGR	174	21	3654
38		DL1SXS	131	28	3612
39		SP3FLR	159	22	3498
40		SP4AVG	150	22	3300
41		OK2ON	146	22	3212
42		DJ5GG	143	22	3146
43		SP6BEN	133	23	3059
44		DL8ZWG	136	20	2720
45		HA6WT	133	20	2660
46		EA7AAW	129	19	2451
47		RW3QA	115	19	2185
48		YO3CR	113	19	2147
49		DL1DQD	113	15	1695
50		SP9EML	70	14	980
51		LA5AP	68	13	884
52		UA3XDF	43	8	344

RECEIVING SECTION

1	+	ONL383	258	36	9288
2		OK2-31097	210	27	5670

Check logs gratefully acknowledged from DF5WN, F/G3HKO, LA1IE, SM0CSX, SM0BDS, UB5LF, UZ3ZK, YO5BFJ, YO8MI, VE3JKZ, VK5JG and ZD8VJ.

* Thomas G6QB Trophy
\+ Certificate of Merit
\# Multi-operator

VHF RESULTS

1ST 1.3GHZ AND 2.3GHZ FIXED CONTEST

Activity for these contests did not seem to be very high, and conditions matched activity well with the bands probably depressed from their flat state! The choice of Easter Sunday was not appreciated by many contestants, and we will do our best to avoid that date next year! This said however, the tables below do not represent the activity level that well, and there were a number of stations who would have had very respectable scores had they cared to send in a log - shame on you! 13cm was bitterly disappointing, however G8ZQB and G6PHJ were not actually alone on the band - G8DOR was also looking for 13cm contacts, but unfortunately didn't make any! Particular congratulations to Roger Piper, G3MEH, who moved up from second place in the claimed score stakes with a perfect log. As usual certificates will go to the winners and runners-up in each section, and to G6XDI for being the leading station running 25W or less and a single antenna. *G4PIQ*

23CM SINGLE OPERATOR SECTION

Pos	Callsign	Points	QSO	Loc	Pwr	Ant	Best DX	km
1	G3MEH	1633	22	91QS	100	48QLY	G8VLL	163
2	G6PHJ	1554	14	92LO	120	27QLY	GD4GNH	293
3	G4ZTR	1410	14	01LV	100	55Y	G4XUM	265
4	G6PZT	1184	15	01FS	50	4 x 23Y	G4XUM	244
5	G8ZQB	859	7	92JN	50	27QLY	G0JBA	189
6	G0JBA	607	6	01II	6	4 x 23Y	G8ZQB	187
7	GD4GNH	479	2	74QD	10	4 x 23Y	G6PHJ	293
8	G8DOR	258	6	91OQ	200 in	23Y	G4WYJ	58
9	G8ACJ	219	7	91RF	29	16/16	G3MEH	60
10	G6XDI	150	6	91SM	20	23Y	G8ACJ	32

23CM MULTI OPERATOR SECTION

Pos	Callsign	Points	QSO	Loc	Pwr	Ant	Best DX	km
1	G0FCT	714	13	91QJ	75	55Y	G4NBR	167

13CM SINGLE OPERATOR SECTION

Pos	Callsign	Points	QSO	Loc	Pwr	Ant	Best DX	km
1	G6PHJ	12	1	92LO	50	51QLY	G8ZQB	12
1	G8ZQB	12	1	92JN	6	1.6m	G6PHJ	12

DIRECTION FINDING

12TH ANNUAL SOUTH MANCHESTER QUAD NIGHT EVENT

Nine teams made the start at Werneth Low Country Park. Added spice to the event was in the form of a split map incorporating part of the Peak District. All four stations were heard, although weakly in some instances, but this was expected as aerial wire was generally kept short (apart from station B which was operating on low power). All teams headed south for their second bearings and descended on the most southerly station first (Station C, G3WFT/P) located hidden among rhododendrons at the top of a slope at the head of Todbrook Reservoir. Station B (G3UHF/P) located on the River Goyt between Marple and Romiley was most teams' second choice and proved very difficult. Station A (G3FVA/P) was a much simpler affair located in some holly bushes near Harshead Green reservoir. Station D (G3ZDM/P) was only visited by three teams and then not till after 11pm (much to the operator's relief; he was feeling lonely). These teams enjoyed a 'bracing uphill walk' into Peak Park open country just above the Langendale trail Information Centre alongside Torside Reservoir to find the station.

Supper was held afterwards at Glossop community House followed by the traditional prize-giving and recounted tales of the evening. Honours were split evenly between north and south with Dave 'doc' Yorke taking first place and the Rosebowl, with Chris Wells second.

As usual with these night events, this was a difficult one and although no-one managed to find all four stations 66% of the teams found three, a creditable achievement by all concerned.

A special thanks to Lorraine Metcalfe who, in addition to providing supper, had to deputise at the last minute as starting marshall, due to the event organiser having to go and find a missing transmitter crew.

RESULTS

Pos	Name	Club	Time of Arrival at Transmitters A	B	C	D
1	D Yorke	South Manchester	2343	2259	2127	-
2	C Wells	Mid Thames	2344	2256	2128	-
3	D Holland	South Manchester	2345	2255	2135	-
4	B Bristow	Mid Thames	2353	2254	2127	-
5	A Simmons	Mid Thames	-	2246	2126	2358
6	G Foster	Mid Thames	-	2253	2127	2359
7	T Gage	Mid Thames	-	2308	2126	-
8	G Whenham	Coventry	-	-	2137	2230
9	J Hall	Ripon	-	-	2230	-

HF CONTESTS CALENDAR

1993	
4/5 Sep	SSB FIELD DAY (Jul 93)
4/5 Sep	*JARL All Asia SSB (Aug 93, p14)*
5 Sep	*LZ DX CW (Aug 93, p14)*
Sep/Oct	QRS Cumulatives (Jul 93)
11/12 Sep	*WAE SSB*
18/19 Sep	*SAC CW (Sep 93, p17)*
25/26 Sep	*SAC SSB (Sep 93, p17)*
25/26 Sep	*CQ WW RTTY (Sep 93, p17)*
2/3 Oct	*VK-ZL SSB*
3 Oct	21/28MHz Telephony(Apr93)(note date changed)
9/10 Oct	*VK-ZL CW*
17 Oct	21/28MHz CW (May 93)
30/31 Oct	*COWW DX SSB*
1/7 Nov	*HA-QRP*
13 Nov	Club Calls (CCC) (Aug 93)
12/14 Nov	*JARL Int'l DX SSB*
13/14 Nov	*WAE RTTY*
14 Nov	*OK DX (Mixed)*
20/21 Nov	2nd 1.8MHz CW (Aug 93)
20/21 Nov	*All Austria CW*
27/28 Nov	*COWW DX (CW)*
4/5 Dec	*ARRL 160m*
12 Dec	*ARRL 10m*
1994	
Jan/Feb	LF Cumulatives
7/9 Jan	*JA International DX CW (LF Bands)*
9 Jan	AFS (CW)
15 Jan	AFS (SSB)
15/16 Jan	*HA DX CW*
15/16 Jan	*AGCW-DL QRP*
29/30 Jan	*CQ WW 160m (CW)*
29/30 Jan	*UBA SSB*
29/30 Jan	*REF CW*
12/13 Feb	1st 1.8MHz CW (Aug 93)
12/13 Feb	*PACC*
19/20 Feb	*ARRL CW*
25/27 Feb	*CQ WW 160m (SSB)*
26/27 Feb	7MHz DX (Sep 93)
26/27 Feb	*REF SSB*
26/27 Feb	*UBA*
5/6 Mar	*ARRL SSB*

RSGB 1993 VHF/UHF CONTESTS CALENDAR

4/5 Sep	144MHz Trophy (Feb 93)
15 Sep	144MHz CW Cumulative
19 Sep	70MHz Trophy (Apr 93)
30 Sep	144MHz CW Cumulative
2 Oct	1296MHz Trophy
2 Oct	2320MHz Trophy
2/3 Oct	432MHz-24GHz & IARU Contest. (Apr 93)
5 Oct	1.3/2.3GHz Cumulative (Apr 93)
13 Oct	432MHz Cumulative (Apr 93)
15 Oct	144MHz CW Cumulative
20 Oct	1.3/2.3GHz Cumulative
28 Oct	432 MHz Cumulative
31 Oct	2nd 1296/2320MHz Fixed
1 Nov	144MHz CW Cumulative
4 Nov	1.3/2.3GHz Cumulative
6/7 Nov	144MHz CW, Marconi/6/24 hr
12 Nov	432MHz Cumulative
18 Nov	1.3/2.3GHz Cumulative
29 Nov	432MHz Cumulative
5 Dec	144 AFS / Fixed
6 Dec	1.3/2.3GHz Cumulative
14 Dec	432MHz Cumulative
26,27,28	
29 Dec	70/144/432MHz Fixed

For details of rules for European contests, contact G4PIQ, QTHR.

Please remember to include full details of your antenna, particularly the height above ground, with your entry.

THE TYPEFACE in Contest News has been reduced at the request of the HF Contests Committee in order to do justice to the large amount of contest information requiring publication, whilst retaining the same page allocation.

TELFORD RADIO RALLY

Telford Exhibition Centre Sunday 5 September

Trade Stands
Local Clubs
Special Interest Groups
Flea Market
Bars & Good Restaurant
Novice Feature
Free Prize Draw
Very Large Free Car Parks
Talk-in S22 and GB3TF (RB8)

Doors open 10.30

The 1993 Rally, the 16th consecutive one, is put on by the Telford Amateur Radio Rally Group.
Telford is easy to reach and is very close to the M.54 (no problems on Sunday!) Contact the Talk-in station when you want help. There is plenty of car parking. If any disabled visitors need special parking assistance please call one of the numbers below. We will be pleased to help.

Local attractions include
Telford Town Park
Cinemas
Ice skating rink
10 Pin Bowling
Telford Ski Centre
Ironbridge Gorge
Restaurants
Model Railways next door
Telford World of Snow
advance booking needed
So why not bring the family

Repeated for 93. the BRING & SELL SALE

There has never been a Bring & Buy Sale at Telford and we are not going to start now! This is a **Bring & Sell** Sale. **You** bring what you want to sell and **you** sell it. Tables will be available free of charge. You can sell up to 5 items. (if you have more then take a table in the Flea Market). If you sell - you pay 10% to Rally Group. If you don't - you pay nothing. The idea is to create a forum where private sellers can meet potential buyers - to bring back some of the (lost?) excitement to Rallies. There are no restrictive barriers to get in the way - you haggle face to face and enjoy it. Your hosts look forward to welcoming you to Telford.

If YOU have kit to sell - then bring it along

Info from Bob G7BWQ on 0952 770922 or Peter G4LSA on 0785 284388

This advert has been donated anonymously — Many thanks

SUNDAY SEPTEMBER 26th at 10.30 am

35th HARLOW RALLY

Harlow Sportcentre, Hammarskjold Road, Harlow, Essex

THREE HALLS

New spacious layout

Giant Bring & Buy ★ Licensed Bar & Refreshments
Ample FREE Parking ★ Special Interest Groups

ACCESS: M11 (Jn. 7) H'low A414. **TALK-IN:** S22 & SU22 Call G6UT

Organiser Hotline: Mike G7BNF (0850) 487863
or call (0279) 452124

SUNDAY, 26th SEPTEMBER at 10.30am

9th NORTH WAKEFIELD RALLY

Outwood Grange School,
Potovens Lane, Outwood, Wakefield

Radio and Computer Traders, Bring & Buy, Craft Stands, Special Interest Groups, Novice Stand, Refreshments & Licensed Bar

AMPLE FREE PARKING

Open 10.30 am (10.15am disabled) TALK IN ON S22 BY GB2NWR

Details from John G4RCG 0924-362144 (Eves & W/end)
John GOEVT 0924-825443 (eves & W/end)

B.A.R.T.G. RALLY

SUNDAY, 12th SEPTEMBER, 1993

Sandown Exhibition Centre, Esher, Surrey

Easy Access by Car — PLENTY OF FREE PARKING — Well Signposted
Talk-In S22 — Plenty of Trader, S.I.G. & Local A.R.G. Stands in large Exhibition Hall

★ ★ ★ ★ **BRING 'N' BUY** ★ ★ ★ ★

ADMISSION: ADULTS £1.50 OAP's £1 CHILDREN UNDER 14 FREE (If accompanied by an adult)
OPEN: 10.30am to 5pm

On-Site Catering — Hot and Cold Meals — Snacks — Beverages — Licenced Bar

Further details from: Peter Nicol, 38 Mitten Avenue, Rubery, Rednal, Birmingham B45 0JB Tel: 021-453 2676

Members' Advertisements

RSGB Members wishing to place an advertisement in this section must use the official form incorporated on the label carrier of Radio Communication. This will prove membership and must be for the current month. No acknowledgment will be sent. Ads not clearly worded, or which do not comply with these conditions will be returned. If an ad is cancelled no refund will be due. An advertisement longer than 60 words will be charged pro rata. Trade or business ads, even from members, will not be accepted. Traders who wish to use this facility must send a signed declaration that the items for sale are part of, or intended for, their own personal amateur station. The RSGB reserves the right to refuse ads, and accepts no responsibility for errors or omissions, or for the quality of goods for sale or exchange. Ads for CB equipment will not be accepted. Each advertisement must be accompanied by the correct remittance, as a credit card payment, cheque or postal order made payable to the Radio Society of Great Britain. Please note that because this is a subsidised service to members, no correspondence can be entered into. Licensed members are asked to use their callsign and QTHR, provided their address in the current edition of the RSGB Amateur Callbook is correct. RS members will have to provide their name and address or telephone number. Please include your town and phone number in the free boxes provided to assist readers. Advertisements will be placed in the first available edition of *RadCom*.

Warning: *Members are advised to ensure that the equipment they intend to purchase is not subject to a current hire purchase agreement. The 'purchase' of goods legally owned by a finance company could result in the 'purchaser' losing both the goods and the cash paid.*

FOR SALE

AAA ISOLOOP AMA3 10/30MHz, mint unpacked, all complete. Surplus to requirements: £150. G3AOS. (Macclesfield) 0260 252287.

ALINCO DJF1E 2m H/held Rx 108-174MHz, charger, power lead, remote spkr, Mic and Microset 30W Linear Amp. All mint cond, manuals, boxed: £200. (Add £10 postage if necessary) (Newtownabbey) 0232 837159.

ALL MUST GO. Complete Satellite System FT726R 6/2/70/Sat with HF module: £850. BNOS Linears 100W/2m: £115. 50W/70cm: £100. 50W/6m: £80. PK88 c/w DCD mod: £85. KR400RC c/w top bearing: £90. KR500 Elevation Rotator: £100. Landwehr MA144 Preamp: £75. FT709: £115. Daiwa 24A PSU: £65. SP767 Spkr: £35. KLM14C Antenna: £60. Jaybeam 88 Multibeam: £30. 4y/6m Beam: £25. AR40 Rotator: £25. (Bolton) 0204 594235.

ALL MUST GO: IC275H 2m 100W + matching Icom PSU: £800, will split. TS780 2m/70cm: £550. IC271E 2m M/mode 10W + base Mic + Mutek: £400. TS811E contest winner: £650. TS700 2m + Mutek: £200. IC202S: £100. SSB 23cm Tvtr + LMW 13cm Tvtr: Offers! IC735 HF Gen cov: £700. Trio AT230 ATU: £120. Ian, G8KQW. (Berkshire) 0483 465348 daytime or 0734 886049 evenings.

AT 286 16MHz 3.5 FDD, 20Mb HD, Super VGA card, 1Mb Ram, Mono VGA Monitor c/w much Radio S/ware, DOS3.3: £300. Panasonic KXP1170 Printer and stand, used two hours only: £75 ono. SX200 PWR/SWR: £40. Revex PWR/SWR: £40. Phone for details. Two Way Coax switch "N" types: £18. 2m Wavemeter: £12. 4m H/wave Vertical : £10. Westminster 4m AM Boot 50W: £15. (Bolton) 0204 594235.

BBC Master Compact + Adapter + TV, comprehensive s/ware, manuals, operating instructions, 3.5" disks: £200 ono. AKA PK232 Multimode, manuals, all connections: £260 ono. Sell Complete: £400 ono. Can be seen working, prefer buyer collets, otherwise carriage extra. Call or write William Nicoll, GM4LFZ 124 Hilton Avenue, AB2 2LH. (Aberdeen) 0224 480483.

EDDYSTONE COLLECTION for Sale. Over 100 sets from 1924 to current model. Pages of original and photocopy Manuals. Send A4 SAE for List. Baker, c/o Hallen, PO Box 27, Wednesbury, West Midlands WS10 7SZ. (Wednesbury) 021 556 3324.

FT290R with MuTek front end, mobile mount, case, nicads, Mic, YH1 Boom H/set and Control Unit: £260. (Farnborough) 0252 547900.

FT301 6 Band HF Tcvr, c/w FP301 PSU, FC301 ATU. Boxed with manuals: £350. FT101 Mk2 incl G3LLL WARC Bands Conversion, manual, DC leads: £225. FT102, FV102DM, boxed with manuals: £475. All in nice condx. G4XRV, QTHR. (Chesham, Bucks) 0494 783557.

ICOM IC25E, 2 Nicads BP82 - BP83, softcase, SP/MK HM46 with base charger BC72E, boxed, mint condx: £175 The Lot. Sat/TV System Gensat Receiver/Positioner IRTE 18" Actuator IRTE LMB with HiTech Companion 2 Decoder, good condx: £150. G4TDR, QTHR. (Wolverhampton) 0902 765374.

KENWOOD TS940S Auto ATU: £1450. 2KW Linear: £850. 1.2KW: £475. FT757GX: £525. FT902DM: £500. FT101ZD: £550. FT101Z: £375. FT200: £250. FT101E: £275. B40: £75. 9R-59DS: £95. RA17: £175. TR4C: £250. R2000: £350. FRG8800: £425. TS770: £450. TS700G: £300. Phone Richard anytime. (Tiverton) 03986 215.

SOLITOL 60M-C Colour Head Filter Enlarger. 50mm, 75mm Lenses. Philips PCA 060 Negative Analyser. Jobo PCE4531 Motorized Processor. Durst TIM60 Timer. Two Paterson film Developing Tanks. Selection of stainless steel and plastic developing trays and measures. Colour thermometer. All instructions for above many bits and pieces. The lot: £300. NO SPLITS. Buyer collects. Contact G0EJV any time. (Lincoln) 0522 683113.

TEN TEC Century 22 Tcvr: £220. SEM Transmatch + Ezitune: £70. Bencher Key: £45. Bencher CW Filter: £40. Eimac SK600 Valve base: £40. Shure 444D Desk Mic: £30. All in exc Condx. Peter, G4TFH, (NOT QTHR). (London) 081 969 2720.

TENTEC ARGOSY 2, Rarely used as standby rig, Hi/Lo power 5/50W, matching PSU: £300. Navico AMR1000 2m Rig 5/25W, little used: £110. Yaesu FC902 ATU, ex condx: £120. Rx Sony ICFSW 7600: £105. Shack clearance due to illness. G3NJP. (Truro) 0872 501487.

TRIO TS780 VHF/UHF D/band Base Stn: £550. Yaesu FT290 Mk1 Mutek + Mobile mount: £210. Yaesu FT230R 25W mobile: £150. Icom R71E HF Rx: £450 ono. G4UKV. (Manchester) 061 904 0529.

VALVES NEW BOXED. At £1 each. Several available of each Type. EB91, EBC81, EBF89, EC90, ECC81/2/4, ECL80/83, ECL84/5/6, EF42, EF80/85/89, EF91/95, EF183/184, EL42, EL81/85, EM87, EY51, EZ80. Also available at £3 each. 5R4GY,5U4G, 5Y3GT, 6V6GT, 6X5GT, AC/P, AC/P1, D63, DH30, DH63, GZ32, GY501, KT33C. Please add £2 Postage. Cheques to :- K. Bailey, 40 Seymour Close, Selly Park, Birmingham, B29 7JD.

YAESU FT757GX, FP757GX 20A PSU, FC700 ATU, boxes and manuals: £600 the Lot. Owner giving up HF. (Worthing) 0903 690009.

50Ft Mast in 10 sections, complete with fittings and guy ropes. All in canvas bag: £60. (Farnham, Surry) 0252 713851.

6M TRANSVERTER MML50/144, 20W o/p, 144MHz IF, good front end, mint condx, manual: £140 ono. G3ZTZ, QTHR. (Camberley) 0276 25430.

AALA 80/40/30 Metres Magnetic Loop, new, unused, all leads, parts, control box, instructions: £150. Cushcraft AV3 Vertical 10/15/20 Metres 14ft high, new, unused, complete with APR18 Radial Kit: £85. (Wellingborough) 0933 278264.

AEA AMIGA Video Terminal system for SSTV Colour and B/W, FAX, as new: £110. GM4HKW, QTHR. (Kirriemuir) 0575 73455.

AEA CP-1 Computer Interface, send/receive CW, RTTY, MBA-TOR S/ware: £79 ono. Datong Woodpecker blanker, box: £35. Both like new. (Cardiff) 0222 465463.

ALINCO 2m Tcvr DR-110T/E 5/45W: £150. Yaesu FT230R 2m Tcvr 3/25W: £110. Cables, Mic, manuals, both recently checked and realigned. No offers but will pay carriage. G3MWH, QTHR. (Leominster) 0568 616608.

ALINCO DJ120 2m FM H/held and charger, little used: £100. Vectronics ATV VC300DLP, as new: £100. 2m Collinear, ex condx: £20. 1/4 Wave Whip: £6. Heatherlite Headset for DJ120: £10. Kent Straight Key: £25. (Bolton) 0204 385466.

ALTON TILT over Mast: £195. Kenwood 130S HF Tcvr: £330. FP700 PSU: £125. Kenwood TS670: £580. Wanted Amstrad 4386. Dave. (Norwich) 0603 745512.

ALTRON AQ-6-20 Mini Beam 3 ele, vgc. Still in the air until sold: £100. (Kent) 0474 823797.

AMSTRAD 6128, Disk drive, no games, used Mini office Two and others: £140 ono. David, G0PFN. (Norwich) 0603 424864.

AMSTRAD PC1640 Computer, enh Colour Monitor, 30Mb H/Disk, 5.25 Floppy, various S/ware: £190 ono. Phone Andrew, G8TZJ 8-11pm. (Lancaster) 0524 33079.

AMSTRAD PPC640D PC compatible twin 720k floppy drives plus MS DOS3.3, Mirror two comms S/ware and four slot expansion box: £180 ono. Also Sinclair Spectrum 48k. Complete with Interface One and microdrive Unit plus many other accessories and S/ware: £40 ono. (Lutterworth) 0455 550315.

ARMY RADIOS; A13 Manpack, A41 No 2, A43, WS38 AFV, Canadian 52 Receiver, New Zealand ZC1, PRC6, B2 Tx & Rx. Phone (Kingston-upon-Thames) 081 949 2317.

AS NEW condx FL200, FR100 (Ex Silent Key), revalved, serviced, manuals, circuits etc. Pending move disabled housing forces sale. Ring anytime. (Richmond) 081 876 1108.

B40D Gen Coverage Rx with matching SSB Unit, good working order: £100 ono. Trigem 286 PC 14inch Colour VGA, 40Mb h/drive, 3.5 + 5.25 Floppies, MS DOS 5: £350 ono. Dave, QTHR. (Trowbridge) 0225 755980.

CODAR AT5 with matching P/S, inter connecting leads, in un-marked condx, complete with few spare valves, instruction manual and recent articles: £50. (Glasgow) 041 779 2709.

COTTAGE for Sale in quiet North Notts village. Four Bedrooms, recently installed Double Glazing. Large Kitchen. 60ft Versatower with full planning permission. Set on Third of an acre plot: £70000 ono. G4TYS, QTHR. (Retford) 0777 248080.

CPS8256 RS232C serial interface and parallel Centronics interface for Amstrad PCW 8256 to run Packet or Morse Tutor etc with packet driver disc: £40. (Hereford) 0981 540419.

DEWSBURY MORSE Keyboard, recent Grey model: £140. Prefer checking and collection. G3DCV. (Gravesend) 0474 833010.

DIAMOND SX600 SWR/Power Meter 1.8-550MHz: £105. Pye 70cms Europa, xtals RB8 + RB9: £45. 4m Ground Plane: £28. 13.8v/7A Reg PSU: £25. Many other bits and pieces and RSGB/ARRL books. SAE for List. G8FRA. (Coventry) 0203 415815.

DUAL BAND Antenna 2m/70cm with 10 metres UR67 (collect): £50. Datong Morse Tutor: £35. G6TPQ. (Oldham) 061 633 3895.

EDDYSTONE EA12 Receiver: £50. Marconi TF801A Signal Gen 10-300MHz: £25. Copies of RadCom 1973 to 1993, offers invited. Buyer collect. G6HL, 7 Thame Road, Piddington, Bicester, Oxon OX6 0PT. (Nr Biscester) 0844 237763.

EIGHT 4.75ft Sections Aluminium Mast, 2inch Dia: £55. Buyer collects/Pays carriage. (Largs) 0475 675967.

EMOTO ROTATOR (£165): £100. Cage Housing(£50): £25. Upper Mast Bearing(£30): £15. Or the three for: £125. All vgc. (Manchester) 061 766 5265.

EPSON EQUITY LT Laptop Portable Computer LCD Screen, Twin 740 drives plus s/ware, amateur radio etc: £200. Tatung BSB System + Dish: £50. Amstrad DMP200s Printer: £50. CGA Monitor, slight fault: £50. Pair of Mission 700 leading edge Hi-Fi Speakers: £50. G0JCG, QTHR. (South Wirral) 051 339 9599.

EPSON PXH Lap Top Computer, built in Printer. Charger maxpax, TNC, Storno 144.650 working on Packet: £105. Buyer collects. G3ZLN. (Ipswich) 0473 749139.

FT101E Osker SWR-200, Western DX31 with homebrew ATU, complete station: £350. FT703R 70cm H/held with Nicads, charger: £90. SRX30 Gen coverage Rx, built in FM IF strip: £100. ST5 TU: £15. Telequipment Scope, OK for Audio work: £15. G0PFD, QTHR. (Hornsea) 0964 535146.

FT101Z Mk3 1.8-30MHz inc WARC bands, CW/SSB/FM, CW filter, fan: £395 ono. G3TQF, QTHR. (Leicester) 0533 878561.

FT401DX with manual and spare valves: £100. FT23R gd condx, boxed, manuals etc: £130. (Holsworthy) 0409 241548.

FT411 2m H/held with accessories: £200. (Coventry) 0203 443888.

FULL HF STATION FT757GX, FC757AT, FP757HD all boxed with manuals: £750. Also Realistic PRO2021 Scanner: £85. vgc. Phone after six. (Liverpool) 051 734 0328.

GOULD OS250B 15MHz Dual Beam Oscilloscope with manual: £140. G4CJJ, QTHR. (Cheltenham) 0242 242117.

HEATHKIT DX100-U Tx 160 - 10, AM/CW, 120W, new PA and Murphy B40C Rx, gen cov, ex RN, AM/SSB/CW. Both GWO, handbooks, spares: £75. (Reading) 0734 785348.

HEATHKIT RA1 Rx 1.8-30MHz: £17. TW2-120 AM Tx QQVO640: £20. TW2 AM Rx Portable: £5. Pye VHF Tx 25-174MHz: £10. Transformer 650 - 650 @ 250mA: £5. Tonna 50MHz 5 ele Beam(as new): £30. Morse Dewsbury Supa-Tuta: £30. Yasesu 690R/2 with BNOS 50W Amp: £300. G8BFH. (Hitchin) 0462 457881.

HEATHKIT SB303 Rx, 9 bands, filters for SSB, CW, AM: £150. Datong PC-1 Gen Coverage HF Converter 0-30Mhz in 1MHz steps to 2mtr band M/mode: £50. Both good condition with original manuals. Carriage extra. GM3LGU, QTHR. (Dunoon) 0369 87341.

HF ANTENNA System comprising Strumech VL40 Tiltover complete with Auto-Brake Winch Base Unit, Head Unit and Bearing. Tet 2el Tri-Bander Mini Beam KR 400C Rotator and Control Unit. 130ft RG11 Coax and rotator cables: £500 ono. Collins 30L-1: £500. G3ONU, QTHR. (St Albans) 0923 676344.

HOUSE AYLESBURY Modern Detached 3-Bed Cul-de-sac, Nearby facilities, commuter Railway London: £92500. G3AYS, QTHR. (Aylesbury) 0296 393186 or Agent 0296 88111.

HY-GAIN TH6 Beam. Hacker Super Sovereign with manual. Kent twin Paddle, unused. Seven (7) off QY3-125s, Offers please. RA17L Meter needed. (Derby) 0332 671536.

IC720S vgc hand Mic, all filters fitted, FB rig, never used mobile: £450. Wanted Tentec Corsair. G4WDZ, QTHR. (Hillingdon) 0895 421540.

ICOM 720A boxed with Mic and IC PS20 PSU. As new condx with manuals: £600. Phone evenings. (Mansfield) 0623 797119.

ICOM 745 with FM, as new: £700 ono. Part Exchange 120S or 130S or 2 metre gear, WHY? G0IMK, QTHR. (Clows Top, Worcs) 0299 832279.

ICOM IC R70 Top quality HF Receiver, vgc, boxed, FM fitted: £375. (Huddersfield) 0484 603963.

ICOM IC735 HF Tcvr as new condx: £550. Redifon ATU: £28. Phone evenings or w/ends. Prefer buyer collects. G3ZQF, QTHR. (West Wickham) 081 777 1315.

ICOM IC735 Tcvr with PS55 PSU and Tokyo HF Antenna Coupler HC400L. Can be seen working: £750 ono. Phone (Greenford, Middlesex) 081 575 7984.

ICOM IC735 with Spkr and PSU: £750. Desk Mic: £25. Trio 520S: £275. Icom IC245 with SSB: £150. SEM Transmatch: £75. SEM Dummy Load: £20. Datong Notch Filter ANF: £45. 144MHz MM 100W Linear: £50. Daiwa CN620A SWR & Power Meter: £35. All Plus Carriage. GM4LPG, QTHR. (Nr Grantown on Spey) 047 985254.

KAM V5 purchased new in January plus Lynx2000 14MHz Tx 14W o/p. Both as new and only tested: £275. (St Annes on Sea) 0253 782339.

KANTRONICS DATA Engine plus 9600 Board plus External Modem Interface plus 'Hostmaster 2+', PC s/ware (mint): £405. PacComm TNC 2(New): £105. PSK1 Modem: £145. Kenwood SW200A SWR/PWR Meter plus SWC-2 70cm coupler and SWC-4 23cm Coupler (mint): £185. Tokyo HyPower 1240U 23/24cm PA (45W) metered/Preamp: £440. SSB 2m/70cm/23cm Pre-amps/Control Units(new): £100 each. Telephone Paul, G4XHF, QTHR. (Crawley) 0293 515201.

KENWOOD TH27E 2m H/held, boxed, carrying case, little used: £180. Peter, G6TWW, QTHR. (Guildford, Surrey) 0483 579840.

KENWOOD TS120V, DFC230, TL120, AT130: £400. Heathkit HW9, no mods: £225. Heathkit 14MHz 200W PEP: £60. HBR Electronics KB29, DM170, TD224, Tx/Rx RTTY System : £100. Sony AN1 Active Antenna: £30. Bearcat 220FB: £75. Belcom 144MHz Scan Rx, fully Xtalled: £40. (Huddersfield) 0484 538426.

KENWOOD TS440S internal ATU, VS1 'AT' Tune buzzer filters: £850. Kenwood TH77E 2m/70cm FM, SMC31 Spkr Mic, additional battery, BC10 compact charger, high gain Antenna: £350. (Nr Colchester) 0206 263560.

KENWOOD TS450SAT, VGC, includes 2.4kHz SSB filter, Auto ATU, MC43S, matching Spkr and VS2 voice Unit. All items boxed with manuals etc: £1095 the Lot. Simon, G0TBE. (Oldham) 061 627 1661.

KENWOOD TS530S gd condx: £420 ono. VR3 TriBand Vertical: £35. Prefer Buyer collects. G0CZB. (Hitchin) 0462 434552.

KENWOOD TS820S immaculate, original packing, spare 6146B's: £450. VFO520: £70. SP820: £80. TS440S: £495. All ovno. Phone anytime answer machine. G0MOK. (Westhoughton) 0942 840195.

KENWOOD TS940S, AUTO ATU, SP940 ext Spkr, 3 years old, never used on Tx, used as Rx only: £1350. Chris, G1YXT. (Horsham, Sussex) 0403 258826.

KENWOOD(TRIO) TS120V 10W HF rig + 12v PSU. Ideal for portable/weekend/mobile or transverter base for VHF/UHF. Little used, vgc, boxed, CW filters: £300. G3JKS, QTHR. (St Albans) 0727 859318.

KW2000A Power Supply, mic, spare valves, operating manual, Frequency Counter. Buyer Collects: £120. (London SE9) 081 856 8437.

MAGNETIC LOOP AMA3 (complete) 10-20mtrs: £150 ono. Jaybeam MBM88 70cm Antenna: £35. UHF Wideband High gain TV antenna: £20. Amstrad PCW9512 Computer/wordprocessor with Locoscript 2 & 3, spellcheck, locomail, Mail232, Printer support pack, CPS8256 SER/PAR Interface, Disc etc: £300 ono. Buyer collects. (Bristol) 0272 427668.

MOSLEY TA32JR with new spares: £50. CDE Rotator: £60. Turner plus Three Mic: £20. Hi-Mound MK703 Twin Paddle: £10. Bencher ST1 Black non - lambic: £35. Bencher BY1 Black lambic, new: £45. FT290R, case, Mic, Nicads, charger: £200. Star Master keyer with memories: £50. TS440S, PS430, SP430: £800. All ono. Collect or carriage extra. G2FDF. (Oswestry) 0691 658422.

NORTH DEVON. B & B, good food, good beer, HF Station! 1 mile Woolacombe Beach. G0DOT, The Smuggler's Rest, Mortehoe, North Devon. (Mortehoe) 0271 870891.

PRIVATE COLLECTOR Selling up WW2 Military Radio Equipment. Various sets:- 19, 22, 62, 18, 46, 38, 31, R107, R109, R103, C12. Also Accessories, Test Equipment, Valves, Handbooks, Manuals. Must dispose of, either in lots or as a whole. List available. (Guernsey, C.I.) 0481 46719.

PSION LZ64 Organiser, Mains adaptor, RS232 Link, 32k Ram Pack. S/ware Filemaster, Spell checker, Formulator plus Books, own written Amateur related s/ware, over £400 new. Reason for sale, now proud owner of a Psion series three: £150. G0JYQ. Evenings only. (Southampton) 0489 577033.

RACAL RA17L 1-30MHz Rx, gwo: £150 ono. G4OSJ, QTHR. (Oakham) 0572 85451.

ROBOT 400 Look-Alike, genuine PCB, offered as bought: £65. "Guardsman" quality security Camera, no Lens, needs attention: £35. 12 Volts(NOT 13.8v) 10A + 4A Rack mounting PSU, must collect, offers: £20+. BBC-B RTTY/CW System: £195. DIY 15MHz Counter project(unfinished).: £28. G0OZK. (Stockport) 061 477 5303.

ROBOT 400 SSTV Scan Converter immac, boxed, manual: £300. CT410 Noise Generator 15kHz to 160MHz Audio Power meter: £100. G4JBH. (Yeovil) 0935 23873.

RTTY SYSTEM Comprising Texas T199/4A Computer, Kantronics Interface with comprehensive s/ware stored in EPROM, home brew terminal unit, printer port, much s/ware on cassette (mostly radio related), several cartridges including Extended Basic, joystick, much documentation etc. Bargain at only: £50. (Oxford) 0865 890066.

RX8 Multimode Receive System for BBC: £90. J&P RTTY Spectrum tape, filter: £15. New 286 Motherboard: £40. Sangean ATS803A: £60. (Kidwelly) 0554 890538.

SILENT KEY Galaxy V Mk3 500W TCVR as new, separate Spkr/PSU, manuals and operating notes, 5 bands. Property of G6DZ. Offers around £200 acceptable. Details G3MIZ, QTHR. (Bruton) 0749 812473.

TELE TILT over Tower 40ft, with Fritzel 3 ele 3 band Beam. Must sell, moving QTH. Best offer. Tony, G3NXQ. (Worcester) 0905 20264.

TENTEC CENTURY 21 CW Solidstate Tcvr, 0-25W o/p, AC and 12v operation. Ideal for Novice or QRP: £165. (Nr Bristol) 0454 318539.

TIMESTEP PDUS Wx System, comprising Rx, PC Interface Card and S/ware: £420. (New Milton) 0425 615143.

TINY-2 PACKET TNC +Terminal, leads etc, boxed as new: £100 ono. Ask for Lee, GW0MMW. (Maentwrog) 0766 85298.

TOKYO HT120 20m SSB/CW Tcvr 20W: £150. G3ZJF. (Shepton Mallet) 0749 830926.

TONO 2m All Mode Linear Amp, i/p 1W - o/p 50W, boxed, instruction Manual: £120 inc carr. Hameg HM605 Scope 60MHz, c/w leads, case: £250 inc carr. G3WAO, QTHR. (Fareham, Hants) 0329 665757.

TOWER TELESCOPIC 60ft Tilt-over: £280. Also HF 3 ele Beam and VHF Array for above: £100. Photo available. Buyer collects. (Glasgow) 041 762 1517.

TRANSWAVE PHASE Converter. 1.8kW Three Phase from 12 amp single Phase Power point. Technical data, installation and operating instructions included. Immaculate, four hours use only: £175 ono. Also Datong Morse Tutor: £40. G0OYZ, QTHR. (Peterborough) 0733 203184.

TRIO TS520 80-10m Tcvr, boxed, manual: £275. Laser printer Centronics PP8, needs drum kit: £200. Minature 286 PC, 20Mb, includes mono Monitor (NO keyboard): £175. EGA Monitor: £70. All gwo. No offers. All can be seen working. G4GKB, QTHR. (Aldershot) 0252 330455.

TRIO TS520S gd condx, reliable with Shure 444 Desk Mic, handbook: £285 ono. Amstrad PC1640DD/MD Dual floppy, Mono Display, boxed as new, with DOS 3.2 and Ability W/P Database spreadsheet and misc Ham S/ware, Packet, AMTOR, propagation: £260 ono. Carriage Extra. John, G3VLH. (Copthorne, Sussex) 0342 714402.

TRIO TS830S, mint, fitted 270Hz filter, Delux tuning Knob, spare Valves and H/B 2 metre Transverter: £595. Valve 813: £20. Valve 4X250B, pair £45. All new. RG8U low loss Coax, 60p per metre. Inclusive 4m 4 ele Jaybeam Antenna: £25. 4m 2 ele Antenna: £15. (Hemel Hempstead) 0442 211220.

TRIO TS930S Auto ATU fitted, filters, recent service, box and manual: £850. Yaesu FT208R: £125. Contact John. (Telford, Shropshire) 0952 200280.

TS440S internal AATU, CW and SSB filters, matching PSU, Hand and Desk Mike, SP23 Spkr, boxed with manuals, perfect: £995. (Sidcup) 081 309 1295.

TS450S with ATU and CW filters: £975. Also TS440S with ATU and CW filter: £850. Both ono, vgc. G4BWP, QTHR. (Newmarket) 0638 552080.

TS830S + both CW filters, recently serviced by Lowes, new PA tubes: £600. IC211E + Mutec 2m M/mode 10watts 12/240v: £275. ICRM 3 Computer Remote cont for Icom 745/211 - Offers. Heathkit Mohicon Gen coverage Rx + internal mains PSU and manual: £40. G4AAW. Phone eves. (Maidstone) 0622 756331.

VALVE EQUIPMENT: Solartron CD1212/CT484 scope with 24 and 40MHz plug-ins. Needs attn. Offers. WANTED: VLF Radio Engineering by A D Watt, Pergamon (or similar), 50 or 70MHz convertors. G3PAI, QTHR, tel: Woodbridge, 0394 460298.

VERTICAL DIPOLE MFJ1796 for 40-20-15-10-6-2 metres, 12ft High, no radials needed, new, unused, cost £199 now £120. Microwave Modules Morse Talker model MMS-1: £60. G3IJL, 16 Bloemfontein Avenue, Shepherds Bush, W12 7BL. (London) 081 749 1454.

WAM Clearance. FT227R 2m 10W Mobile: £120. Offers Please for:- 10MHz XT Clone, Oak VGA, 30Mb Disc, 640k, also spare 30Mb. 18M 5150 XT, 10Mb. Spare 10Mb Drives. IBM Amber Monitor. Priam 65Mb MFM Drive for AT. DEC LA50 D/M Printer, No Manual. Philips D/WL Printer and Manual. G4WAM, QTHR. (Stoke) 0782 522314.

WW2 COLLECTORS Items. T1154, R1155, WS19 Mk3, No38 AFV with PSU. Clean and GWO. Please phone G3LEO. (Bedale, N Yorks) 0845 567519.

YAESU 7700, ATU, vgc, boxed: £200. BC221 Freq Meter, PSU, charts: £70. Autophone VHF Rx 80-180MHz(valve), vgc: £160. (Chessington) 081 391 0580.

YAESU COMPLETE HF, VHF, UHF station. FT101Z Mk3 WARC bands, fitted FM Tx. Used only 1 year: £400. Matching 101DM ext VFO Digital readout: £175. Matching FTV901R VHF - UHF Transverter 2m & 70cm Microwave Modules fitted, Duplex capability, repeater shift and satellite bands: £200. All one owner from new. Mint condx, will separate or: £650 if purchased together. John, GW0PEA, QTHR. (Neath, S Wales) 0639 710023.

YAESU FL2000B Linear 1KW, seems OK but has stopped working: £50. Prefer buyer collects. Manual, circuit diagram included. GM3AWW, QTHR. (Glasgow) 041 639 2370.

YAESU FRT7700 HF ATU 150kHZ to 30MHz, new, unused, bargain: £45. Alan, G7CDK, QTHR. (Royston) 0763 262443.

YAESU FT101Z, vgc: £350 ono. G4DMS, QTHR. (Northants) 0327 50632.

YAESU FT200 Excl cond: £230. FT208R needs new battery pack: £75. 90ft Trapped Dipole 10 - 80m has four sets of traps, c/w feeder: £75. (was £175 new). Diamond 7/8 2m Whip with Magmount: £40. Both Antennas very little used. (Scarborough) 0723 891336.

YAESU FT290-2 with FL2025 Linear, nicads and charger, mobile mic, case, boxes etc: £360. Ian, G0SGZ. (Nr Harlow, Essex) 0279 725331.

YAESU FT290R Mk1, standard, complete with Nicads and handbook: £200. G0TGS. (Buxton) 0298 22608.

YAESU FT290R Mk1: £200. Microwave Modules MML144/30LS: £50. Both in showroom condx. G0AFQ. (Nr Wigan) 0695 632674.

YAESU FT480R 2m M/mode Mobile 10+w o/p, twin VFO memory facility, good boxed condx: £255 ono. (Paignton) 0803 521699.

YAESU FT5200 D/band Tcvr complete with remote head kit and twin speakers, as new cost over £700, bargain: £450. Alinco DJ500E D/band H/held Tcvr, spare Nicads, PSU and car charger: £200 complete with carrying case. (Taunton) 0823 400926.

YAESU FT690R Mk2 6m M/mode, incl nicads and battery charger: £250. 6m Linear LP50-3-50: £75. 6m LP Filter: £5. 5ele 6m Tonna Beam: £25. AR6 6m H/wave Vertical: £20. Light weight Antenna Rotator: £15. Drae VHF Wavemeter: £10. Three way Antenna switch PL259: £5. G3HRY, QTHR. (Newport Pagnell) 0908 616519.

YAESU FT77 HF all mode plus FM 100 Watts: £375. Commercial grade 70cms Colinear: £35. 4 Stacked Dipoles 8.5dB gain: £25. LDF 4-50 Low loss Cable, state your requirements: £1 per Mtr. Wanted: D/Bander Tcvr. Also 23cm Masthead Pre-amp. 23cm Transverter and a Icom HF Tcvr, Icom IC735. IC751A. (Norwich) 0328 710641.

YAESU FT790 Mk2 70cms with matching FL7025 clip on Linear. Yaesu FT690 Mk2 6m. Both with chargers and high power batteries. Both unopened and in new condx. Genuine reason for sale. Offers around half list price. (Swindon) 0793 878515.

YAESU FT790R Tcvr in mint condx, will accept: £250 cash. No offers. Call Phil, G6DAU. (St Albans) 0727 872528.

YAESU FTV-107R solid state tcvr; 50, 144 and 432MHz fitted. 20W output. Ex condx; £220 ono. Steve, G4UOL, QTHR.

YAESU FTV901R Transverter 2m Module fitted: £75. Addonis AM303G Base Mic: £20. HyGain 12AVQ Triband Vertical: £25. Kent Electronic Keyer: £25. (Darlington) 0325 468411.

WANTED

AP1086 Issue 1, (RAF Radio Stores Ref No's). Also Air Publications Relating to Radio, Radar Equipment. Ex price offered. Would purchace Post-War to current:- Magnetrons, Klystrons, T/R Cells, Photo Multipliers, Microwave and Special CV Types. Required Static or Rotary Inverter, AC or DC Input with Output of 80/115v 1500/2000Hertz. Also Rx Type R1355 10D/13032, Unmodified. Please phone anytime. (London) 071 511 4786 or 071 790 2846.

KENWOOD / ICOM HF Tcvr, preferably with internal Auto ATU. Will accept separate. Not more than three years old in gd condx and full operational order. Also req stand mic. Will collect within 50 miles radius of Swindon. (Malmesbury) 0666 860263.

MOTOROLA or Stewart Warner R39A. Good R390A VFO unit. RCA AR8 or CRV 46151 Rx. Collins ARR15 or 51H Rx. BC375 SX17 manuals. ART13 LF Osc Unit. Good prices paid for genuine articles. Call John, G3LNT, QTHR. (Maidstone) 0622 761276.

RECEIVER. General Coverage HF Communications Rx. Perhaps 9R-59DS. Prefer valves! Available later, my old but working HRO. Godfrey, G4GLM. (Edgware) 081 958 5113.

WS No 18 (18 Set), MCR1 Receiver or similar, B2 spares Box or B2 parts. Good price offered for above. G4GVD, QTHR. (Preston) 0772 713370.

YAESU FV707DM Must be in gd condx with handbook and preferably orig box. (Princess Risborough) 0844 346274.

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19 SET Un-modified. Crossed needle Meter for Daiwa CN101 SWR Meter. 2.5KV Power Supply. Oil-filled Capacitors about 12mfd 4KV. Valves for 18 Set (ARP12, AR8, ATP4). Circuit for Z81 Computer, Amplifier type G for Telequipment D43 Scope. G3MFW, QTHR. (St Austell) 0726 73608.

23CM MODULE for Kenwood 790E. Cash waiting. Telephone office hours only. Ask for Graham. G0SUB. (Cirencester) 0285 644407 x205.

70cm AERIALS for car and loft. (Hemel Hempstead) 0442 241281.

AEL 3030 4 channel Transceiver. Battery charger, manual for PF70 H/held Radio. Needed for local ATC Sqn. (Tayside) 0307 818796.

ANY CP/M Startup Utilities S/ware for Altos 580 Computer System. Also any radio S/ware for the same System. Copy or sale. Also Instruction book for Altos 580 computer System or information of current Dealers. 12 Rosneath Gardens, Dundonald, Belfast BT16 0UN. (Belfast) 0232 487925.

AR88 and AR77, Scrap or modified for parts or rebuild. Anything considered. Collect 60 miles radius Central London. Also Trimming Tools and AR88 meter Logo plate wanted. Phone Nick. (London) 081 852 4065 24hr ans.

DIGITAL READOUT DG1A for TS820. G3JWC, QTHR. (Burton on Trent) 0283 42164.

DIPOLE OF Delight 3.5/7 High Power Version. G0KTN, QTHR. (Melksham) 0225 703726.

EDDYSTONE 898 DIAL and Drive in FB condx. Knapp, G3NMJ, QTHR. (Bexhill on Sea) 0424 215556.

EDDYSTONE RECEIVER 770/R, 730/4 in vgc. Buyer collects or carriage paid. Racal Receiver HF to 30MHz acceptable. Call Gittins. (Christchurch) 0202 470084.

EDDYSTONE RECEIVERS EC10, EB35, 1000 Series. Others considered. Also Speakers, signal strenth Meter, Edometer. For cash. Lepino. Fax 0372 454381 or phone (Surrey) 0374 128170.

FRONT FOR ICOM IC280E. Must be worker, I only need the CPU board but will buy the whole set. (Coatbridge) 0236 425142.

FT101ZD Mk3 with fan + FM board. G0NIB, R Lucking, 62 Ember Farm Way, East Molesey, Surrey. (East Molesey) 081 398 3603.

GOOD COPY Teleprinter Handbook 1973, Goacher and Denny. (Newport, Gwent) 0633 420641.

HF BEAM - Mini or Full Size. Within the Manchester area. Phone Peter. (Swinton) 061 736 0667.

IC275E, SSB Electronic or Mutek Transverter for 2m in good condx. Phone after 6pm and ask for David. (Castleford) 0977 558706.

ICOM IC275E 2m M/mode Base Station. Please state condx as cash waiting. Roger, G3UAX, QTHR. (Reading) 0734 584858.

ICOM RC10 Frequency Controller. KW Ezee Match or well made Home Brew Z-match. Kenwood HS5 Headphones in gd condx. (Neath) 0639 813431.

ICOM751 or 751A. Must be in gd condx. Cash or part exchange for Realistic scanner. Mike, G0CVZ. (Peterborough) 0733 222588.

INFO REQUIRED on mod to add FM to IC720A, commercially fitted board acceptable. John. Letters via G0JAJ, QTHR. (SE London) 081 857 8096.

KANTRONICS KTU Telemetry unit and/or any Weathernode accessories wanted. Unsed ICS weather station available for possible P/ex. Bob, G8IYK. (Redditch) 0527 64885.

KENWOOD TH77E Dual Band H/held. Must be in gd condx. (Telfod) 0952 618016.

LOWE HF225 or HF150, must be in gd condx with manual. Will collect reasonable distance. Please ring Tony, G7NZR. (Ilkley) 0943 607506.

RACAL 1217 Receiver also Power Unit Variometer Harness and a Microphone receiver for No 19 Set. GM0CNY, QTHR. (Lochgilphead) 0546 602475.

RT106 REDIFON Safari 'B' Band RF Modules. Avo CT160 Valve Tester, Data and Handbook, buy, loan copy! Circuit, info SE Labs DVM type SM211. Circuit, info SE Labs Timer/Counter type SM202. (Gainsborough) 0427 611160.

RTTY Eprom for Commodore 64. G0KSL. (W London) 081 868 6815.

TEMPO 2002A 2 Metre Amplifier. Contact Glyn, G8WXU, QTHR. (Billericay) 0277 623019.

TRIBANDER 3 ele for 10/15/20m in good condx. Limited space, maximum turning radius 14ft 9inches. G0FQX, QTHR. (Milton Keynes) 0908 667250.

VALVE TESTER. Avo CT160, Taylor or Other. Working or repairable. Kaye. (Ilford) 081 551 3546.

WANTED COLLINS 516F-2, 180S-1, 302C-3, Mech Filter F455FA-0.5 Directional Coupler. 312B-4. 312F-5. SM3. 75A4 Rx NO Mods. G4KDV after 8pm. (Otley, W Yorks) 0943 463083.

WANTED FOR Use with Yaesu FR101, 6m and 2m Converter Units, also FL101 Tx. G4YZZ, QTHR. (Dorset) 0747 822024.

WANTED Valve HiFi, Quad, Leak or Radford. Also BBC Microphone. Will pay cash and collect. Please phone. (Chelmsford) 0245 266027.

WANTED: A Lancet Telegraph Galvonometer unit. Also a Heathkit Mohican Receiver Manual. G3BPE, QTHR. (Westbury, Wilts) 0373 826939.

YAESU FT290 Mk1. Details to GM0ELL, QTHR. (Glasgow) 041 339 4552.

YAESU FT726R - Tone Squelch Unit FTS32R, Tone Encoder unit FTE36. Also WW1 Mk3 Short wave crystal Rx or Tx. (Haywards Heath) 0444 458390.

CLUB NEWS

DEADLINE - Items for inclusion in the November 1993 issue must be sent to HQ marked "Club News - DIARY", to be received by 16 September latest. If news is received by the published deadline, it should appear in the listing. It is your responsibility to ensure that items are sent DIRECT to HQ in good time. News items should be sent in writing, preferably typed or written legibly, and be signed by the club secretary or the person responsible for publicity.

NOTE: This is primarily a service for clubs affiliated to the RSGB, to whom priority will be given.

AVON

RSGB CITY OF BRISTOL GROUP - 27, History & use of Oscilloscopes by G8KGH. Details 0272 672124.

SOUTH BRISTOL ARC - 1, Preparation for the Bristol rally; 8, Review of Bristol Rally; 15, talking brick bring & buy; 22, talk 'Air Band Monitoring - the Facts. Details 0275 832222 Wednesday eve only.

THORNBURY & DARC - 8, talk 'Growing with Computers'; 22, Rig night HF/VHF/UHF. Details 0454 415215.

ABERDEENSHIRE

BANFF & DARC - 10, (Free evening); 24, Talk "Radio Auroras" by Martin, GM6VXB; Oct 8, Junk Sale. Details 03465 82061.

BEDFORDSHIRE

SHEFFORD & DARS - 9, talk 'The Bletchley Park Trust'; 16, Mobile DF Hunt; 30, talk 'Trunked Mobile Radio' by Vince, G8NGZ; Oct 7, talk 'HF Noise Bridge' by Hugh, G0LVG. Details 0462 700618.

BERKSHIRE

NEWBURY & DARS - 22, talk 'Amateur Radio - an old man needing a kiss of life!' by G4JGS. Details 0635 863310.

READING & DARC - 9, Club Quiz; 23, Autumn Junk sale. Details 0734 476873.

BUCKINGHAMSHIRE

AYLESBURY VALE RS - 1, Visit to RAF Croughton (VHF/Satellite); 15, talk 'Foreign QSOs' by Liz, G0ETU; Oct 6, Surplus Equipment Auction. Details 0296 81097.

CAMBRIDGESHIRE

CAMBRIDGE & DARC - 3, Trophy Contest preparations; 10, Video evening; 17, talk 'Electron Microscope' by Dave, G8JKV; 24, talk 'The 10GHz Band' by Brian, G8DKK. Details 0763 243570.

CHESHIRE

CHESTER & DARS - 14, talk "Groping for DX" Antennas, ATUs and Matching by Dennis, G3EWZ; 21, Stories from the Log, Repeaters and Things by Ted, GW8HYI; 28, talk 'Computer/Windows 3.0/3.1 etc' by G4BDM & GW0PJX. A Morse Code training session will be held before each Club meeting. Details 051 608 3229.

NORTH CHESHIRE RC - 19, RAE course starting, leading to May 1994 exam. Registration at 8.00pm on Sunday 19 Sept. Details 061 485 5036.

STOCKPORT RS - 8, talk "Pulsars - Time Keepers of the Universe" by Ian, G0DMU; 22, Surplus equipment sale. Details 061 439 4952.

CUMBRIA

EDEN VALLEY RS - 30, Video Night-radio related by Paul, G4XTA. Meetings at the BBC Club, Penrith, odd months, at 7.30pm. Details 07683 52106.

DERBYSHIRE

BUXTON RA - 14, Amateur Radio Licence Discussion; 28, Talk by Clive, G4FZH; Oct 12, Home brew night. Details 0298 25506.

DERBY & DARS - 1, Junk Sale; 22, Demo of video Surveillance Equipment by G3XER.; Oct 6, Junk Sale.. Details 0773 856904.

DEVON

AXE VALE ARC - 3, Talk on the Construction of the "Yeovil" Tcvr by Tim, G3PCJ; Oct 1, AGM. Details 0297 33756.

APPLEDORE & DARC - 20, Bring & Buy Sale - Auctioneer G0KKG. Details 0237 477301.

EXETER ARS - 13, A visit (to be arranged); Oct 11, Annual General Meeting. Details 0392 214204.

SOUTH DEVON RC - 9, Aeronautical Video by G6ZRM; 22, Pre-Rally meeting. Details 0803 522995.

TORBAY ARS - 17, CQ WW SSB Video by Dudley, GW6ZUQ. Details 0803 526762.

DORSET

DORSET POLICE ARS - 2, Barbecue & evening on Air; 21, Introduction to constructional competition. Details 0202 229351.

SOUTH DORSET RS - 7, Talk and video 'RAYNET' by Chris, G8RXA; Oct 5, SDRS Technical Forum. Details 0305 773860.

EAST SUSSEX

CROWBOROUGH & DARS - 23, PDSL Software or Logging with computers. Details 0892 661807.

SOUTHDOWN ARS - 6, Talk "AMTOR and RTTY"; Oct 4, Equipment Sale. Details 0323 412699.

ESSEX

BRAINTREE & DARS - 20, talk 'Aspects of VHF/UHF/SHF operating' by Ela, G6HKM; Oct 4, Widgets 2. Details 0376 327431.

CHELMSFORD ARS - 7, Talk 'The Latest Propagation Information from Space' by Pat Gowen; Oct 5, AGM. Details 0245 260831.

LOUGHTON & DARS - 3, talk 'Morse (CW) Operation from Lancaster Bombers in WW2' by G4PSY; 17, Testing PCB boards by G8DZH. Details 081 566 3434.

VANGE ARS - 2, Junk Sale; 9, Rally Review; 16, Talk 'Weather Satellites' by Dennis, G1UBO; 23, Photography; 30, A talk by Robin, G3JWI. Details 0268 552606.

FIFE

DUNFERMLINE RS - 9, talk 'Radar' by Paul, GM7GUC; 16, HF evening with Class B Supervised operating; 23, VHF operating evening; HF operating evening; Oct 7, Annual General Meeting. Details 031 331 4340.

GRAMPIAN

MORAY FIRTH ARS - Meets every Thursday at 7.30pm. Details 0343 86395.

GREATER LONDON

ACTON, BRENTFORD & CHISWICK RC - 21, Discussion 'The Poor Man's Rig'. Details 081 749 9972.

BROMLEY & DARS - 21, talk 'Introduction to Electronics'; Oct 19, Junk Sale. Details 081 777 0420.

COULSDON ATS - 13, talk 'Test Equipment and its Applications' by G3OOU; Oct 11, talk 'Secret Listeners' by G8DIU. Details 081 684 0610.

CRAY VALLEY RS - 2, talk 'Military Radio (part 2)' by G7KOO; 16, talk 'Ballooning with Branson' by G4SOT; Oct 7, Surplus Sale. Details 081 850 1386.

CRYSTAL PALACE & DRC - 18, Illustrated talk 'The History of Crystal Palace' by Ian Bevan of the Crystal Palace Foundation. Details 081 699 5732.

EDGEWARE & DRS - 9, discussion "Setting up an Amateur Radio station" by Stephen, G0PQB; 23, Morse training evening. Details 081 204 1868.

KINGSTON & DARS - 15, talk 'Cross Modulation and Filters' by Peter, G3ZPB. Details 081 398 1128.

SOUTHGATE ARC - 9, talk & demonstration 'Amateur TV' by Dave, G4NJU; 23, SARC is hosting the 'Great Erg Race'; Oct 14, Junk Sale. Details 081 360 2453.

SURREY RCC - 6, Fibre Optics; Oct 4, Surplus Sale. Details 081 660 7517.

WIMBLEDON & DARS - 10, Surplus Equipment Sale; 24, Civil Aviation Safety Videos; Oct 8, Desert Island Radio. Details 081 397 0427.

GREATER MANCHESTER

ECCLES & DARS - 7, tecture 'JOTA and Radio Scouting' by G7ELA; Oct 5, discussion 'NARSA contribution to RSGB AGM'. Details 061 773 7899.

SOUTH MANCHESTER RC - 3, SSB Field Day Preparations; 10, talk 'Commercial Satellites for Amateurs' by G3ZDM; 17, talk 'Digital CQ Caller' by G4JLC; 24, Surplus Equipment Sale. Details 061 969 1964.

GWYNEDD

DRAGON ARC - 6, talk by Jeff, GW7OIX; Oct 4, Annual General Meeting. Details 0248 600963.

HAMPSHIRE

HORNDEAN & DARC - 2, talk 'RAYNET' by Dick, G0MNL; Oct 6, Annual General Meeting. Details 0705 472846.

ITCHEN VALLEY ARC - 10, Open meeting; 24, talk 'Digital Signal Processing' by Nigel Gerdes, Royal Corps of Signals. Details 0703 732997.

SONY BROADCAST ARTG - 27, talk "Training the Service Engineers for the 1990's" by Roger Stephens. Details 0256 483103 (24hr answerphone).

HEREFORD AND WORCESTER

BROMSGROVE ARS - 14, Technical topic; 28, RTTY night on the air; Oct 12, EMC problems! Details 0527 546075.

VALE OF EVESHAM RAC - 2, visit from "Castle Electronics". The BBC Club, High Street, Evesham at 8pm. Details 0386 41508.

HERTFORDSHIRE

CHESHUNT & DARC - 1, Video evening 'Chernobyl DXepedition'; 8, Members' Forum; 15, talk 'Movies with your PC' by Simon, G4EYR; 29, talk 'TV Waveforms and all about them' by Adrian, G0OJY. Details 0992 464795.

DACORUM AR&TS - 21, Talk by John, G3WGV. Details from D Boast, 8 Juniper Green, Warners End, Hemel Hempstead, HP1 2NQ.

HODDESDON RC - 2, Pre Field Day briefing; 16, Emergency First Aid by Nurse Jane Churchil; 30, talk 'The Training of a Guide Dog' by John, G8PPZ. Details 081 804 5643.

STEVENAGE & DARS - 7, DF hunt(within the boundry of Stevenage) Simon, G0EVZ as the fox; 14, Discussion, Help & advice where needed with projects, kits and conversions etc; 21, talk Tony's trip to Friedrichshafen 93 Rally; 28, Start the promotional/teaching video production. Details 0438 350882.

HUMBERSIDE

GOOLE R&ES - 3, 'On Air' hosted by Andy, G8ZCS; 10, Quiz night - host, G0SWL; 17, Annual General Meeting; Oct 8, Construction Competition. Details 0405 769130.

GRIMSBY ARS - 2, Visit to RRS James Clarkeross in Grimsby Dock; 16, talk by the Chairman; 30, talk 'Airband Radio' by George, G4EBK; Oct 14, AGM. Details 0472 825899.

NORTH FERRIBY ARS - 3, Members QSOs of interest; 10, talk 'DX pile-ups from the other end' by Tony, G4HYD; 17, night on the air; 24, visit of Jandek Ltd; Oct 1, The Way Ahead meeting. Details 0482 650410.

KENT

HILDERSTONE RS - Starting late September, Canterbury area, RAE course run by G3JIX for Examination in 1994. Details 0843 869812.

MEDWAY AR&TS - 10, Video evening (includes Local Shacks); 17, Novice evening by G3UXH; Oct 1, Junk Sale. Details 0634 710023.

SEVENOAKS & DARS - 20, talk 'RADAR' by Alistair, G7IET. Details The Secretary, S&DARS, c/o Sevenoaks District Council, Council Offices, Argyle Road, Sevenoaks, TN13 1HG.

SOUTH EAST KENT (YMCA) ARC - 1, Novice evening; 8, Television - Q & A by G7NOR; 22, Operating; 29, Novice trainees, start of new course. Details 0304 852030.

WEST KENT ARS - 3, Return after Summer break. Details G3OHV, QTHR.

LANCASHIRE

HESKETH ARC - 14, Autumn Open evening(open to the Public); 28, talk 'Air Traffic Control Systems'. Details 0704 63344.

NORTH SEFTON ARC - Club meets 2nd Wednesday of each month. Details 0704 579017.

ROCHDALE & DARS - 20, Construction Competition - Judgement day. Details 0706 32502 or 061 653 8316.

LEICESTERSHIRE

LOUGHBOROUGH & DARC - 7, talk 'The Other Man's Shack'; 14, Construction evening; 21, DF Hunt (last DF "walking" 2m); 28, talk 'Meteor Scatter' by G3KWY. Details 0509 218259.

MERSEYSIDE

LIVERPOOL & DARS - 7, Pitcairn DX video; 21, Pre-AGM; 28, Surplus Sale; Oct 5, Annual General Meeting. Details 051 722 1178.

WIRRAL & DARC - 8, Surplus equipment & junk Sale; 12, Double DF hunt, VHF & UHF with two foxes. 2pm Heswall lay-by; 22, Event "The Great Egg Race 4" - bring your tools; 29, Quiz night, venue Irby CC, Team members needed. Details 051 648 5892.

NORFOLK

THE ARC of FAKENHAM - 7, talk "How the RAFARS QSL Bureau Ooperates" by Ian, G0HAV; 11, Annual Dinner; Oct 5, Video '75 Glorious Years and the History of the Royal Air Force" by Paddy, G0MQU. Details 0485 528633.

NORFOLK ARC - 1, Final Briefing - Town & Country rally; 15, talk 'Refrigeration' by Chris, G4ILR; 29, talk 'Pre-Historic Elephant of West Runton' by Dr Tony Stewart; Oct 6, Construction competition. Details 0603 618810.

YARMOUTH RC - 19, The next Novice licence tuition course begins. Details 0493 721173.

NORTHAMPTONSHIRE

KETTERING & DARS - 14, talk 'Water Distribution and Radio Communications and Control' by Jim Morrison, Anglian Water. Details 0536 514544.

NOTTINGHAMSHIRE

ARC OF NOTTINGHAM - 9, talk by G6ABU; 16, Foxhunt No 6; 30, talk 'Monolithic Microwave Integrated Circuits' by Paul Beastall. Details 0602 501733.

SOUTH NOTTS ARC - 3, Discussion - Taking equipment to site; 10, talk 'SNARC Sponsored Courses available' by Trevor, G4IRH; 17, Construction. Details 0602 211069.

NORTH YORKSHIRE

HAMBLETON ARS - 16, RAE Course (new course commences).; 23, Talk "All about ATU's" by Brian, G3KJX. Details 0609 776608.

OXFORDSHIRE

OXFORD & DARS - 22, Demonstration of 'Computers and Amateur Radio' by Terry, G0CFN. Details 0865 863526.

POWYS

POWYS ARC - 2, Fox Hunt; 9, Test your rig, courtesy of Don, G3UQH; 23, Talk on security & property marking by Sgt Pope, Newtown Police Station; Oct 7, Fox Hunt. Details GW3JSW, QTHR.

SOMERSET

WEST SOMERSET ARC - 7, talk 'QRP Operations'. Details G4AJU, QTHR.

YEOVIL ARC - 2, talk Getting on the Air for "peanuts", G3ICO; 9, 2m DF event; 16, A PSU project by G3PCJ; 23, talk 'WW2 Clandestine Radio' by G3CQR; 30, Discussion. Details 0258 73845.

SOUTH GLAMORGAN

CARDIFF RSGB G - 13, talk 'Loudspeakers in General' by Bill, GW6MNC. Details 0446 773212.

SOUTH YORKSHIRE

SHEFFIELD ARC - 13, Construction evening; 20, Planning meeting for JOTA; 27, Presentation of this year's awards; Oct 4, Annual General Meeting. Details 0742 446282.

STRATHCLYDE

PAISLEY (YMCA) ARC - 1, Preperations for the SAR Convention; 15, TBC; 29, Debate "The Codeless Licence". Details 0505 335195.

SUFFOLK

FELIXSTOWE & DARS - 13, talk 'Amateur Test Equipment' by Alan, G3NYK. Detail 0394 273507.

IPSWICH RC - 8, talk 'Computers in Amateur Radio' by Jonathan, G0DVJ; 29, 21/28MHz Contest Planning session. Details 0473 742072.

LEISTON ARC - 7, talk by Andy, G8AXO; Oct 5, talk 'The Use of Computers in Amateur Radio' by Paul, G4YQC. Details 0986 874800.

SURREY

THREE COUNTIES ARC - 1, Club Junk Sale; 15, talk on heraldry and coats of Arms; 29, talk - technical(details tba). Details 0428 642930.

TAYSIDE

DUNDEE ARC - 7, Enrolment for new session; 14, talk by members of MEGS (Morse Enthusiasts Group Scotland); 21, Construction evening; 28, Annual General Meeting. Details GM4FSB, QTHR.

WARWICKSHIRE

STRATFORD UPON AVON & DARS - 13, Opening Evening; 27, An evening with David Marcuse, son of Gerald, founder of Empire Broadcasting. Details 0608 682495.

WEST GLAMORGAN

SWANSEA ARS - 2, Final preparations for HF SSB Field Day. Details 0792 403527.

WEST MIDLANDS

MIDLAND ARS - Club meets every Wednesday evening for RAE and Morse classes, and on Thursday for other activities. For details on other activities tel: 021 628 7632

SOUTH BIRMINGHAM RS - 1, VHF Rig checks. Bring your rig to test and align! 8pm, Hampstead House, Visitors welcome. Details 021 474 3784.

STOURBRIDGE & DARS - 20, talk 'Transformers' by Bob, G4VPE. Details 0384 374354.

WORDSLEY RC - 9, Fox Hunt, starts at Club QTH at 7.30pm; 23, Practical "On Air". Details 0384 834109.

WEST SUSSEX

HORSHAM ARC - 2, talk 'The Night Sky' by Ron, G3PYC; Oct 7, Surplus equipment sale. Details 0737 842150.

WEST YORKSHIRE

DENBY DALE & DARS - 1, Silent Key Sale; 8, Fox Hunt; 15, talk 'Sporadic E' by Ron, G3OTS. Details 0484 532371.

EXCHANGE

ALL THE EXCITEMENT YOU CAN HANDLE.

LIVE '93, The Consumer Electronics Show, is going to be the most electrifying hands-on event ever staged in the UK.

Get to grips with videos and camcorders that think for themselves, televisions that have to be seen to be believed, computers that are so simple even grown ups can use them, the very latest in video games, systems and musical instruments, as well as the world's most exciting hi-fi.

Then there are the features - Dolby's Home Cinema, the amazing BT Time Tunnel, live TV and radio broadcasts, celebrity appearances, live music on stage, worldwide satellite links, the car stereo and security concourse, Premier League football stars... The list of attractions is endless. But the number of tickets isn't. Prices are £7.00 for a full day or £5.00 after 4.00pm. To get your hands on a ticket, call **071-373 8141** now.

LIVE '93

GET YOUR FINGER ON THE PULSE

HALIFAX & DARS - 21, Annual General Meeting. Details 0422 202306.

KEIGHLEY ARS - 2, Packet on the Air; 9, Fox Hunt; 16, Quiz v Northern Heights; 30, "More Packet" by G3TQA. Details 0274 496222.

SPEN VALLEY ARS - 2, talk 'Aerials etc' by Ian, G6LD; 16, 'ATV on 10GHz' - Live Demo by G4XKC & G8HUA; Oct 7, Surplus Sale. Details 0532 534437.

WILTSHIRE

SALISBURY R&ES - Meets 7.30pm Tuesdays at Grosvenor House Centre, Churchfields Road. Tuition all aspects Amateur Radio. Details 0722 329481.

TROWBRIDGE & DARC - 1, talk 'Raynet' by G4TIX; 15, Social. Details 0225 864698 (evenings).

RALLIES AND EVENTS

This is a list of all rallies, hamfests, exhibitions and conventions notified to HQ (as at press date). Items are given in detail for the next three months inclusive and in brief thereafter. Please send detailed information, including contact callsign and telephone numbers direct to HQ and marked 'Rally News - DIARY'.

4 SEPTEMBER

SALTASH & DARC - A "Field Day" Rally at Trebrown Farm, Horningtops, near Menheniot, Cornwall on the A38. Bring and buy stall for a wide range of items including radio gear. Club station, callsigns G4GXK and G8SAL will be operational from 9am to 9pm and all contacts most welcomed, also personal callers. Talk in on S22 is planned. Refreshments available and a barbecue in the evening. Details 0752 844321

5 SEPTEMBER

BRISTOL Radio Rally (incorporating Bristol Computer & Electronics Fayre) - Brunel Centre, Temple Meads Station, Bristol. Doors open 10.30am, 10.15 for disabled visitors. Forty plus trade stands, large bring & buy, under £25 bring & buy, refreshments. Ample under cover parking. Talk-in on S22. Details G4YZR 0275 834282.

MILTON KEYNES & DARS 7th Annual Radio Boot Sale - Cranfield Airfield, Cranfield, Beds. Off jun 13 or 14 M1. Details Ray, G1LRU, 0908 660798.

TELFORD AR Rally - Telford Exhibition Centre, Telford. Doors open 10.30am. Trade stands, flea market, bring & sel. Talk in S22 and GB3TF RB8. Any disabled person(s) needing parking help, please phone in advance. Details from G7BWQ tel: 0952 770922/ 0836 739903 or G4LSA tel: 0785 284388.

VANGE ARS Annual Rally - Laindon Community Centre. Corner of Laindon High Road and Aston Road. A short walk from Laindon Railway Station on the Fenchurch St/Shoeburyness line. Doors open 10.30am Admission 75p. Many traders, bring & buy, refreshments, free raffle. Talk-in on S22. Approach roads signposted. Details Mike, G4NVT, 0268 543025.

11 SEPTEMBER

BALLYMENA AR Rally - Ballee High Community School. Doors open 12 noon. Usual trade stands, RSGB Bookstall and QSL Bureau, large bring & buy stall. Refreshments. Details GI4HCN, QTHR.

SCOTTISH AR Convention (SARC93) - Cardonal College, 690 Mosspark Drive, Glasgow. Doors open 11.00, 10.30 disabled. Over 180 tables for traders and special interest groups, RSGB Bookstall and officials in attendance and a large bring & buy stall. An RSGB Open Forum hosted by RSGB President-Elect Ian Suart, GM4AUP and General Manager Peter Kirby. Other open Forums on Digital Communications and Repeaters. Two lecture theatres with full programme of talks. Morse Test - no advance booking, just arrive with 2 passport photographs. Talk in on S22. Details Tom, GM3EDZ, 041 882 5753.

12 SEPTEMBER

BARTG Rally - Sandown Exhibition Centre, Esher, Surrey. 10 min from M25, jn 10 and not far from M3, M4 and M40. Doors open 10.30am. Over 250 tables, exhibitors, special interest groups. See latest in radios, computers, computer peripherials, s/w, books, kits, test equipment, a bring and buy plus much more. On-site catering, hot and cold meals, snacks, beverages and bar. Details Peter Nicol, 38 Mitten Avenue, Rubery, Rednal, Birmingham B45 0JB, 021 453 2676.

LINCOLN SWC Hamfest - Lincolnshire Showground and Exhibition Centre. Four miles North of Lincoln on the A15, Lincoln/Scunthorpe road. Doors open 10.30am. All the usual trade stands, large bring & buy stall. Morse tests on demand (2 photographs required of candidate plus fee). Refreshments available. Lots of attractions for the whole family. Caravans welcome by arrangement. Talk in on S22. Details from Denis, G1XZG, 0522 684214.

16-20 SEPTEMBER

LIVE '93 - Consumer Electronics Show at Olympia. See page 88 for details, and this month's News and Reports pages for how to get free tickets.

18 SEPTEMBER

ISLE OF WIGHT - Annual Wight Rally, National CEM Wireless Museum, Arreton Manor, Nr Newport, IOW. Trade stands and a bring & buy stall. Free entry to visitors. Refreshments available. Talk in on S22 by G3IOW and GB3WM. Covered accommodation if wet. Details G3KPO 0983 567665.

19 SEPTEMBER

PETERBOROUGH R&ES - East of England Rally. East of England Showground, Peterborough. Access from A1, A47 and A605. Doors open 10.30am, 10.00am disabled visitors. Dealer access from 7.30am. Modern hall and large marquee. Traders, large carboot and flea market area. Bring and buy stand. Additional on-site attractions. Full catering + bar. Talk-in on S22. Entrance £1. Free car parking. Details from Mike, G0CVZ 0733 222588.

26 SEPTEMBER

HARLOW AMATEUR RADIO RALLY & COMPUTER SHOW - Harlow Town Sports Centre, off Fifth Avenue, Harlow. Easy access off M11 Jn 7 and A414. Doors open at 10.30am Disabled parking and lifts available. Varied selection of traders, both new and old to the event, massive bring and buy stands. Catering and bar within the Sports complex. Talk-in on S22 and SU22 by G6UT. Details from Mike, G7BNF 0850 487863.

THE THREE COUNTIES Rally - The Three Counties Show Ground, Malvern, Worcestershire. ***NEW EVENT***. Open 11.00am, 10.30 for disabled. Trade stalls, bring & buy stand, book stall, radio & computer accessories. Refreshments available. Admission £1. Details G4PQZ Tel: 0905 773181.

9th NORTH WAKEFIELD RC Rally - The Outwood Grange School, Outwood, Wakefield. Venue is 1 mile from the M1 & M62. Doors open 11.00am. Electronic and computer dealers, repeater groups and novice stand also a bring & buy stall. Talk in on S22 with club callsign G4NOK. Details from John, G4RCG, 0924 362144 or John, G0EVT 0924 825443.

3 OCTOBER

GREAT LUMLEY Radio Rally - Great Lumley, near Chester-le-Street, Co Durham. Doors open 11.00am, 10.30 for disabled. Many varied trade stands, bring & buy, Refreshments. Entrance fee £1 incl a program, children under 14 accompanied by an adult free. Details 091 388 5936.

BLACKWOOD & DARS Rally - Oakdale Community College, Blackwood, Gwent. Doors open 10.30am. Traders, bring & buy, Raffles. Talk-in on S22. Details Norman, GW0MAW, 0495 227550.

WINCANTON RALLY - Wincanton Racecourse, Somerset. Doors open 10.00am. Trade stands (under cover), car boot, refreshments, ample free parking. Talk-in on S22. Details Norman, G4YXX 0749 850432.

8/10 OCTOBER

RSGB International HF Convention: The Beaumont Conference Centre, Old Windsor, Berks. Talks, latest amateur radio software, ladies' programme; Young Amateur of the Year award; invited traders and Special Groups; overseas visitors' reception. Send SAE to: HF Committee, PO Box 599, Hemel Hempstead, Herts HP3 0SR. Details G4BWP, 0638 552080. See also page 12 this month.

9/10 OCTOBER

The ALL IRELAND INTERNATIONAL Radio & Hobbies Exhibition - First Major exhibition of its kind to be held in Ireland, and is hosted jointly by Dundalk Amateur Radio Society and the Armagh & Dungannon District Amateur Radio Club. Trade stands, many from the UK mainland, amateur TV, radio, computers and much more. The Presidents of the IRTS and the RSGB will attend. Features many side shows and entertainments to cater for all tastes. Details GI8RLE on 0762 870423.

10 OCTOBER

KIDDERMINSTER & DARS - ***NEW DATE, NEW VENUE***: Stourport on Severn High School. Usual traders, bring & buy, flea market. Refreshments. Talk-in on S22. Details: Malcom, G8JTL 0384 894019 or Jeff, G0RJP 0299 822206.

SOUTH DEVON RC Computercations 93, Amateur Radio & Computer Rally - Hillhead Campsite, Kingswear Road, Brixham, Devon. Doors open 10.00am. Trade stands radio & computer, bring & buy, raffle, refreshments. Talk-in on S22. Details Bill, G6ZRM on 0803 522216.

16/17 OCTOBER

36th JAMBOREE ON THE AIR. Details from Activities Office, The Scout Association, Gilwell Park, Chingford, London E4 7QW. Tel: 081 524 5246. Participants are asked to complete a registration form so that they can be sent the full information available.

17 OCTOBER

HORNSEA (East Yorkshire) RC Rally - Floral Hall, Hornsea. Doors open 11.00am. Traders, radio clubs, bring & buy, Slow Scan TV. Good parking. Talk-in on S22. Bring the family and have a day at the seaside as well. Details Duncan, G3TLI tel: 0964 532588.

29/30 OCTOBER(FRI/SAT)

LEICESTER Amateur Radio Show - Granby Halls, Leicester. Usual trade stands, bring & buy, RSGB books. Details Frank, G4PDZ 0533 871086.

6/7 NOVEMBER

7th NORTH WALES Radio & Electronics Show - Aberconwy Conference and Exhibition Centre. Entrance £1 adults, under 14 free. Details GW7EXH, 0745 591704.

7 NOVEMBER

BISHOP AUCKLAND Radio Amateur Clubs Rally. ***NEW DATE***. Originally scheduled for Sunday 31 October. Details Mike, G0PRQ on 0388 766264.

DONEGAL TIR CONAILL ARS Annual Radio Rally - Jacksons Hotel, Ballybofey, Co Donegal. Details Ken, EI4DW, QTHR or Tel: (from UK) 010 353 74 31109 or 074 31109.

13th NORTH DEVON Rally - Holsworthy Memorial Hall. Doors open 10.30am. Bring & buy stand etc. Details G8MXI, QTHR.

TYNE & WEAR REPEATER GROUP AUCTION - Fence Houses & District Community Centre, Fencehouse, Nr Chester-le-Street, Co Durham. Doors open at 10.30am for booking goods in. Auction starts at 12.00 noon. Details Brian, G8FBQ, QTHR or Tel: 091 388 2913.

14 NOVEMBER

BARNSLEY & DARC AR Rally. Details Ernie, G4LUE, 0226 716339 (6pm-8pm please).

BRIDGEND DARC Amateur Radio Rally - Bridgend Recreation Centre, Bridgend, Mid Glam. Details Mike, GW7NIS, 0656 722199 or GW3RVG on 0656 860434.

MARS/STOCKLAND Radio Rally. Details Norman, G8BHE 021 422 9787.

21 NOVEMBER

WEST MANCHESTER RC "Winter Rally" - Bolton Sports & Exhibition Centre, Silverwell Street, Bolton (town centre). Doors open 11.00am, 10.30 for disabled visitors. All the usual trade stands, societies, bring and buy, etc. Refreshments/ meals available. Admission £1, children free. Details Dave, G1IOO on 0204 24104 (evenings only).

4 DECEMBER

RSGB ANNUAL GENERAL MEETING, Manchester Conference Centre, UMIST, Manchester.

5 DECEMBER

LEEDS & DARS (Pudsey Rally). ***CHANGE OF VENUE***: now Allerton High School, Kings Lane, Leeds 17. Details 0532 552344 or FAX 0532 393856.

12 DECEMBER

CENTRE OF ENGLAND CHRISTMAS Radio, Satellite Computer & Electronics Rally - ***NEW VENUE***. Details tel: 0952 598173

23 JANUARY 1994

OLDHAM ARC Radio Rally - Details 061 652 8617 home or 061 633 0550 work.

6 FEBRUARY

SOUTH ESSEX ARS Radio Rally - Details G0BBN, 0268 755350.

13 FEBRUARY

CAMBRIDGE & DARC Radio and Computer Rally. Details 0954 719273.

20 FEBRUARY

TRAFFORD Rally at G-MEX - Details 061 748 9804.

20 MARCH

NORBRECK AR Electronics & Computing Exhibition - Details G6CGF on 051 630 5790.

GB CALLS

The list below shows all special event stations licensed for operation during this month and up to 30 September. It was taken from the HQ computer on 6 August. These callsigns are valid for use from the date given but the period of operation may vary from 1-28 days.

SEPT 1

GB0AGC	Armagh Golf Club Centenary
GB2CDA	Cumberland Deaf Association
GB2GMM	Guglielmo Marconi Memorial

SEPT 2

GB200NLP	200th Anniversary of Newcastle Literary & Philosophical Library

SEPT 3

GB1NAR	National Ambulance Rally
GB4OS	Orsett Show
GB5GT	Grass Track

SEPT 4

GB0DOG	Guide Dogs for the Blind
GB2WMF	Winscombe Michaelmas Fair

SEPT 5

GB0NOV	GB Novices, Telford
GB2AMN	Air Museum Newark

SEPT 6

GB0CCA	Chesham Community Centre
GB0WHC	Whitehill Centre, Chesham, Bucks

SEPT 8

GB2SJA	St John Ambulance
GB8CC	Coastal Command

SEPT 10

GB2RAY	Raynet
GB2GAF	Gloucester Air Force

SEPT 11

GB0RAF	Royal Air Force, Lincoln
GB2CDA	Cumberland Deaf Association

SEPT 16

GB0CES	Live '93
GB4RED	Royal Eltham District

SEPT 17

GB0WFB	Wireless for the Blind
GB75RAF	75 Years Royal Air Force

SEPT 18

GB0CDT	Coastal Defence 'T'
GB0MOG	Manchester Olympic Games
GB0NTW	National Trust Wrexham
GB2MOG	Manchester Olympic Games
GB2NTE	National Trust for England
GB4MOG	Manchester Olympic Games
GB8MO	Manchester Olympics

SEPT 21

GB2HCD	Hoddesdon Carnival Day

SEPT 22

GB2RCC	Radio Caravan Club
GB2VK	Marconi - GB to VK Contact

SEPT 24

GB0APD	Action Plus Day, Herts

SEPT 25

GB2GPC	Guinea Pig Club
GB2IRC	Ipswich Radio Club
GB2NWR	North Wakefield Rally

SILENT KEYS

WE HAVE BEEN advised of the deaths of the following radio amateurs:

G0AEH	Mr A E Hill	
G0IGV	Mr C E Willcock	07.07.93
G0NVH	Mr R J MacKenzie	19.05.93
G1VVW	Mr F M Bell	
G2DM	Mr A S Binks	
G2FCV	Mr G Leigh	01.01.93
G3BHS	Mr F A Russell	10.06.93
G3ECR	Mr L Harrington	05.07.93
G3FZG	Mr A Treanor	25.06.93
G3GBF	Mr S Oake	
G3GFU	Mr W H Otley	27.06.93
G3KMR	Mr T Heslop	27.05.93
G3MBQ	Mr S J Scarbrough	18.05.93
G3YFQ	Mr A E Chivers	
G4EYS	Mr W H Fielding	21.06.93
G4FWL	Mr B A C Bastable	18.07.93
G4NBB	Mr B Hodgson	24.06.93
G4PLO	Mr C R Baigent	Jan 93
G4UYO	Capt E R Rose	02.06.93
G4WEB	Mr E Webb	03.10.92
G4ZGK	Mr F Smith	
G6CAK	Mr J J Allen	
G7JDJ	Mr F Webster	10.02.93
G8BIY	Mr T J H Hancox	16.07.93
GD2HDZ	Mr A E Breese	
GI8OLV	Mr J O'Kane	
GM0OFG	Mr D G Gittings	17.07.93
GW3RIL	Mr M L Lewis	14.05.93
GW4KRP	Mr I Williams	17.06.93
RS17426	Mr T Brown	22.05.93
RS50113	Mr D R J Goodwin	

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RSGB – at Your Service

SOME OF THE RSGB'S TEAM OF VOLUNTEER EXPERTS — AVAILABLE TO HELP YOU

Council, Committees and Honorary Officers

The Society has a large number of volunteer experts available to help and advise members on a wide variety of subjects. Each month we will be focussing on a different section of the volunteer workforce, whilst still giving brief details of the main office-holders. See also the Information Directory section of the *RSGB Call Book*.

• RSGB Policy Matters (Zonal Council member):-

Zone A (North of England):

Peter Sheppard, G4EJP, 89 St Catherines Drive, Leconfield, Beverley, North Humberside HU17 7NY. Tel: 0964 550397.

Zone B (Midlands):

John Allen, G3DOT, 4 Philip Avenue, Waltham, South Humberside, DN37 0QD. Tel: 0472 825899.

Zone C (SE England and East Anglia):

Neil Lasher, G6HIU, 8 Highwood Drive, Mill Hill, London NW7 3LY.

Zone D (SW England):

Julian Gannaway, G3YGF, Dean Hill Barn, East Dean, Salisbury, Wiltshire SP5 1HJ. Tel: 0794 40008.

Zone E (Wales):

Clive N Trotman, GW4YKL, 19 Park View, Dolau, Llanharen, Pontyclun, Mid Glamorgan. CF7 9RZ. Tel: 0443 226198.

Zone F (Northern Ireland):

Ian Kyle, GI8AYZ, 1 Portulla Drive, Pond Park Road, Lisburn, Co Antrim BT28 3JS. Tel: 0846 665034.

Zone G (Scotland):

Ian Suart, GM4AUP, 37 Meldrum Mains, Glenmavis, Airdrie, Lanarkshire, ML6 0QG. Tel: 0236 765937.

• For general advice and details on local clubs, or if you don't know who to contact:-

Your RSGB Liaison Officer. See the *RSGB Call Book*, your membership card or *RadCom*, May/June 93.

• Antenna Planning:

Need for permission and how to apply – booklet free to members from the Amateur Radio Dept at RSGB HQ.

Planning application refused – RSGB Planning Panel, via RSGB HQ.

Planning Advisory Committee Chairman: Geoff Bond, G4GJB, QTHR.

• Awards:

For contest awards, refer to the appropriate contest committee.

For other awards, enquiries and applications go to either:

HF Awards Manager – Bill Ricalton, G4ADD, QTHR.

IOTA (Islands on the Air) Awards Manager – Roger Balister, G3KMA, QTHR.

VHF (and Microwave) Awards Manager – Ian L Cornes, G4OUT, QTHR.

• Band Plans and operating practices:

See the *RSGB Call Book* or March 93 *RadCom* for latest bandplans. For policy, contact the appropriate spectrum manager or committee chairman:

HF Manager – Martin Atherton, G3ZAY, 41 Enniskillen Road, Cambridge CB4 1SQ.

HF Committee Chairman – David Evans, G3OUF, PO Box 599, Hemel Hempstead, Herts HP3 0SR.

VHF Manager – Dave Butler, G4ASR, Yew tree Cottage, Lower Maescoed, Hereford HR2 0HP.

VHF Committee Chairman – Peter Burden, G3UBX, 2 Links Rd, Penn, Wolverhampton, WV4 5RF.

Microwave Manager – Mike Dixon, G3PFR, Woodstock, Gaze Bank, Norley, Warrington, WA6 8LL.

Microwave Committee Chairman – Steve Davies, G4KNZ, 14 Herondale, Birch Hill, Bracknell, Berkshire RG12 7ZT.

• RSGB Contests:

First contact the contest adjudicator (see the contest rules). For policy, contact the respective Committee Chairman:

HF Contest Committee – Chris Burbanks, G3SJJ.

VHF Contest Committee – Bryn Llewellyn, G4DEZ, QTHR.

ARDF (direction finding) Committee – Brian Bristow, G4KBB, QTHR.

• EMC:

Advice on solving breakthrough and other electromagnetic compatibility matters:

Committee Chairman: Robin Page Jones, G3JWI, QTHR.

• Emergency Communications:

Emergency Communications Officer – Post Vacant.

• Exhibition & Rally Committee:

Chairman: Norman Miller, G3MVV, Tel: 0277 225563, QTHR.

• Intruder Watch (IARUMS):

Non-Amateur Service operation in exclusive amateur radio bands.

Co-ordinator – Chris Cummings, G4BOH, QTHR.

• IEE:

Liaison Officer – Prof Peter Saul, G8EUX, QTHR.

• Licensing:

Licensing Advisory Committee Chairman (RSGB Policy) – John Bazley, G3HCT, 'Brooklands', Ullenhall, Nr Henley in Arden, Warwickshire, B95 5NW.

Renewals – Subscription Services Limited, PO Box 885, Bristol BS2 8RH.

• New Licence Applications:

Subscription Services Ltd, PO Box 884, Bristol BS2 8RH. SSL Help Desk – 0272 258333.

• Membership Liaison:

Membership Liaison Committee Chairman – Clive Trotman, GW4YKL (see Zone E above).

• Morse:

GB2CW Co-ordinator – David Pratt, G4DMP, QTHR.

Chief Morse Examiner – Roy Clayton, G4SSH.

• Novice Licence/ Project YEAR:

Hilary Claytonsmith, G4JKS, 115 Marshalswick Lane, St Albans, Herts, AL1 4UU. Tel: 0727 859318.

N.B. For details of training courses and examinations, write direct to RSGB HQ, quoting your postcode.

• Packet Radio:

Datacomms Committee Chairman – Tom Lilley, G1YAA, QTHR.

• President:

Peter Chadwick, G3RZP, 'Three Oaks', Braydon, Swindon, Wilts, SN5 0AD.

• Propagation:

Propagation Studies Committee Chairman – Charlie Newton, G2FKZ, QTHR.

• QSL Bureau:

Outgoing cards – PO Box 1773, Potters Bar, Herts, EN6 3EP

Incoming cards – your QSL submanager (see *RSGB Call Book*).

• Repeaters:

Repeater Management Group Chairman – Geoff Dover, G4AFJ, QTHR.

• Spectrum abuse:

Amateur Radio Observation Service Co-ordinator – Geoff Griffiths, G3STG, QTHR.

• Technical queries:

Technical and Publications Committee Chairman: Dick Biddulph, G8DPS, QTHR.

• Trophies:

Trophies Manager – Bob Harrison, G4UJS, QTHR.

The LAST WORD

CASTING THE NET

I wonder why *RadCom* does not publish times and frequencies of Club Nets? May I suggest that such information is essential to beginners to our hobby and could be included in the *Club News* section.

I have been a member of the Echelford Radio Club for many years, having first heard their Top Band Net by chance one Sunday morning. After going along to one of their meetings, I joined - and have attended most meetings since.

Steven Wilkins G0NIF

*[*RadCom *deals with club information which is changing, eg lectures, changes of secretary etc. Basic unchanged information appears in the* RSGB Call Book, *the Editor of which tells me that he is always happy to include net details sent to him. He regrets, however, that the deadline for the next edition has just passed - Ed]*

COBWEBB AND THE SPIDERS

Thank you to your two contributors ('Two views of the SWR Cobwebb', *Radcom*, June) whose views I can corroborate.

I suffer from a restrictive covenants on outside aerials of any sort (an increasing trend in areas near TV transmitters). The CobWebb has been one answer to this for me and operated satisfactorily in my loft only three feet away from FM and TV reception aerials also in the loft, without breakthrough!

Its size is such that it should fit in most lofts and can be taken up in bits and pieces and assembled sitting by the sizzling cisterns and the spiders!

Assembled, it's also a one-hand-lift even with gout in the wrist! I easily tuned mine for phone-only by altering the ties according to G3TPW's formula.

Colin Sumner G0POS

ROUND THE BEND

I had to smile when I read P B Etchells', GD0TFY, story 'Gone Dotty' (*The Last Word*, July). Training as Aircrew Wireless Operator/AG I first attended the No 4 Radio School, Madley, Hereford, then to be moved to No 2 Radio School, Yatesbury, Swindon (both now defunct).

The standard of tuition was first-class and amongst the instructors was one ex-liner 'Empress of Britain' operator. He used to arm himself with a chair spindle, instructing us to loosen the wrist with the chant 'da da dit dit dit' over and over again, when finally, with staring eyes (all an act) he would declare "You think I'm bloody mad don't you?" As 18-year-olds we began to believe him a little. But he got us through the 10WPM barrier (mentioned in the same issue of *RadCom* by Gerald Batty, G0THB). We were required to pass out 20WPM code and 18WPM plain language, if I remember correctly.

At present I await the results of my attempt last May to pass the RAE for my Class A licence, not having availed myself of a licence upon demob. I can well imagine anyone not having a flair for Morse possibly being overcome GD0TFY recalls. Then maybe, many a would-be op could be last seen 'galloping along the frequency range, disappearing around the anode bend'.

F Langley RS94812

LOCATION ONLY

I think it is now time that something else was said about the use of "Station located in . . . ." in the *RSGB Call Book*. I know it has been said before, but it could lead to easy use of a callsign for pirate use, and also defeat the object of the book. This I found for myself when trying to reply to a station on hearing a request for reports, for when I looked in my 1993 *Call Book* I found: "Station located in . . .". It makes a mockery of the *Call Book*.

I know many listed amateur stations feel as I do that if this continues and increases the book will die, for its usefulness will die. Although there are other useful things in it these days its main QTHR use will be gone for ever.

John Lugg BRS31350

[Whether a station wishes his address to be published in the RSGB Call Book *is entirely his choice. He needs only to inform the licence agency Subscription Services Ltd of that choice and the subsequent* Call Book *edition will automatically reflect this. A couple of year ago, the Society, being unhappy with the old "Particulars withheld" tag, obtained permission to publish the minimum Postal Area information instead which we believe is an improvement - Ed]*

VHF PACKET'S EFFICIENT

An important aspect about the allocation of VHF/UHF packet radio frequencies has still been overlooked, and it impinges on aspects discussed in a different context in these pages some time ago. 'Use it or Lose it' has been a heartfelt cry from many VHF/UHF users over the years and, while I am not advocating squeezing other modes unnecessarily, packet radio provides the perfect response to this cry. Let us look at the figures.

The packet channel bandwidth is currently 25kHz, although many users in the Kent and Essex Area are moving towards 12.5kHz. Suppose SSB stations can work comfortably within 5kHz of each other. Consequently, 5 SSB QSOs (8 at best) occupy the same bandwidth as one packet channel. I have made measurements of the number of packet contacts on 144.675MHz over a five minute period at different times during the day. The number has varied from 7 to 15 and, of course, the channel is in use 24 hours a day. There is little doubt, I think, that packet radio uses its VHF/UHF frequencies much more efficiently than *any* other mode. How often do you find five SSB contacts per 25kHz? Only during contests!

I believe that those wishing to restrict the growth of packet are those who have never used the mode. I admit to having been prejudiced against packet for many years but, like all inquisitive amateurs, I decided to find out more about it and try it for myself. I am now more than happy to defend it! There may be particular problems on HF, but on VHF/UHF it provides the most efficient use of spectrum space of any mode.

Dr G Brown G1VCY

SHAPE FACTOR

I have followed with interest the recent correspondence by G6CBP and G3NXC (*The Last Word*, July and August) concerning the relative merits of rectangular and zigzag symbols for resistances in schematic diagrams, and would like to offer the following comments.

Contrary to G3NXC's contention, the 'rectangular' resistor appears to be of continental origin, although in fairness it long pre-dates the EC. I have here numerous schematics of military radio equipment manufactured in Hitler's Germany prior to and during WW2; the pre-war diagrams mostly contain the zigzag symbol (actually, these more closely resemble sections of square waveforms!), whilst by 1941 the box symbol had been adopted - by order of the Fuhrer, perhaps. The schematic of the legendary 'Koln' receiver which appeared in 1942 contained over a hundred of these little boxes, and the symbol remained in use in both East and West Germany throughout the 50s, 60s and 70s until its inevitable adoption by other EC member states.

Neil Clyne G8LIU

Please note that the views expressed in *The Last Word* are not necessarily those of the RSGB. We reserve the right to edit letters for publication. All letters are acknowledged and may be passed to the relevant department or committee.

ACTING UNPAID

Our world-wide hobby of amateur radio exists in its present form because of support from volunteers. From the lowliest level to the governing of national societies, these unpaid and often unsung workers toil away to enable all of us to enjoy our own particular aspect of the hobby. I think it is time to remind ourselves of some of these voluntary efforts.

Many amateurs belong to their local radio club - it doesn't run itself! Lots of effort has to go into making a club work successfully. Who makes the tea? It's often an XYL who devotes an evening to this. Is it an important contribution? Yes, I think so. Who makes sure the hall rent is paid so the club doesn't find itself evicted? Who spends hours on the phone or writing letters to make sure the club has an interesting lecture programme, and who spends more hours deciphering contest logs after yet more volunteers have spent part of their weekend setting up the contest station? In a club it isn't, or shouldn't be, just the efforts of the committee that keep things rolling along.

Driving home from work, do you put out a call through the local repeater? If so, spare a thought not just for the people who built and maintain it, but also for those who spent months planning the original application and for those who sit on committees coordinating nationally and negotiating with their national controlling body. And what about the television repeaters?

The national and international beacon service requires planning and many hours to be spent on building, repairs and monitoring to uphold the excellent service we have. Many beacons are in third world countries where this places real strains on local amateurs. Those in the UK are often on remote sites that give severe problems to their keepers when things go wrong. Not only are beacons of little use to local amateurs but can often be a nuisance by wiping out parts of the spectrum, still their keepers devote hours to their operation. Do we complain when our favourite repeater/beacon goes down? We do, I'm afraid!

A more recent facet of our hobby is the growth of packet mailboxes and the nodes and gateways that support the world-wide forwarding network. Although some of these are run by clubs and groups, most are privately run and financed and need regular daily attention to keep them working efficiently. Also coordination is vital here as well, and groups operate all over the world to see that this is done.

I bet that you have been to a rally this year? Although there is a commercial aspect to many rallies, unpaid help is usually essential, from car parking to running the bring & buy. Many smaller rallies are club events that subsidise other radio activities.

Do you have a Class A licence? Did you attend a Morse class? Even if you did your own thing, it's a volunteer examiner these days who conducts your test. In many areas it is voluntary effort responsible for running RAE and novice classes, and that's quite a commitment.

It's quite possible to enjoy our hobby by operating from home without any personal contact with other amateurs, indeed, many people do. So, why are there volunteers? The amateur population is probably quite a fair cross-section of society as a whole. Some will volunteer because they like the personal kudos and the praise of their peers in return for their efforts. Providing that they are doing a good job, that's something I can live with. Others just like to be helpful and enjoy the social contacts, and yet others find that unless they do the job themselves, their particular aspect of the hobby can't be pursued. There are obvious problems when volunteers are *not* doing the job they are supposed to do. If they hold an elected position then, when their term ends, don't re-elect them. That pre-supposes you can find someone else to do the job! If the post they hold is not an elected one, then you may have some problems, but tactful treatment by a friend or colleague or redirection to an area where their talents lie, will often succeed.

I don't hold the view that volunteers should never be criticised for their efforts. If you stick your head above the parapet, someone is going to shoot at it! What does upset me sometimes is to hear carping, negative criticism. Be positive! If you think you know best, then say so, but please do it in a constructive way. Offer help and advice or a friendly word - that will achieve much more. A word or note of thanks to your QSL manager, council member, or club chairman is rarely received and because of that, will be most welcome and offer some encouragement to them to continue working on your behalf.

Roger Frisby G4OAA
Hon Sec Cheshunt & District ARC

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ADVERTISERS INDEX

NEXT COPY DATE

The display advertisement copy date for our November 1993 issue will be **10th September 1993**

HANDHELD HEAVEN

IC-P2E/P2ET

The picture below shows the IC-P2E 144MHz FM transceiver, typical of ICOM's new wave of handhelds, the IC-P2ET has extended functions and is keypad operated. Both of these compact radios have AI (Artificial Intelligence) a unique feature that allows instant access to previous functions. The IC-P2E and P2ET will evaluate your operating capability and memorize the order of functions used Other features include; 100 memory channels, programmable call channel, ergonomic design, system clock with timer and lots more.

IC-P4E/P4ET

The IC-P4E and P4ET (pictured) are 430MHz FM transceivers visually similar to the IC-P2E range.

Features include: compact and ergonomic design, 100 memory channels, 5 watt power output with 13.8VDC. cartridge-type battery pack, full programmed and memory scan features, a variety of tuning steps, simple 1750Hz tone call, auto power-save and frequency lock function. The durable splash-resistant body measures 49W x 105H x 38D mm. and weighs a mere 280g. We think you will agree that these compact handhelds will prove to be winners.

IC-2iE/4iE

These two new, ultra-slim and rugged handhelds have got to be the smallest transceivers around. Even including battery pack these radios will fit snugly into your shirt/jeans pocket or handbag. The IC-2iE operates on 144 - 146MHz FM and the IC-4iE on 430 - 440MHz UHF FM bands. Both of these radios feature: maximum 5 watt output (with 13.8VDC battery), output miser to conserve battery power, 10 memory channels, scanning, power-save function and dual tuning steps. A full range of practical accessories are also available to make these pocket pals even more fun to operate.

IC-W21E

The IC-W21E offers dual-band 144/430MHz simple operation using few switches and independent volume / squelch for each band.

The ergonomic and splash-resistant design makes the IC-W21E a snug fit in the palm of your hand. Features include; cellphone-style 'whisper' function. This allows cross-band full duplex use via the mic-equipped battery pack, and easier repeater operation with repeater memory. Every time you access a repeater all settings are automatically memorized in a repeater memory.

IC-W21ET

The W21ET has the same dual-band performance characteristics as the IC-W21E but sports a command keypad and relocated back-lit display (manual operation is also available). Features are as the IC-W21E and include: battery capacity indicator, remote control via an optional HM-75 speaker mic, 70 channels, dial select steps, monitor function, high-speed scan functions, frequency-lock function, external DC power jack for mobile use, auto power-down to allow last minute operation before battery fades, giving you the most from your IC-W21ET.

IC-2SRE/4SRE

The distinctive appearance of these two handhelds is bound to start the tongues wagging. You can enjoy the advantages of a handheld transceiver with a wideband receiver allowing true reception of FM Broadcast, Air and Marine bands. Until now this was only achieved by purchasing separate equipment. The IC-2SRE is a 2m FM transceiver with wideband receive and the IC-4SRE is its 70cm companion. Other great features include; selective calling, 30 ham memory and 60 wide-band receive memory channels plus loads more.

N.B. Photographs not to scale.

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