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Loughton Photographic Limited, Southend Sony Centre, 11 South Church Road, Southend-on-Sea, Essex SS1 2NJ.

Loughton Photographic Limited, Chelmsford Sony Centre, 1-4 West Square, High Chelmer, Chelmsford, Essex CM1 1XW.

Waters & Stanton Electronics, 18/20 Main Road, Hockley, Essex.

Waters & Stanton Electronics, 12 North Street, Hornchurch, Essex.

Merrow Sound, Unit 34 West Street, Horsham, Sussex.

Merrow Sound, 45 Commercial Way, Woking, Surrey.

Merrow Sound, 22 Tungate, Guildford, Surrey.

Merrow Sound, 5 High Street, Epsom, Surrey.

South West England: Ron Millard, 31 Southgate Street, Bath, Avon BA1 1TP.

Tape Recorder & Hi-Fi Limited, Bristol Sony Centre, 8-10 Bond Street, Broadmead, Bristol BS1 3LJ.

Tape Recorder & Hi-Fi Limited, Weston Sony Centre, 4 Waterloo Street, Weston-Super-Mare, Avon.

C. F. Loader, Plymouth Sony Centre, 20 Armada Centre, Armada Way, Plymouth, Devon PL1 1LE.

Hickmans Limited, Swindon Sony Centre, 39b Havelock Street, Swindon, Wilts SN1 1SD.

J. P. Williams Limited, Exeter Sony Centre, 15 Paris Street, Exeter EX1 2JB.

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Battarbee's Limited, Taunton Sony Centre, County Walk, Taunton, Somerset TA1 3TZ.

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Tom Molland Ltd., 110 Cornwall Street, Plymouth, Devon PL1 1NF.

Visibly Sounder, 100 Union Street, Torquay, Devon.

Moss of Bath, 45 St. James Parade, Bath BA1 1UQ.

Upton Electronics, 31 Torquay Road, Paignton, Devon TQ3 3DT.

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Stuart Westmoreland Limited, Derby Sony Centre, 2c Albert Street, Derby DE1 2OS.

Kings Radio (Hereford) Ltd., 35 Widemarsh Street, Hereford HR4 9EA.

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Johnson's Shortwave Centre, 43 Friar Street, Worcester, Worcs.

Ray Withers Communications, International House, 963 Wolverhampton Road, Oldbury, W. Midlands.

Millers Music Centre, Sussex Street, Cambridge, Cambs.

Northern England: E. W. Hewitt Limited, Stockport Sony Centre, 104 Princes Street, Stockport, Cheshire SK1 1RJ.

E. W. Hewitt Limited, Altrincham Sony Centre, 91a George Street, Altrincham, Cheshire, WA18 1RW.

E. W. Hewitt Limited, Warrington Sony Centre, 48 The Mall, Golden Square, Warrington, Lancashire, WA1 1OE.

Peter Bamford Limited, Hull Sony Centre, 42 Paragon Street, Hull, North Humberside HU1 3ND.

Jones of Oakwood Limited, Leeds Sony Centre, 103 Vicar Lane, Leeds LS1 6PJ.

Jones of Oakwood Limited, Wakefield Sony Centre, 35 Cross Square, Wakefield, W. Yorks.

Cleartone Ltd., Manchester Sony Centre, 66/68 Bridge St., Manchester, M3 2RG.

W. M. Hewitt, 549 Ecclesall Road, Sheffield.

Lester and Nix Ltd., 11 King Street, Belper.

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CBS Audio Vision Ltd., St. John's Precinct, Liverpool.

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Video One, Glasgow Sony Centre, 31 Sauchiehall Street, Glasgow, Scotland G2 5HS.

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David Steven, 1-3 Main Street, East Kilbride, Scotland.

Murray Mackie, 30 High Street, Fraserburgh, Scotland.

Martin E. Payne Limited, 38 South Methven Street, Perth, Scotland PH1 5NU.

Martin E. Payne Limited, 18 Union Street, Dundee, Scotland DD1 4BH.

C. Bruce Miller, 363 Union Street, Aberdeen, Scotland.

J. D. Brown, 28-36 Castle Street, Dundee, Scotland.

McMichael Bros. 23/27 Upper Craigs, Stirling, Scotland FK8 2DG.

In Hi-Fi Ltd., 63 George Street, Edinburgh, Scotland.

Wales: Radiocraft Sonus Ltd., 251 Cowbridge Rd. Estate, Canton, Cardiff CF1 9TO.

Radiocraft Sonus Ltd., 231 High Street, Swansea SA1 1NY.

Tele-Electrical Services, 5 The Brackla Centre, Bridgend, Mid. Glamorgan CF31 1DD.

Northern Ireland: F. Rea & Co., 24-30 Chichester Street, Belfast, Northern Ireland.

Laser Electrical Ltd., Unit 3, Abbey Trading Estate, Newtown Abbey, Northern Ireland.

Audio Times, 85 Royal Avenue, Belfast, Northern Ireland.

Channel Islands: Reg Mauger (Sales) Ltd., 20 Halkett Place, St. Helier, Jersey, C.I.

Soundtrack, 1 Church Square, St. Peter Port, Guernsey, C.I.

C. R. Regent, 49 Halkett Road, St. Helier, Jersey, C.I.

World Radio History
**NEW OWNER**

Because of the growth of his cleaning business (Moorpark Cleaning Co) Martyn Bolt G4SUI has decided to stop trading in amateur radio. The business Geefor Enterprises has been taken over by Ian Duffin of Stalham, Norfolk. All enquiries should now be directed to him on (0692) 82075.

Martyn Bolt would like to thank his customers for four enjoyable years in the amateur radio trade and hopes that they will continue to patronise Geefor under its new ownership.

**GODIVA AWARD**

Coventry Amateur Radio Society has recently introduced a new award – the Godiva award. Details are as follows.

1. The award is available to all licensed operators and short wave listeners.
2. Contacts/stations heard must include: G2ASF or G7ASF or any special event callsign operated by Coventry Amateur Radio Society or at least two club members. Also a sufficient number of Coventry stations (ie located within the city boundary) to achieve the requisite number of points:
   - 20 points for any station located within the British Isles.
   - 15 points for other stations within Europe.
   - 10 points for stations outside Europe.
3. Each CARS callsign worked/heard = 5 points.
4. Each CARS member worked/heard = 2 points.
5. Each Coventry station worked/heard = 1 point.
6. All contacts must be made after 1 January 1988.
7. All contacts via repeaters are not acceptable.
8. QSL cards are not required, but a data list, signed and verified, by two other amateurs is required.
9. There is no time limit for the achievement of the award.
10. Endorsements are available for: (a) achievement on a single band; (b) achievement using a single mode; (c) achievement using QRP (<5W).
11. Cost of the award is £1.50.
12. To obtain the award send your data list and full payment to: J Ward G4HHT, 3 Shirley Road, Coventry CV2 2EL. Cheques etc should be made payable to Coventry Amateur Radio Society.

**LOUGHTON AND DISTRICT ARS**

On 4 November Loughton and District Amateur Radio Society has a junk sale, and on 18 November a film show. Meetings are held at Loughton Hall, Rectory Lane, Loughton, Essex IG10 3RU, in Room 20. They start at 7.45pm. All visitors are welcome.

**BARTG’s AGM**

The AGM is on 5 November at the Churchill Room, London House, Mecklenburgh Square, London WC1. It starts at 2pm.

One of the issues which is to be discussed is a proposed change of name from the British Amateur Radio Teleprinter Group to the British Amateur Radio Teledata Group. As the Group is now not only concerned with mechanical RTTY but also with computer RTTY, Packet radio, AMTOR and fax, it is felt that the possible change of name will be more indicative of the BARTG’s current interests.

Because of this possible name change, the BARTG would like as many members as able to attend the AGM.

Further details are available from: Ian Brothwell G4EAN, 56 Arnot Hill Road, Arnold, Nottingham NG5 6LQ. Tel: (0602) 262360.

Finally, BARTG subscriptions for 1988 are £8.00. Details from: Mrs Pat Beedie GW6MOJ, Ffynnonlas, Salem, Llandeilo, Dyfed SA19 7NP.

**RALLY**

The Verulam Amateur Radio Club’s annual rally is on Sunday, 27 November at St Albans City Hall. Doors open at 11am and close at 5.30pm. Entry costs just £1.00. Attractions include club and trade stands, bring and buy, talk in on 2m, prize draw, refreshments and bar.

For further information contact Hilary G4JKS. Tel: St Albans 59318.

**DTI NEWS**

On 30 September 1988 the Department of Trade and Industry announced changes to the amateur radio licences which will increase the use of digital technology. Digital communications include Packet Radio, Radio Teletype (RTTY) and Amateur Teleprinting over Radio (AMTOR). The changes will enable radio amateurs to:
- use their stations for automatic digital communications;
- receive and transmit digital communications along a chain of amateur stations;
- allow such operation to be conducted unattended;
- keep a modified log to accommodate the speed of operation and complexity of chains involved in this form of communication.

Most amateurs will not be allowed to operate a mailbox or bulletin board (a facility which receives and stores messages for or on behalf of other licensed amateurs for retransmission at a later time). The use of an individual’s amateur radio station to receive his or her own personal messages is permitted.

The amended licences explicitly permit licensees to record and retransmit messages from other licensed amateur stations including the relaying of messages along a chain of such stations. The licences also provide for the unattended operation of digital communications although this is limited to:
- the frequency band 50-51MHz, with a maximum power of 10dBW erp carrier or pep and the frequency bands 144-146MHz, the sub-band 436.6-436.8MHz, the bands 2310-2450MHz, 3400-3475MHz.

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5650-5680MHz, 5755-5765MHz, 5620-5850MHz, the sub-bands 10,000-10,250MHz and 10,270-10,300MHz and 10,400-10,450MHz, the bands 10,450-10,500MHz, 24,000-24,050MHz and all bands above 47,000MHz listed in the Schedule to the Amateur Licence, with a maximum power of 14dBW erp carrier or pep.

There are special provisions for logging the automatic operation of digital communications. Automatic operation is taken as including both unattended operation and the use of the station as an intermediate link in a chain of stations. The requirement to record callsigns is waived for automatic operations involving digital communications. It is not necessary to record each and every contact or message passed, although the licensee must still record the time of commencement and shutdown of operation of the station.

A more general change in the way logs may be kept has also been announced. From now on a log need only be in 'permanent' form rather than in a book ('indelible...not loose leaf'). This means that logs may now be kept on mobile or personal computers.

Some changes have been made to the requirement for identification to facilitate digital communications. Identification, which is required at least every 15 minutes, must be made in the type of transmission being used for the message. However, identification in Morse or telephony is required for periods during which transmissions are made lasting 30 minutes or more; Class B licensees may now use Morse in addition to telephony for identification purposes.

Mailboxes/bulletin boards

The DTI has agreed with the RSGB a procedure for the licensing of mailboxes/bulletin boards. Under an agreement made with the Secretary of State for Trade and Industry, the RSGB will distribute notices varying the licence conditions of individual amateurs so as to authorise them to establish such a facility. (There will also be provision for microwave linking of mailboxes/bulletin boards).

Applications for this notice of variation should be sent to the RSGB, which will remain responsible for the co-ordination of such facilities. Amateurs authorised by a notice of variation to operate their stations as a mailbox/bulletin board will identify their stations using a special GB7 prefix, allocated by the RSGB, ie GB7 + letters. (GB7 + 3 letters will denote digital communication repeaters).

Operation of an amateur radio station as a mailbox/bulletin board without a notice of variation will be unlicensed.

The DTI has also announced clarification of regulations for handling third party traffic by radio amateurs operating in the UK. This follows discussions with the RSGB.

The Amateur Service exists on the understanding that it is used 'for the purpose of self-training, intercommunication and technical investigations carried out by amateurs'. Third Party Traffic should be regarded under two separate headings: the passing of messages on behalf of other licensed radio amateurs and the passing of messages on behalf of non-licensed people or organisations.

The DTI accepts that the passing of messages on behalf of other licensed radio amateurs (at home and abroad) does not contravene the prohibition against third party traffic to be found in the International Radio Regulations. Regulation 2733 permits the Amateur Service being used for commercial (unlicensed) traffic. If UK radio amateurs were to pass messages on behalf of unlicensed people or organisations thereby providing a service, then a breach of the Telecommunications Act 1984 would take place.

Passing third party messages initiated by or intended for unlicensed persons is permitted under the terms of the amateur radio licence under three very limited circumstances:

**During Special Events:** a special event station is established by a licensee with the authority of a letter of variation administered by the RSGB on behalf of the DTI. The variation permits the licensed amateur's station to be used by unlicensed third parties for two minute periods only, and then only to discuss trivial matters of personal interest;

**At the request of a 'User Service':** for the purpose of self-training for natural disaster planning and other exercises promoted by the User Services. (User Services are defined in the licence);

**In the event of natural disasters:** where the established lines of communications have failed. Under these circumstances the amateur may, without reference to User Services, pass messages on behalf of third parties until the normal communications systems have been restored. Such messages should only relate to matters directly concerned with relief of distress and should be kept as short as possible.

The bands identified for this purpose are: 3.5MHz, 7.0MHz, 10.1MHz, 14.0MHz, 18.068MHz, 21MHz, 24.85MHz and 144MHz.

**COUNTER/TIMER**

Now available from Global Specialities is the Model 6010 fully programmable, low-cost counter/timer.

The new product is based on Global's 6020 IEEE-based instrument, but without some of the 6020's features and options, so that they have been able to achieve a low price of £795.00.

The 6010 gives optimum resolution and is available in a wide range of application areas and are available in four sizes. These multilayer ceramic capacitors are designed for professional use in a wide range of applications, and are available in COG and XTR dielectric to IEEE specifications and in 5µF dielectric for commercial purposes.

Using three independent channels and nine full size LEDs, different measuring functions can be provided including time interval averaging, rise/fall time, and peak voltage.

Features in the counter/timer are internally pre-selected intervals or external intervals ranging from 100s to 1000s.

A trigger level function is included for eliminating false triggering on unknown signals, and a non-volatile memory is capable of storing up to ten complete front panel setups, guaranteeing duplication of multiple test routines.

For further information, contact: Global Specialities, 2nd Floor, 2-10 St John's Street, Bedford MK42 0DH.
devices are offered in 200V, 100V and 50V versions.

For further details, contact: The Capacitor Group, STC Electronic Services, Edinburgh Way, Harlow, Essex CM20 2DF. Tel: (0279) 626777.

DIGITAL MULTIMETER

The Pan 35-C, a compact digital multimeter with 4 digit LCD clock is now available from Electronic & Computer Services, Edinburg Way, Harlow, Essex CM12 0BZ. Tel: (0277) 626777.

The meter measures 54 x 108 x 12mm, weighs 80g and comes complete with hard cover case, two batteries and instruction manual.

For further information contact: Electronic & Computer Services, Unit 1, Cromwell Centre, Steepfield, Witham, Essex CM8 3TH. Tel: (0376) 517413.

FUSE MONITORING SYSTEM

Klippon Micro-Systems has developed a new combined fuse and fuse monitoring rail-mounted module - FMS/48D - which incorporates 5 fused channels, each capable of supplying 5A.

Each output channel of the device is monitored and, should fuse failure occur, a red LED comes on to alert the user. In addition, an alarm output is triggered for any channel fuse failure and this feature is offered as an open collector transistor output from the nominal 48V dc supply line which is capable of sourcing 100mA. The maximum operational current for the complete unit is 10A.

Other features include:
- green LED input voltage indication; humidity tolerance from 0 to 80% (non-condensing);
- 0.5-4.0mm² (solid) and 0.5-2.5mm² conductor acceptance and Polyamide 6.6 housing.

For further details, contact: Klippon Micro-Systems, DPTS House, Cramptons Road, Sevenoaks, Kent TN14 5DZ. Tel: (0732) 460066.

FAST COMMON OP-AMPS

Bandwidths of up to 180MHz are featured in Comlinear's new CLC205 and CLC206 wideband operational amplifiers, now available from Anglia Microwaves Ltd.

The two devices offer a choice of low power consumption (CLC205) or high drive capability (CLC206) and have features which have not been available before in this price bracket.

The CLC205 has a power consumption of 570mW at ±15V and just 56mW at ±5V - far lower than that of most high speed hybrid amplifiers.

At the same time it is fast, with a settling time to 0.05% of 24ns and a 170MHz bandwidth (-3dB). Output drive capability is ±12V, 50mA; making it a good choice for flash O/C drive, D/A buffering and line driving in PC-based instrumentation as well as aerospace applications.

Designed for maximum speed and drive level, the CLC206 has a 19ns settling time and 180MHz bandwidth. Its output level is up to 100mA (150mA max) and slew rate is 3400V/us. This gives a full power -3dB bandwidth of 70MHz at 20p-p with a gain of 20. Typical applications are signal distribution (50 or 75 ohms) and fast pulse response system operation over the full military temperature range from -55 to +125°C.

For further information, contact: Anglia Microwaves Ltd, Radford Business Centre, Radford Way, Billericay, Essex CM12 0BZ. Tel: (0277) 630000.

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DXPEDIITION TO HOWLAND ISLAND
by J B Smith VK9NS

Baker and Howland Islands lie approximately 1° north of the equator and about 179° west. Both are uninhabited by humans. However, Howland Island does have a history of colonisation in the 1930s. This colonisation by a handful of people was used by the USA to substantiate their claim to the islands. Howland became associated with the famous aviatrix Amelia Earhart and her last fatal flight. The Lockheed Electra went missing on route from Lae in New Guinea. Of course, WWII saw both islands in use as wartime airfields for US forces in the Pacific.

In the beginning . . .
This story starts several months ago when I became interested in a possible DXpedition to Canton Island (T31). It had not been active for some time and it appeared to be quite easy to get to. Licensing was no problem since I already held a T30 callsign.

However, as things progressed I realised that it would need a four day sea voyage to get to Canton Island, almost 1,000 miles east from Tarawa. I then thought that Baker and Howland (KH1) would be much more in demand. Six years had elapsed since SMOAQD had signed portable KH1 during a stay on Canton Island. On alternate days Erik also used a T31 callsign.

To understand the situation better, it has to be remembered that until the independence of Kiribati, Canton Island had been jointly administered by both the British and US governments. As a result, UK personnel interested in amateur radio were issued VR1 (T31) call-signs and US personnel were issued the KB6 or later the /KH1 call-signs. This convenient arrangement of two DXCC countries for the price of one came to an end about six years ago. Now the only way to work the KH1 is activity from Baker or Howland Islands.

Since both islands were US territories I approached the US Department of the Interior in Hawaii. After several false starts I finally talked with the people who dealt with Baker and Howland Islands. I was informed they were part of the US National Wildlife Refuge. Talking to Doug Forsell of the Fish and Wildlife Service I discovered several interesting things. Firstly, he had been to both Baker and Howland Islands and secondly he was extremely interested in my idea of visiting either island for amateur radio purposes.

There were, of course, a couple of valid points. Firstly, the department was interested in US representation and was not too keen on a completely ‘foreign’ invasion of the islands. It was also worried about the impact on the bird population of generators, antennas and a bunch of crazy radio amateurs working on a 24 hour basis screaming into microphones and so on.

After about six weeks, several letters and telephone calls, HIDXA and the US Fish and Wildlife Service came to a working agreement. We, the radio amateurs had agreement in principle for landing permission and they in turn had a method of getting to both islands at a considerably reduced cost to their department. HIDXA was to charter the vessel for the then planned 15 day charter.

Originally HIDXA planned for a 10 member team. Seven would be radio amateurs with at least a couple of US participants. The other three would be US Fish and Wildlife staff and one weather man. The agreement was that each member would share the charter costs equally and this would be about US$2600 on a pro-rata basis.

Logistics
So, the ground work continued with more and more to do in the logistics of the operation. All major DX contacts were informed of our intentions. There is nothing on either island and so everything needed had to be taken. Much of the planning was done by fax, telex and telephone and of course dozens of letters. I noted in my mind how much easier this DXpedition was than our previous DXpedition to Heard Island. With the computer I wrote one letter and ran off copies—all addressed to different people. I could recall the letter and write a few updates and with fax facilities a great deal was achieved very quickly. Such is progress.

However, there was also one very prominent similarity to Heard Island. We had dozens of operators who wanted to go to KH1. A great and marvellous opportunity, wouldn’t miss it for the world! But, as things moved along we remained stuck with only five operators. Also, for some reason or another, the US weather man was withdrawn at the last moment. The major effect was that HIDXA had a larger and larger commitment to the overall costs. At the last moment we had one more operator join us, Mac KV4AM decided to come along. Unfortunately, after travelling to Tarawa Mac pulled out and remained in Tarawa signing T30MA. He would have been our oldest member and on reflection he decided that the whole trip might be too much. In hindsight he was probably right as our stay on Howland was pretty basic and usually uncomfortable.

As a financial move the charter was cut to 13 days thus reducing costs by some US$3,500 and this allowed for seven days on the island. As events proved, we had just over six days ashore owing to rough weather on the way out. We would have liked to have extended the charter by a couple of days but financially it would have been crazy to do this.

The Shipping Corporation of Kiribati has a huge responsibility serving all the island groups. The company has an excellent reputation and although charter costs were US$1760 per day, the group was looked after very well. It was arranged that the vessel would remain in the vicinity of the island and also that the company would be responsible for getting the party and equipment ashore. This in itself is a major problem when landing through heavy surf on remote islands. The arrangement also relieved the party of a great deal of sheer physical effort. (I thought of this as we were finally getting ready to leave Howland Island. We were all very tired and even lugging everything down to the beach would
have been a problem. With the help of the crew, however, it was a different story. We did what we could and they did the heavy stuff.

The choice of Howland Island was taken quite early, largely as a result of Doug’s advice and his flat statement that it was very hard to get ashore on Baker Island. That was good enough for me. However, we did play with the idea of putting Baker Island on the air for IOTA and carried a spare generator and so on. However, in reality it became apparent that much more could be achieved if we stuck together.

**Operators**

In addition to charter costs each member had to find his way to Tarawa as this was our starting point and some 700 miles from our destination. Gradually the operator list filled up — the list started with Kirsti and myself and very quickly Jean-Louis TR8JLD decided to come. He travelled all the way from Gabon in West Africa – such is dedication. Almost immediately he was followed by Chris KA100Z from Connecticut, who had just upgraded and was awaiting his new call. Most will now recognise this new call as NO1Z. This was the one finally used for the operation. Ron 7J3AAB was then in the running. Finally, Jackie 7J1ADX, who was also an early starter. Unfortunately, he had to withdraw due to work problems during our time frame. So once again we were back to five radio operators, until the very late appearance of Mac KV4AM mentioned earlier.

It is my opinion that we really needed at least one more operator and I still feel that the original idea of seven operators was about right. We had an enormous commitment in the shape of 6m, RTTY and a brand new YL country. Not to mention a genuine attempt to operate 160m. So once again we were back to five radio operators, until the very late appearance of Mac KV4AM mentioned earlier.

With the help of Ali T30AY I knew my way around Tarawa within a couple of days and all the contact points. I had met the chief customs officer and so on.

**Major hiccup**

However, almost immediately there was a major hiccup: one of the three reserved Yamaha 2.8 KVA petrol generators had been sold. There had been a power failure on one of the nearby islands and a generator was needed urgently. As a result there were only two generators left and these were not enough. I had always planned for three stations plus RTTY and 6m. There was no chance of getting a generator to Tarawa on time unless more expense in air freight was incurred.

Our salvation came in the form of a large diesel generator which was being held for a local Catholic Mission. They had not enough money to pay for it, so it was being held for them. I then suggested a deal; if they would let us have the generator for 15 days (to cover the DXpedition time) HIDXA would sell it to them, with a $1000 discount, as a slightly used item. This is the stuff of the bargain basement but it was a reasonable approach for HIDXA as we got all our power for $1000. The generator was paid for on the spot after one quick visit and discussion at the shipping company as to whether they could get it ashore. This was to prove no problem.

The generator was started soon after arrival, fuelled on the run (very carefully) and was shut down just after our last OSO some six days later.

With the problem of shelter we had a stroke of luck. In a telex to Tarawa, I had asked if there was a local Boy Scout group which might have tents that we could hire, to save the expense of buying them. A few days later I had a reply that a large tent 15ft square was available for hire at a very reasonable daily rate.

When we went to check the tent we found that there were no ropes or pickets. I had to order 20 strong wooden tent pegs to be made. Plastic covered rope was also obtained and we were in business. The tent was repacked and it was hoped that the next time it was unpacked we would all be on Howland Island. It easily accommodated all our stations and the mountain of junk which we carried. In addition we had a bit of room for a cot to grab a nap.

Two other areas of shelter had been planned and the wooden frames had
Nei Momi tackles the surf

been made and labelled for easy assembly at our destination. A further area of shelter was also envisaged using framing and tarpaulins with the Amelia Earhart beacon as a tie point. This worked out very well. Kirsti and I brought along a tent but this proved to be inadequate for the very windy local conditions.

Antennas

As part of the antenna farm we had two Cushcraft 3e1 beams. Two seven metre masts were to be organised locally using 2in water pipe. I had checked that this was available but it turned out to be quite difficult to obtain. There was a large bundle of it in the shipping yard but this was a lost consignment with no paperwork. Customs clearance was impossible and it became a dead end. I offered to quietly remove three lengths and return them in due course, however, it was not to be. Very frustrating. Finally, a source was found and they were welded to my specifications and a suitable base made from old car wheels and a simple bearing system also arranged. The masts worked very well in practice but finally confirmed a principle I have always believed in. It is based on Murphy's Law; the one which says that your beam is never in the right direction. Armstrong methods are fine but I will always make one antenna rotate electrically in future. It is well worth adding a rotator and cable to the heap of equipment usually carried.

Guy rope was purchased and the mast problems finally fixed. All welding was done locally but I thought it was expensive. However, the people involved were not Kiribati people and that may explain the situation.

Final arrangements

Gradually Jean Louis and I got more and more of the essentials organised. We had an arrangement with the shipping company where they lent us one of their ship containers to store our bits and pieces. This also pleased customs who were quite happy to release our freight into this other bond area. It worked very well in practice and provided good shelter and security for all our material. Water and fuel containers, fuel pumps, tables, chairs and so on gradually built up and our store started to look fairly full. Fuel for the generators was now arranged with the purchase of 400 litres of diesel and 400 litres of petrol for the one back-up generator we decided to carry, just in case. Lubricating oil was purchased, in smaller quantities of course and also Kerosene for our stoves. A promise was made that the fuel would be delivered on the day of our departure. Things were really moving along now with the arrival of Mac then Chris and finally Kirsti and Ron, along with Doug and Dick of the US Fish and Wildlife Service. Departure had been set for 6pm on Thursday 24th March. This allowed all the latest arrivals one full day of shopping for anything needed at the last moment.

Doug and Dick purchased fresh fruit; bananas, limes, coconuts, papaya (paw-paw), imported apples and oranges and so on. It was time to buy the soft drinks and a few cartons of beer, all based on a ration of so many cans a day. The arrangement worked out fine. Even after our return to Tarawa we still had a stock of beer, although this had been increased by a donation of two cartons of beer from the Captain of the Nei Momi.

The vessel has the unlikely name of Miss Marble. It was built in Japan, and the passenger area which we occupied was really nice. Clean and had everything one could hope for without the expense of an ocean liner. The crew cared and made us feel at home. The food was simple but well-cooked and served with the smile that was important to them. I must comment on these wonderful people of Kiribati and their continuing ability to smile and be friendly. It became a feature of all our dealings with them.

On our way

By 6pm we were all aboard, the fuel had been delivered as promised and loaded. Our generator was safely aboard and stowed and finally the large aluminium dinghies were loaded. Each of us were getting settled in our small but comfortable cabins and there was a call for a meal. We thought that we were on our way.

We finally cleared the quay for Howland Island early next morning and some hours later were clear of the reef surrounding Tarawa. The sea was pretty rough and a strong 25 knot headwind very apparent. In fact this weather pattern followed us all the way to Howland Island and it took over four days to finally arrive off the island about 9 o'clock in the evening. In the bright moonlight we could see the old Amelia Earhart Beacon and the long edge of beach dead ahead. It was an exciting moment.
Some of the equipment we used

We drifted off the island all night until dawn next day, then we attempted to get ashore. Our excitement had been dampened slightly as the breaking water on the reef looked very formidable. However, the first boat was soon loaded and on its way. It had to land well down from the target point of opposite the beacon due to rough water. This resulted in a long slog bringing gear up to our intended operating area.

The next boat was better and made it through the surf almost on target. So with one boatload after another, all the group and our gear gradually made it ashore without mishap. Fuel drums were floated ashore and were soon in position near the generator.

A start was made to pitch the tent and the generator was already in place. The tent was pitched in quite windy conditions but it went up all right with many willing helpers. With the wooden pickets and rope in place the tent started to look quite a substantial shelter. That evening we were hit by a wild squall and heavy rain, and I think we were very lucky that the tent stayed up. Next morning we had a hurried re-assessment of the tent guying. It was then made very secure in a couple of hours. We had no more trouble.

With the tent up, a station was quickly organised. One of the power cords was run and connected to the generator. In the meantime Jean-Louis and Ron were assembling one of the Butternut verticals. They quickly had this HF antenna ready and the coax was plugged into the rig. 'All switches off', I cried and started the diesel. It was a comforting sound as we finally had power available.

The rig was switched on and NO1Z/KH1 was finally on the air. We said hello on 14220kHz, with Bob KH9AC being first in the log. A quick résumé and acknowledgement that all were ashore safely and we moved to 14195kHz, split to 14200-14210kHz. The DXpedition was in business! It was a great moment for us all. The planning, hard work and rough sea voyage suddenly seemed worthwhile.

As the hours progressed, another antenna was raised and then both beams were in the air and so on. Very quickly another station was connected up and brought into action. The DXpedition was very lucky with propagation and the bands remained open hour after hour. Always a huge pile-up and always more and more to be done.

Conditions on the island were very basic, it carried much more grass cover than had been expected. Most photographs show the island as a white sandy, coral area. All around were the birds and they quickly adjusted to our presence. There was not much time for sight seeing but gradually we got around.

The focal point of the island is of course the Amelia Earhart beacon. Built in 1937 as a memorial to this famous aviatrix who disappeared over the Pacific on route to Howland Island. This is an aviation mystery which has never been solved. In addition the settlers of the 1930s built their town Itacatown and signs of their work are quite prominent. Long stone walls mark the boundary of their small community buildings, representing many hours of hard labour. It must have been a lonely sort of life, perhaps compensated by the beautiful beach on the lee side of the island with its fringing reef and pure white sand.

There are many mementos to their occupation of the island and it was a surprise to talk to one station in Hawaii who had been one of those early settlers. He had many questions. Were we really on Howland Island? Was the beacon still there? Had we seen an old bulldozer which was left behind? Had we had any luck on the North Reef with the lobsters, there for the catching at night with a suitable light? I promised him a few photographs on my return to Norfolk Island.

Howland Island has never been active in a radio amateur sense since 1948 but there are records of pre-war QSOs and I have a couple of letters from people who were on this island during the war and also pre-war. In due course I hope to be able to get a better picture of this era.

Excitement

We certainly had our moments of great excitement during our stay on the island: someone, as 6m opened up, hearing our beacon VK9NL/KH1 running on 50110kHz; Kirsti working several stations during the opening; one memorable sunset opening on 160m when the strength of the incoming signals was unbelievable; still being called and working stations after many OSOs and long after sunset proper; the early moments of RTTY and giving Howland Island for the very first time in this mode; another major pile-up. It was the same
story for most of our 166 hours of continuous operation. There seemed to be no end to the clamour for QSOs.

**New YL country**

It was exciting to see Kirsti, giving all and sundry a new YL country. She was the only one to use this call as all other operators used NO1Z/KH1. So it was with just around 27,500 QSOs in the log that it was time to leave. A final QS0 with a JA just around 27,500 QS0s in the log that the only one to use this call as all other DXpeditioners seem to feel the same way. Certainly all of us felt that we had done a good job.

**Lady Luck**

On the credit side we had no major equipment failures. Usually this is the curse of DXpeditions — as the linear equipment failures. Usually this is the curse of DXpeditions — as the linear blow on the same band. The dozens of things that can and do wrong didn’t open up in response to an overdose of RF as another operator beam, verticals, tents and so on all came down much quicker than they went up. We cleared our site efficiently and slowly.

Log Breakdown of the DXpedition

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Totals are around 27,416 QSOs. There are some QSOs on 6m CW and also a couple of hundred RTTY QSOs which should be added.

**Thanks**

To all who helped make this DXpedition possible many thanks, in particular the members of HIDXA. Thanks also to all the operators who worked so hard, to Kirsti, Chris, Ron and Jean-Louis. All major contributors are acknowledged on the QSL card. These cards are now being mailed and we hope you like them.
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WOOD AND DOUGLAS
144LIN25B AMPLIFIER REVIEW

by
Steven Goodier G4KUB
and
John Goodier G4KUC

In the January 1988 issue of Amateur Radio I described a base station adapter for the Yaesu FT-209 hand-held 2m transceiver. I mentioned at the end of the article that I would be reviewing the Wood & Douglas 25W linear amplifier and giving details about fitting it to the adapter. The following is a complete review of the Wood & Douglas 144LIN25B amplifier kit and it was decided from the start that the review would take the form of a complete constructional project. Apart from describing the kit, I will also detail the kit’s construction, mentioning any problems I encounter along the way. I will also recommend a suitable case and heatsink, plus wiring information and alignment details which will result in a fully working 25W linear amplifier.

Introduction to the amplifier
Wood & Douglas have been producing very high quality VHF/UHF communications kits for a number of years and have built up a unique reputation for designing high quality products. Their range of products varies from fully synthesized transceiver kits for both 2m and 70cm, ATV transmitters, low noise preamplifiers to general accessories such as tonebursts, piptones and audio OW filters. Of greater interest to us is their range of linear amplifier kits which can be built more cheaply than purchasing a ready built commercial unit.

The 144LIN25B linear amplifier is the high power version of the Wood & Douglas 144LIN10B. It has been designed with the current generation of multimode transceivers in mind such as the very popular FT-290R (it requires a drive level of between 2-3W for full power output). The changeover is fully RF sensed which gives a straight through path in receive mode, or when the power supply is disconnected. Wood and Douglas claim a less than 1dB loss in receive gain. Transmit is achieved in one of three ways: 1. RF sensed; 2. the point marked '+T' is applied to the positive line; 3. the point marked '-T' is applied to earth.

The main RF device which is TR1 is thermally tracked, with TR3 giving excellent stability of the bias current over a wide temperature range. It is recommended that a good heatsink is fitted and a 2" CW or better is used.

The amplifier has a minimum gain of 8.5dB that is about 7 times in real terms, so a drive of 3W will produce an output of about 21W. There are two LED outputs on the board, these indicate Power on' and 'Tx'. The size of the amplifier is 92 x 54mm and the PCB is double-sided. The specifications of the amplifier are shown in the table below and the circuit diagram is shown in Figure 1.

The kit arrived in a large padded bag by John Goodier G4KUC

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The kit arrived in a large padded bag by John Goodier G4KUC

The first thing to do is read the instructions two or three times and make sure you understand them thoroughly. It is also a good idea to familiarise yourself with all the components. When you have had a good look at the kit and have read all the instructions, should you then feel that it is beyond your constructional skills, Wood & Douglas will replace your kit with a ready built and tested module for the additional balance. This kit is a fairly advanced project using an expensive RF device, so if you are in doubt then it is wise to return the kit for a ready built unit. If after completion the board develops a fault then Wood & Douglas will service it for a fee of £6.75 (including VAT and return postage).

I will now deal with building the kit as set out in the supplied instructions, but I will add my own comments and additional information where needed. When building the unit I would advise you to follow the instructions to the letter as they are well set out and provide useful tips. Remember to take things slowly and double-check all your work. Figure 2 shows the PCB overlay.

1. Check the PCB for any faults or
Fig 1: Circuit diagram of the 144LIN258. TR1 and TR3 are thermally tracked and are mounted on the heatsink.
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1. The next job is to fit TR1 which is the main power device. Before I did this I used the board as a template to mark the position of the mounting holes. This will help in marking out the metalwork later.

2. Fit all the trimmers. These are colour coded and be sure to choose the correct values. As these are the first components to be mounted on the board, make sure you choose the correct holes. If you are unsure about the colour of a particular capacitor then you can double-check it with the components checklist which is supplied with the kit. Some of the capacitors are top soldered and this is indicated on the PCB overlay. You will be unable to top solder C19, so two rivets have been placed through the board for this purpose.

3. Fit all the terminals. These are used to connect cable to the board and there are 13 in all. Some are top soldered.

4. Fit the through links around TR1 and adjacent to C1. On the board supplied, a stud was placed through the hole near C1 so no link was needed. All links are soldered on both sides.

5. Fit all resistors. Double-check their values before fitting.

6. Fit all the transistors except TR1 and TR3. TR4, TR5 and TR6 look the same so be careful to choose the correct device.

7. Fit all the diodes. Most of these can be identified by the coloured markings; it is best to refer to the additional components checklist for this information. In the kit supplied to me, D1 and D5 are made up of two diodes, one of which is soldered under the board. The only two diodes which were not clearly marked were D3 and D4, these turned out to be small chunky devices with a blue dot at one end. Lead lengths on D1 to D5 should be kept very short.

8. Fit all the capacitors except C13, C22, C14 and C9. These are fitted later. All capacitors should fit flush with the board. Keep all leads as short as possible. Double-check the polarity of the electrolytic capacitors.

9. Fit all the coils. These are easy to identify as they vary in size. L7 needs to be a height of 15mm off the board.

10. The next job is to fit TR1 which is the main power device. Before I did this I used the board as a template to mark the drilling positions on the heatsink. It is possible to use the paper template to do this job (more about the drilling of the heatsink later on). The transistor has four leads which need to be cut short before mounting. The transistor is easy to identify as it has an angled corner on one of the legs (the legs of the transistor are clearly shown in the instructions). Use a pair of sharp scissors to trim the leads short. When satisfied, fit the transistor through the mounting hole and solder all four legs. Next, fit C13 and C14. These are fitted between the base and emitter and then soldered on the track side. Keep all leads very short. That completes most of the PCB assembly. The next job is to prepare and drill the heatsink. If you have not already marked the positions of TR1 and TR3 on the heatsink then use the paper template to do so. Wood & Douglas recommend that a 2" CW heatsink is used. The one I used is available from Verospeed (Cat No 253-25535C) and is 152 x 94mm in size and rated at 2.25" CW. First drill the hole for TR1, making sure you do not use too large a drill bit. Then drill the mounting hole for TR3, again make sure this is not too big. Drill two mounting holes at either end of the heatsink which can be used to mount the amplifier to the box. Use the mounting kit supplied and bolt TR3 to the heatsink, using thermal grease on both sides of the mounting kit. Bend the legs up and solder C22 between the base and emitter, again keeping the leads short. With a test meter set to read ‘ohms’, check there are no shorts between TR3 and the heatsink. Before mounting the PCB on to the heatsink, give the board a final check for poor solder joints, solder splashes etc. Although it’s difficult to check all the components, it’s worth giving the diodes and transistors a quick check to ensure they are in the correct way round. Apply thermal grease to TR1 and bolt the PCB into position, if all is well then the legs of TR3 should appear through the profiled hole on the PCB. Bend the legs of TR3 towards the pins and solder. This completes the construction and mounting of the linear amplifier.

Before testing, mount the linear into its box. The diecast box I used was 152 x 82 x 50mm and is also available from Verospeed (Cat No 86-20103J). Cut a large hole in the bottom of the box and drop into place the amplifier and heatsink as one unit. The drilling details of the box are shown in Figure 3. The components list shows the extra parts needed to finish the unit. I pre-wired the LED drivers, power supply cables and coaxial INPUT/OUTPUT leads before fitting and this made wiring up a lot easier.
Testing and setting up
To set the amplifier up you will need a test meter capable of reading up to 2.5 amps and, if possible, it should have a 50mA resolution. VHF power meter and 50 ohm dummy load. The layout of the test equipment is shown in Figure 4. To set it up see the table above and follow points 1-4.

1. With no power supply connected to the amplifier, key the driver (in my case a Yaesu FT-209 hand-held, about 2.5W) and peak C2 and C5 for minimum power loss in transmit. C2 and C5 should settle at about the same settings, ie not with one at minimum and the other at maximum.

2. Set P1 fully clockwise. Connect a dc power supply with an ammeter in series as shown in Figure 4 and set the meter scale to read about 50mA FSD. Switch the supply on and the 'POWER LED' should light, the current drawn should be less than 20mA. If higher, turn off and check for constructional errors.

3. Switch the power off and reset your current meter to read about 500mA FSD. Connect a lead to either or - T on the PCB. Switch back on and when +T is connected to +12V, or terminal - T is connected to 0V, the current should increase to about 150mA and the 'Tx' LED should light; in my case the current reading was 165mA. Again, if the reading is very much higher switch off and check for errors. With one of these pins still enabled turn P1 anti-clockwise for an increase in current of about 50mA.

4. Apply about 3W of RF to the input. Changeover should occur, this is indicated by the 'Tx' LED. Adjust C11, C12, C18 and C19 for maximum power output, do not adjust C2 and C5. C11 and C12 will interact as will C18 and C19, so repeat all adjustments several times. Power output should be about 22W for a 3W drive.

This is where I started to encounter some problems. Following the instructions for testing and setting up, all seems to be fine and I was obtaining the results as stated. When I applied about 500mW from the Yaesu FT-209 hand-held, there was no problem in tuning the amplifier for about 8W output. When about 2.5W was applied to the input, the output power would only increase to about 15W. All seemed fine until I went back to receive. The FT-209 switched back, but the amplifier seemed to stay on transmit. This was indicated by the 'Tx' LED staying around 2W (shown on the power meter). I think TR1 was breaking into oscillation when a certain amount of power was applied to the input. This oscillation seems to keep the changeover activated. The linear was not returning to receive when the drive was de-keyed. After testing the amplifier with a drive of 500mW, all seemed to be OK. The problem only occurred when applying about 2W or more.

I tried for a couple of hours to cure the fault, but I was completely lost as to why it was happening. After much head scratching I decided the best course of action was to take up Wood & Douglas' offer to repair non-working kits. I packed the kit up, posted it back to Wood & Douglas and eagerly waited its return. About 10 days later the kit arrived back. I was informed they were unable to correct the fault stated, but that they had fitted a 330R resistor to prevent latching of the changeover. Wood & Douglas re-tested the amplifier with various power levels and all worked well. They re-aligned the linear for maximum power output at 145.000MHz. Their specification check showed that only 0.4dB was lost through receive and power out was 22W.
out for 3W in and 4W out for 0.5W in, all at 145.000MHz and 12V dc.

I'm not sure what caused this mysterious fault but it did show that the kit was built correctly to begin with, and I must congratulate Wood & Douglas on their repair service as this gives me confidence to the first time kit builder. I reassembled the board back onto its heatsink and refitted it back into its box. I then applied 2.5W of RF from my FT-209 hand-held and obtained 22W output. Switching the rig to low power I obtained about 7W output. All worked fine this time with no trace of the previous fault.

Using the amplifier with the FT-209 base adapter

In the original article FT-209 Base Station Adapter, the intention was to include the Wood & Douglas linear amplifier in the base adapter itself. I must admit I did jump the gun a little with this suggestion, and without doubt it is much better to house the amplifier in its own box. If you wish, the linear may be included in the same box, but this is better done right from the start, rather than being an add-on later due to the amount of metal work involved. If housed in a separate box the linear can still be controlled from the front panel 'HI/LO' switch as originally intended.

If you are using an FT209RH then you will have to lower its power output, this is because the RH version of this rig is designed from the front panel 'HI/L0' rather than being an add-on later due to the control of this device is set by resistors R1 and R2. To drop the voltage down, replace R1 with a 560R and replace R2 with a 680R, this should produce about 8.5V output.

Conclusion

I have to congratulate Wood & Douglas on producing such a fine product. If you are looking for a linear amplifier and you want to save some money by building it yourself, then I can highly recommend the 144LIN25B. The instructions are clearly laid out and the PCB and components are of the highest quality. Apart from the few problems I had with setting up, my linear amplifier is working well. The only thing I think is missing from the kit is a length of RG174 miniature coaxial cable for making the RF connections. I usually leave my FT-209 set to low power and drive the amplifier with about 750mW, this produces an output of about 7W. If I drive the amplifier with a full 3W, the output increases to 22W. The heatsink runs very cool over a long period of time.

The nice thing about these kits is that you are not left on your own if you have problems getting the board going. At the time of writing, 144LIN25 kit is £35.75 and the 144LIN30 is £36.25. The hardware packing to complete the amplifier is £14.25. For more information, contact Wood & Douglas at Unit 12-13, Youngs Industrial Estate, Aldermaston, Reading, Berkshire RG7 4PQ, or telephone (07356) 71444. I would like to thank Wood & Douglas for their help with this review.

Components List

Wood & Douglas 144LIN25B Amplifier Kit
Diecast Box 152x82x50mm
Heatsink 2.25° CW 152x94
RF sockets to suit
Single pole ON/OFF switch
LEDs and Holders
RG174 min Co-axial cable
Nuts, bolts etc

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One of the benefits of homebrew equipment, apart from its low cost, is that a little imagination and foresight renders equipment more versatile by incorporating additional circuits or devices.

When I designed this ATU, I decided that not only should it efficiently carry out its primary role of tuning antennas to resonance, it should also incorporate an antenna switching system, so that three separate antennas could be switched in or out at will.

In addition, the ATU could be completely bypassed when using antennas such as multi-band beams and trap verticals. As most readers may be aware, it is not always necessary to have an ATU in series with a well designed and suitably erected trapped aerial: either wide-band beam or vertical.

A 50 ohm load is also built into the ATU for test purposes and the SWR and power meter are built into the front panel.

The advantages of using an ATU on an HF receiver, especially when the receiver is used to cover a large number of bands, cannot be overestimated. ATUs which are used solely for receiving can produce a 5/9 signal from an apparently dead band. This ATU can produce excellent results when connected to a communications receiver and may prove to be of enormous benefit to the serious short wave listener.

Needless to say, if this equipment is to be used only on receivers, then the dummy load, SWR and power meters do not have to be incorporated into the design. Consequently, the variable capacitors and coil windings will not have to be robust as the circuit will not dissipate a high power.

Figure 1 shows the basic pi circuit, the necessary switching circuits for the three antenna sockets and a 50 ohm dummy load. Switches 1 and 2 are used to used to ensure that each winding is firmly attached to the former. Give the coil and the former a liberal coating of shellac. Both should look like the illustration in Figure 2.

With a fine file, remove the shellac from the coil where the taps are to be soldered. As can be seen in Figure 3, the coils will be tapped at 1, 5, 9, 13, 17, 20, 22, 24, 26 and 28. The winding can be counted from either end.

The two coils are now bolted to a piece of non-conductive material. I used

---

**Figure 1**: A basic Pye circuit with a few alterations

**Making the coils**

The first items to build are the coils. Once again, I have opted for simplicity and have reduced the cost of construction without decreasing the operating efficiency. The formers are made of 5cm plastic piping, as used by plumbers, readily available from DIY shops at a cost of approximately £2. You will require two tubes, both 16cm long and, purely for cosmetic purposes, it is suggested that each of the ends is slightly tapered with the aid of a fine file.

The coils are made from hard drawn copper wire, the same type used in electrical installations. Once again, this can be purchased from DIY shops.

Remove about 60cm of the insulation and twist 30 turns of the wire around a broom handle. I have deliberately wound the wire into coils that are smaller than the plastic formers to ensure that the wire will tightly fit the plastic pipes. Now slide the coils onto the plastic formers and space the coils out to prevent them shorting together.

Although the coils may appear to be secure, I recommend that 'Superglue' is used to ensure that each winding is firmly attached to the former.
Bakelite for this ATU. It is important to lay the coils in such a way that there is no possibility of conductive reactance between the two coils; induced voltages must be avoided. This can be achieved by positioning the coils as illustrated in Figure 4.

**Taps**

Tap 1 of coil 1 is soldered to the antenna input socket and tap 28 is soldered to tap 1 of coil 2 so that both the coils are physically connected. There is a total of 22 taps and each one is shown in Figure 5. By closely following the diagram in Figure 5, readers should find no difficulty in building the circuit. To prevent common faults, such as arcing and spurious emissions, each component must be securely bolted to the chassis of the ATU. I also found it necessary to glue to the chassis all the wires leading from each component. This resulted in a solidly built and robust piece of equipment.

**Take care**

In Figure 4 you will note that, due to the position of the two switches that electrically lengthen and shorten the coils, it would have been impractical to glue these wires to the chassis. Instead, the wires were deliberately soldered under tension to their respective components. This ensures they are secure and free of possible movement.

If the ATU is to be used with a tvr, when selecting the components, the variable capacitors and switches must be capable of passing at least 200 watts.

**Components List**

- 32cm of 5cm plastic piping
- 300cm (approx) of hard drawn electrician's cable
- 1x2-gang variable capacitor
- 1x3-gang variable capacitor
- 2x10-position switches
- 3xPL59 sockets

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There are many occasions where it may be useful to have some extra gain available. Perhaps you have a 'scope or some other piece of test gear which is not sensitive enough for your requirements? Another common requirement is having to find some means of boosting the sensitivity of the older type of scanner receivers. These usually cover a wide frequency response but, unless you paid an arm and a leg for your own, the chances are that it's deaf. This is especially true at the higher frequency end of the scale.

The answer

What you need is a good preamplifier with a reasonable gain and a good noise figure. What used to take a handful of components can now be done with an integrated circuit and a couple of discrete components. One device which makes this possible is the RS Components RS560c (also available as the Plessey SL560c). This can be set up to give a variety of gain, bandwidth and noise parameters by simply choosing a couple of resistor values and running it from the appropriate voltage supply line.

General purpose

The circuit shown in Figure 1 is for an amplifier that has a gain of 10dB and a reasonably flat response from 3 to 300MHz. It will handle a maximum input voltage of 300mV peak to peak and will provide a maximum output of 1.5V into a 50 ohm load. The unit needs a 9V supply and the current consumption is about 35mA.

50 in/out

If you want to use 50 ohm lines on both the input and output circuits then use the circuit shown in Figure 2. This is actually the simplest circuit of them all. It provides a gain of about 15dB falling to around 10dB at 200MHz. At this frequency it will provide 5mW of output. Note that the supply voltage is now 6V and not 9V.

Low noise

Now we come to the broad band, low noise system shown in Figure 3. This is designed to run from a standard 12V supply from which it draws 3mA. The specification is excellent; input and output impedances are both matched to 50 ohms. The gain can be reduced from 20dB to 13dB by installing the track between pins 4 and 5 of the integrated circuit. The noise figure is 2.5dB and the specs are held up to at least 150MHz.

Construction

These units should all be built on a double-sided PCB with the upper side used as an earth plane. The physical layout can follow the electrical layout shown in the diagrams. All connections, especially those to the decoupling capacitors, should be kept short. Supply lines (lower than 12V) can be obtained by using dropping resistors and Zener diodes. Remember to place a .01uf disc capacitor directly across the diode to eliminate the noise that these devices generate.
Advanced engineering from ICOM has produced the most sophisticated Amateur HF transceiver on the market today, whether DX'ing, contesting or simply enjoying top performance the IC-781 is a top of the line performer. A unique multi-functional CRT displays frequencies, modes, memory contents, operating notes, RIT, two menu and seventeen optional screens. The soft orange display also serves as a display for DATA modes such as RTTY, AMTOR and PACKET.

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As always, the RSGB's HF Convention proved to be a roaring success, with a large number of overseas visitors including ZL3GQ, K3ZQ, W9KNI, W0A1H, N4AR and others. Paul, W0A1H, gave a fascinating presentation on how he has been able to build up a massive contest station on a shoe-string budget, with over 20 towers, some around 200ft high, supporting an enviable selection of antennas for all bands. Another Paul, F6EXV, told the story of the recent operations from Kingman Reef, Palmyra Island and Eastern Kiribati. From the continuous 60mph winds on Kingman, to the crabs on Palmyra (into everything and forever climbing over the rigs), the discomforts were considerable. All credit then to Paul and the rest of the gang for a terrific operation, giving many European DXers their first contact with these rare spots.

The foreign visitors made a clean sweep of the DX Quiz, with F6AJA taking top honours, followed by OW5NT and F6EXV. OW5NT also showed some slides of the FV8NDX/P operation from 'les Sept îles' and of his recent visit to Finland.

A major talking point at the Convention was the possible impact of the recent changes to the DXCC rules. Rule 2a 'Separation by Water' has been reworded considerably, supposedly to clarify the interpretation which the ARRL had been applying all along. However, the new wording seems to allow new interpretation. The rule used to say that an island would count separately for DXCC if it was over 225 miles away from the relevant mainland.

Between groups of islands rule 2b was applicable, which specifies a distance criterion of 500 miles. The new rule 2a refers not to 'mainland' but to 'a continent, another island or group of islands that make up any part of the parent DXCC country'. Rule 2b still applies to 'additional' island groups. Confused? So am I.

However, some US DXers are already saying that the new wording could lead to anything from twelve to twenty new 'countries' including Jarvis Island, the Marquesas Islands and others. Specifically, KN3T, K3NA, W6SZN and VK8XX planned to put their interpretation to the test from Rotuma Island (currently part of Fiji) from 22 October until 5 November. The callsign was expected to be 3D2XX. A German group operated from Rotuma as 3D2XR some years ago, but at that time separate DXCC status was refused by the ARRL.

While on the subject of possible new countries, the ARRL has recently received yet another package of documentation from the operators of 4J1FS (see DX Diary for September). Meanwhile, there is already talk of a further operation from Maluy Vyotskij in May 1989.

Once again we were treated to some excellent DX openings during September, with 10m positively buzzing with Pacific and Asian DX day after day. It was interesting to note the vagaries of propagation - at times KX6 was coming in short path (over the North Pole) while, at the same time, KH6 was workable long path. You just have to keep that beam turning!

Tony, VP8BRR and Steve, VP8BBB continued to put in appearances from South Georgia. Both are scientists with no previous experience of amateur radio, and had trouble understanding what all the fuss was about! By now they will have had to take the antennas down for the seal breeding season, or the seals will simply demolish them. However, some further operation may be possible before Tony leaves Bird Island next March.

DX News

JX1UG is now operational from Jan Mayen Island and will be there until the middle of April. He will be active on 80-10m, both SSB and CW, using an HF beam together with a Butternut vertical for 40 and 80m. LA5NM, who will handle his QSLs, made a plea for some consideration for JX1UG, particularly on 80m.

LF openings to distant parts can be very short from those northern latitudes, and LA5NM asks that European operators be prepared to stand by while JX1UG looks for more distant QS0s. LA5NM notes that very often the DX end of 80m is full of strong Europeans working strong East Coast US stations for hours on end, thus preventing truly DX QS0s from taking place.

VE31EO is widely reported as organising a major Pacific DXpedition starting next January and taking in KH5, KH5K, ZK1 (both North and South) and T32. The crew will consist of HB8AAE, HB9AHL, F51I, NM2L, ZF2KN, KD2HE and VE31EO himself. They are currently seeking loans of gear as well as financial help. Sounds like an interesting one to look out for although, having seen the slides of this year's KH5 operations, I wouldn't recommend KH5K to any but the most experienced navigators and operators.

Bernhard, DL2GAC, who made the news earlier this year with his operations from various islands in DJ and 9M6, will join DF5UG, DJ9RB and others in India in January. They will make a special effort on the LF bands and will no doubt be turning up from some offshore islands.

C9MKT, who continues to show up on one or two weekends each month, is now acceptable for DXCC credit. Apparently his activities are monitored closely by the authorities in Mozambique. So, if you work him, keep the exchange to the bare formalities.

Ian, G4LJF, is off on his DXing travels again. He will be in Antigua from 17 November until 3 December and plans to be active on all bands, both SSB and CW. As I write this the callsign is uncertain, though it may be V21LJ. Check the usual DX frequencies (14195, 21295, etc, plus 25 up in QSL).

More rumours about a possible operation from Vietnam. This time the talk is of a one month operation from 21 October by HA5KDO, HA5PP and HA5MY, using the callsigns 3W8DX (on SSB) and 3W8CW (on CW). Some QSL addresses have even been quoted! We can but hope.

DX News Sheet reports that UA10EL will commence a tour of duty from Franz Josef Land around the time that this column appears, and promises lots of activity, especially on 160m CW.

Baldur, DJ6SI, is off again. By the time you read this he should be active from Niger (5U), and will be there until 6 November. As usual, look for Bal on CW, 25kHz above the band edge on 20, 15 and 10m, and just inside the band on 40 and 80m. Bal has been putting on these DXpeditions for many years now, and usually manages to fund them from the dollar bills and IRCs people send with their QSLs. CW only for the most part, both because Bal is a superb CW operator and also because his English is limited. He is always easy to find and work.

The active DXers among you will also remember that Bal was one of the members of the ill-fated Spratly DXpedition in 1983 when two of the operators lost their lives following an attack by South China Sea pirates.

Rick, N6E2Z, hopes to be back in South America between late October and early November and, specifically, plans an operation from the Galapagos Islands from 1 until 4 November. Later in November, KH6JEB hopes once again to
operate /KH7 from Kure Island. Moving into December, 3B6DA will be back in 3B6 on business and hopes to be allowed to operate. Let’s hope he can, as the Mauritian authorities have been reluctant to allow 3B6 and 3B9 operation in recent years and these countries are starting to climb up the ‘wanted’ lists. And another one for December, JF11ST, a well-known DX operator, will operate TA1E from 19 to 31 December. Nearer to home, DX News Sheet reports that G4UOL will sign G4UOL from 19 November until 2 December, CW only.

**RTTY**

Despite the clash with the HF Convention, I was able to operate some RTTY during the CQWW RTTY Contest in September. My contacts included ODS5NG, HD8EX, SB4MD, UL0P/U29FWA, UD/U23PWX and, best of all, a 15m contact with KX60I. The ‘got away’ list included SU1ER, FT5ZB, J52US and NH6I.

Looking to the future, T5GG now has RTTY gear and should be active for several months. Incidentally, the UA3AKR RTTY mailbox on 14088Hz often contains useful snippets of DX information. Type the command ‘INFO’ to download the relevant file.

I note that a couple of packet mailboxes are now operational on 10m FM. DF5FF-10 is on 29250 and EA3BKZ-2 on 29310, both using 1200 baud as per 2m. No download the relevant file.

**Contest update**

In addition to the CQWW CW Contest operations which I listed last month, OH8FP will operate as EA8AGD and NQ4I will be active from 9Y4.

**Japanese DX contest**

I have recently received from Japan the details of a new contest sponsored by Five Nine, a Japanese amateur radio magazine. The contest will take place during the 48 hour period from 2300 GMT on 11 November. Points are gained by working Japanese stations on phone in the 80 to 10m bands. You score 2 points per QSO on 80 and 10m and 1 point per QSO on 40, 20 and 15m. The multiplier is the number of Japanese prefectures worked in all (a maximum of 50 per bandwidth — see map). DX stations give signal report and serial number, while Japanese operators will give a signal report and the number of their prefecture. You can enter as single operator single band, single-op multi-band, or multi-op multi-band. There will be a variety of certificates and plaques for leading stations in each category. Single operators are restricted to a maximum of 24 hours of operation. I have copies of the cover sheet and full rules if required. Entries should be sent to: Five Nine, Box 8, Kamata, Tokyo 144, postmarked no later than 31 December.

6/7 December list out for the TOPS CW Contest on 5/6 December, starting at 1800 on the Saturday and running for 24 hours. This contest is 80m CW only and I always find, it a lot of fun.

Early notice now of the UBA contest, run by the Belgian National Society. The CW leg takes place on 28/29 January 1989 and the SSB leg on 25/26 February. Both are for 24 hours from 1300 GMT on the Saturday. Score 10 points for contacts with ON, DA1 and DA2 stations, 3 points for contacts with other EEC stations and 1 point for contacts with stations outside the EEC. 43 multipliers are available per band (80-10), consisting of the nine Belgian provinces (Belgian stations will send a two letter identifier), the various Belgium prefixes plus DA1 and DA2, and the remaining countries of the EEC (with EA6, GM, GW, SV5, etc, counting separately).

I can provide a photocopy of the full rules, address for logs, etc, for the above contest on request. The reason I wanted to pass on details, though, was to mention various associated awards. The highest scoring station in each category (single-op single-band, single-op multi-band, etc) from each country will receive a special award. All participants working at least 40 stations and sending in a log will receive a certificate. Contacts will also count towards the new E-1992-C (European Community 1992) award. This award will commence on 1 January 1989 and requires 144 contacts with the 12 member countries of the EEC. If you work 144 such stations in the UBA contest, with at least two, but no more than 24 per country, you qualify immediately, provided you submit the award claim with your contest entry. Outside the contest, you can qualify for the award by working 144 EEC stations with at least 6 and no more than 20 stations per country. The rules also allow for a mix of contest and non-contest QSOs and the combining of QSOs made in more than one UBA contest. Again, if you need full information please drop me a line and I will send you a photocopy.

Finally, in September I mentioned the computerised 'DX Edge', and I have also mentioned some of the public domain amateur radio software for the IBM. This has prompted Richard Wilmot, GW3RRI, of Technical Software to send me details of his amateur radio software for the BBC, Electron, Commodore and Spectrum computers. One in particular, the UK/Europe Map and Locator, looks of possible interest, as do his various RTTY, CW, SSTV and AMTOR packages. I haven’t had the opportunity to try any of them out, but if you run one of these machines it might be well worth dropping Richard a line to his callbook address for details.
TUNING THE WIRE

by Ken Williams

Less experienced amateurs may often be heard bemoaning the fact that, although they were most careful in cutting their aerials to the correct dimensions, the VSWR on their feeders is still far from optimum.

As we saw, however, in the two previous articles in this mini-series, there are many factors which can affect the resonant length of an aerial. Although the published figures are an excellent guide, the final length must always be determined by experiment. This article is devoted to the gentle art of tuning aerials.

Test equipment

The physical length necessary to achieve resonance for an aerial is affected by nearby objects, be they buildings, trees or even the earth. The object of tuning is, therefore, to compensate for the effect of these so that the aerial presents a good match to the feedline.

In the case of a perfect match, at resonance the aerial would present a pure resistance to the feedline. Off resonance, a reactive component would also be present — capacitive at lower frequencies and inductive above.

In practice, a perfect match is rarely obtained and these effects are exacerbated. It is, therefore, desirable to strive for the best possible match and try to ensure that any combination of impedance and reactance ‘seen’ at the bottom of the feeder cannot possibly damage the transmitter.

The basic aerial test instrument is the VSWR meter which gives a measure of the power being reflected back down the feeder. For this purpose the relatively inexpensive meters available are quite adequate for they are reasonably accurate at low VSWR values and at higher ratios will, at least, indicate the effect of any aerial adjustment.

The second instrument is the RF noise bridge. Of these, the simpler models will measure the impedance presented to the transmitter while the better ones will indicate both this and the reactive component on the feeder.

I have seen aerial tuning instructions which suggest the use of a grid dip oscillator to determine resonance with the aerial at low level. I am not, however, in favour of this technique for, in raising the aerial to operating height, both the resonant frequency and the radiation resistance will change. I feel that the technique of measuring the parameters indirectly, with the aerial at operational height, is preferable.

The exception to this is in the optimisation of VHF beams which can be adjusted quite successfully at only a few feet above the ground, provided they are pointing vertically upwards.

Physical construction

A basic dipole aerial is a piece of wire of specific length suspended above the ground, divided at the centre at which point the feeder is attached.

Insulators are fitted at the extremities of the wire and at the centre, the latter also providing support for the feeder. If the coaxial feeder is in use, the latter may also incorporate a balun.

The length of a half-wave dipole is 468/F feet, where F is the frequency in megahertz, this dimension making allowance for electrical length, etc. In the case of an aerial operating on a harmonic, the length is (492[N-0.05])/F feet, where N is the length in half-wavelengths and F is the frequency.

A simple computer program is included with this article for these calculations.

Although the wire must be of a specific length, as we have seen, this may be affected by the presence of nearby objects. Provision must, therefore, be made for easy adjustment.

The author has found two techniques for this. The first uses one segment of a very large ‘chocolate block’ connector to secure the aerial wire to the insulator. By passing the wire through the connector and insulator and back through the connector, a neat and secure yet easily adjustable termination is achieved.

Alternatively, secure the insulator a short distance before the end of the aerial, leaving the remainder hanging down for adjustment with a pair of side cutters (Figure 1).

In the former case, the initial aerial length should correspond to a little more than that for the low frequency end of the band. In the latter, the distance between the insulators should be a little less than for the HF end of the band. A ‘tail’ is then added which brings the total length up to that for the LF end of the band.

The feeder may be of balanced twin or coaxial cable. The former has the advantage of being lighter, less lossy and less obtrusive. A balun may be placed at the operating position to convert the balanced feed to the unbalanced output of the transmitter or aerial matching unit. Alternatively, some AMUs incorporate a balanced output for direct connection to such feeders.

Where coaxial cable is used, the balun is used as the centre piece of the aerial. The balun need not necessarily be of the traditional ferrite type. There are several alternatives, including one used by several eminent operators, which is merely a coil of six turns of the feeder about six inches in diameter, the whole being held together with two or three ties.

The aerial should be made from semi-hard drawn copper wire. If soft copper is used, over a period it will stretch and the resonance will lower. It will also be more susceptible to breakage in high winds or icy conditions. The aerial should also be erected as high, and as far, from nearby objects as possible.

First tests

With the aerial erected, connect the lower end of the feeder to a VSWR meter and from there directly to the transmis-
ter. Do not put the AMU in circuit.

Turn the VSWR meter to maximum sensitivity and apply just sufficient power from the transmitter to drive the meter to the ‘calibrate’ mark. Measure the VSWR at every 50kHz across the band, recording the figures.

From these, it should be obvious at which frequency the resonance lies. If the advice given previously that the aerial should be initially cut long has been taken, this should be at the low end, or even outside the band.

If the resonance is obviously outside the LF end of the band, shorten the aerial by an amount corresponding to about 200kHz. If resonance is within the band, shorten to bring the resonance to the part of the band most frequently used. The length increment per 100kHz is calculated in the computer program on page 32. If no such machine is available, use increments of one inch at each end on 10m; two inches on 20m; four on 40m and eight on 80m.

If the resonance is found to lie HF of the desired frequency, obviously the aerial will have to be lengthened. If the chocolate block method of adjustment is being used and all adjustment has been used up, the only alternative is to add a ‘tail’. If the alternative method is used, there should be no problem in extending or replacing the tail.

When the minimum VSWR has been obtained at the required part of the band, perform a last measurement of VSWR every 50kHz across the band and record the figures in the station log for future reference.

It is now time to replace the VSWR meter with the noise bridge and measure the impedance at which the transmitter is looking.

As we saw in a previous article, the VSWR represents the ratio of the impedances of the aerial to the feeder. So, although the VSWR may be approaching 1:1 at resonance, at the edge of the band this may rise to 3:1 or higher. If the feeder is 50 ohms, this could mean that the transmitter is looking at 150 ohms, which would limit its output to some degree, but it could equally mean that it is seeing 17 ohms. Although with valve transmitters this is of little importance, with solid state equipment, instability or even destruction of the PA transistors could result.

While a good AMU should take care of such problems, this is not always the case and, as they say, forewarned is forearmed and precautions can be taken. This could take the form of moving the resonance of the aerial sufficient to ensure the lowest possible VSWR at each end of the band consistent with reasonable VSWR on the frequencies most commonly used.

With the noise bridge connected, perform a plot of the impedance across the band, recording the figures in the station log. It would also be interesting to draw graphs of VSWR and impedance on the same axes and compare the impedance with VSWR (see Figure 2).

In conclusion, if the dipole is being fed with 50 ohm coaxial feeder and the noise bridge indicates that the impedance at resonance is around 70 ohms, consider replacing the feeder with a length of 75 ohm coax or twin. The converse is also true.

If the dipole measures a very low impedance, such as 20 to 30 ohms if the aerial is on the LF bands, consider feeding with a quarter wave length of 50 ohm feeder. This would act as a quarter wave transformer to give the transmitter a much higher impedance.

**Long dipoles**

We saw earlier in this series that dipole aerials could be operated on odd harmonics of their fundamental resonance. However, due to the difference between the electrical and physical lengths of aerials, this is not quite true.

The only case where this is useful on the HF amateur bands is on 40 and 15m. Unfortunately, a half-wave dipole resonated at 7.0MHz is 66.8ft long while three half-waves at 21.4MHz are 67.8 feet.

An aerial cut to the compromise length of about 67.5 should perform reasonably adequately on both bands.

In practice, the wisest course would be to erect an aerial of a compromise length and perform a VSWR plot for each band. From these, considering the relative importance of each band to the station, make suitable adjustment, permitting the higher VSWR to exist on the less important band.

**Parallel dipoles**

The adjustment of parallel dipoles attached to a single feeder is exactly the same as for a single dipole. Each will affect the others to some slight degree but this will be compensated for in the adjustment techniques described earlier. It would probably be advisable to adjust the highest frequency dipole first.

When all dipoles have been resonated, perform a second set of frequency/VSWR plots to ensure no further interaction has occurred.

**Multiband trap dipoles**

The multiband trap dipole is a compromise aerial which operates as a dipole on 80 and 40m, as three half-waves on 20m, five on 15m and seven on 10m. Provided it is erected well in the clear and at a reasonable height, the compromise will, in general, hold. However, in many cases the user has neither the length or the necessary height and as a result the aerial has to be bent to be contained within the available space.

In such circumstances, proximity to nearby objects affects some bands more than others with the inevitable result that the overall compromise is lost and the aerial will no longer be effective on all bands. Under such circumstances the best which can be achieved is to make the aerial effective on the most used bands and gracefully accept defeat on the others.

On erecting the aerial, the first task is to resonate the 40m section between the traps. Contrary to the belief of some amateurs, this section does not resonate on 21MHz for the traps are ineffective at this frequency.

<table>
<thead>
<tr>
<th>Band</th>
<th>Length (FT)</th>
<th>Variation 100kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5</td>
<td>133.7</td>
<td>3.6ft</td>
</tr>
<tr>
<td>7</td>
<td>66.8</td>
<td>0.9ft</td>
</tr>
<tr>
<td>10</td>
<td>46.3</td>
<td>0.5ft</td>
</tr>
<tr>
<td>14</td>
<td>33.4</td>
<td>0.3ft</td>
</tr>
<tr>
<td>18</td>
<td>25.9</td>
<td>0.14ft</td>
</tr>
<tr>
<td>21</td>
<td>22.2</td>
<td>0.1ft</td>
</tr>
<tr>
<td>24</td>
<td>18.8</td>
<td>0.9ins</td>
</tr>
<tr>
<td>28</td>
<td>16.7</td>
<td>0.7ins</td>
</tr>
</tbody>
</table>

**Fig 2:** Plots of VSWR and impedance of a typical 80m dipole
Remembering that a trap operates effectively as an insulator, the centre section acts as a dipole and adjustment is the same as detailed earlier.

The next task is to perform VSWR/frequency plots for each of the other bands in turn. At this point it will probably be useful to also plot these graphically. Note the frequency at which the aerial resonates on 80m. This will normally be in the upper part of the band and will not change substantially throughout future adjustments.

Examine the plots for the 20, 15 and 10 metre bands, noting whether a resonance falls within or near (ie VSWR less than about 5:1) any of these.

It is now a matter of selecting for which of the DX bands the aerial will be optimised. From the plots it may be noticed that a slight increase in length will bring one or two bands into resonance.

Alternatively, a decrease will bring in a band which is considered more desirable. The final decision is a matter of operator choice based on the operating practices of the station.

Having decided on which DX bands the aerial will be optimised, the variation in length can be determined from the computer program.

It should be noted that it is unlikely that a very low VSWR will be achieved on any of the DX bands for at these frequencies the radiation resistance of a dipole operated on multiples of its fundamental frequency increases, reaching about 130 ohms when seven half waves long.

As previously, the final action is to record VSWR and noise bridge plots in the log for future reference.

The G5RV

The design of the G5RV multiband dipole leaves little room for adjustment. The matching stub acts, in many ways, as an extension of the horizontal wire. In general, therefore, it is more convenient to adjust the length of this stub than the main aerial wire.

The first task in optimisation is to perform VSWR plots for each band in turn from which may be determined any necessary adjustments. Provided it is remembered that any adjustment affects all bands, a reasonable compromise tuning may be reached.

Feeder checks

Unless brand new feeder is being used it is wise to check that all is well before incorporation in an aerial system. This task may seem daunting but a simple technique is described in the ARRL Antenna handbook.

One end of the feeder is short circuited and a low level of RF is fed to the other end via a VSWR meter. The VSWR obtained is compared with a graph (see Figure 3) from which the loss at that frequency may be determined.

General

On reading the foregoing, the basic principles of tuning any aerial are evident. A VSWR plot is first taken and, from the results of this, any necessary adjustment in length may be made. Having completed this, an RF noise bridge plot is made to confirm that the feed impedance is a reasonable figure and, if not, to warn of impending trouble if solid state power amplifiers are used.

On bands where a low VSWR is impossible all is not lost for, even with standing wave ratios up to 5:1, on high frequency bands...
Fig 4: The ARRL Handbook method of checking losses on coax cable

frequencies feeder losses on coaxial cable are not excessive and if balanced twin is being used, they will be even less. These losses are essentially due to the dc resistance of the feeder conductors. All RF reaching the aerial will eventually be radiated if only because it has nowhere else to go.

In such circumstances the only likely problem is matching the feeder to the transmitter, for many commercial aerial matching units are not capable of handling such high VSWRs.

Conclusion

By following the general principles outlined almost any simple or multiband dipole may be resonated on one or more bands. Requiring only two relatively inexpensive instruments and patience this will pay handsome dividends, particularly in terms of ease of matching the feeder to and safeguarding the transmitter.
Slide switches

The biggest problem with a useless slide switch is finding a replacement with mounting holes that are the same distance apart. I must confess that I have given up and now tend to modify them myself (Figure 1 explains all). I bought a big box of slide switches for 50p that seemed to have their mounting holes closer together than most. When a slider is required, I use one of these and turn the holes into slots with a pair of cutters.

Another annoying problem is when the moving part of the replacement switch (normally black) will not go through the front panel cut-out of the item under repair. To rectify this, file the front panel and open up the cut-out. I have not had much success filing the black piece down on the switch. Even if you file down what will become the underside of the switch, it always looks a little rough.

The biggest enemy of the humble slide switch is heat which is either coming off other components, or generated within the switch due to overloading. If the plastic piece is distorted, it is time for a replacement.

The other great enemy is grit, particularly sand. I once spent an enjoyable morning repairing a colour video camera after someone had accidentally buried it in sand on a beach. The slide switches came up like new after being carefully taken to pieces, washed in solvent and re-assembled.

Oscillating IFs

'The BFO is on, even when it is switched off', wailed the dejected owner of the set. The other components, or generated within the various stages in the set.

If you have straight oscillation then it should not be too hard to cure, since we are only talking of one or two valves or transistors. Look at the IF stages. Are any cans or screens missing? If not, it is a good bet that a capacitor of some sort has ceased to work. Liberally use a similar value of capacitor across everything in the area (one at a time) and when the trouble stops, you have got it. No capacitors across those tuning the IF cans though!

If this does not solve the problem, go across each capacitor with your v.o.l.m., move the switch; set anything? No? It's really not your day, is it?

Oscillation does tend to say that the active device, be it valve or transistor, is capable of gain, so it probably really is innocent. This only leaves the resistors to think about.

In the case of the set under discussion, there were 150 ohm resistors in series between the collector and the IF coils and one of these had decided to become a dead short. This is unusual. If all else fails, solder a resistor across the collector part of an IF coil. Start with, say, 1k and go up until it oscillates, then back down a little. It will widen out your IF but this is often negligible. After all, if the set is on the verge of oscillation, the positive feedback is probably sharpening it back up for you.

Repairing it logically, part II

A few months ago, I detailed how to repair an 'average' receiver (if such a thing exists) by working through it, stage by stage, forward from the audio amplifier. Another approach is to put a signal at the front end (ie into the aerial socket) then follow the signal path back through with a 'scope. This technique is more or less restricted to owners' signal generators and oscilloscopes.

Ideal for this was a Trio JR500 receiver that came in the other day. Bags of hiss and all sounding quite lively but mega deaf, like 10mV up the aerial hole for a slight 'squark' out of the speaker. I must confess that the best clue was right there in front of me, the pre-selector knob was not peaking on any band, but I ignored this and decided to use the 'follow through' technique.

With the 10mV up the aerial socket, a 'scope on the anode of the RF stage showed almost the same again. This really was a breakthrough. The incoming signal is at a nominal 50 ohms, which will be transformed to a higher impedance by the input tuned circuits. Therefore, more volts than the 10mV should have been on the grid, and many more should be on its anode. A good replacement was used but there was still no change. An inspection of the valve base showed no volts missing and everything was more or less correct. It was now time to look at grid 1 with the 'scope.

There was less than 10mV, and no peaking. The pre-selector tune, a shiny variable capacitor, which was quite solidly bolted to the chassis with all its screws intact, was not making contact with the earth. I undid the screws, did them back up and all was well.

To return to the 'work back from the aerial' technique, the first stage, assuming an RF amplifier, should be contributing 10dB or so of gain. Give your circuit generous allowances for impedances and matching. Thus, 10mV input should be giving you at least 100mV or so up the mixer. The reason for using 10mV input is that this is the minimum you can expect to see on your aerial 'scope which is tuned-up with an X10 probe. Put a bigger signal in and you will start overloading the set.

Mixers

This is probably the most difficult stage to work through. There is usually a loss through a mixer stage, thus your 10mV, which became 100mV thanks to the efforts of the RF stage, will now be down to 50mV or so on the input to the first IF stage active device. Note where we are looking (after the IF coil). This is because there is so much junk lurking on the anode/collector of the mixer (oscillator breakthrough, other mixes etc) that you cannot reasonably expect to see the wanted signal. It is also worth remembering that selectivity is now involved, the receiver needs to be accurately tuned to the signal generator.

Fine, super. You have a non-working set that probably isn't too accurate on its tuning anyway, and some fool is suggesting that you accurately set it onto an unstable signal generator? OK, have a look at the mixer anode/collector and swing the generator about the required frequency. It's a good idea to have about 1kHz mod on the incoming signal (look at that on the 'scope) and tune bases, nice and slow to suit. As you swing
the oscillator about you should notice a fairly sharply defined change in the muck you are looking at. Note how many kHz of swing you can make on the signal generator, probably 100kHz or so in the case of an HF receiver, then transfer the scope to the first IF input and swing again while looking for a peak.

The anode/collector of the first IF should really be humming and there should be yards of signal there, a volt or so at least. The detector (which is after the next IF) should have tens of volts floating about.

It is a good idea to practice this 'work through backwards' technique on a good receiver before using it in anger. It is not as simple to repair as going forward from the speaker, but it's worth considering if there appears to be plenty going on in the 'dead' set.

**GDOs**

Grid Dip Oscillators. Well, valve ones are. These are solid state equivalents that have carried on the generic name. GDOs are an extremely versatile tool. Although I have access to magnificent test equipment, there are still times when a twenty-five year old Electroniques valve mains powered GDO is indispensable.

The basic idea is that, in a valve oscillator, the grid current will change a little when the oscillating coil comes into close proximity to another coil which is resonating at the same frequency. Thus, the thing is an oscillator as well as a simple signal generator. Most GDOs have a facility to stop them oscillating and the meter can be used as a (tuned) field strength meter.

The prime use of a GDO is to 'see' where a coil/capacitor combination is tuned. You simply hold the 'unknown' near the GDO and tune for a response. Incidentally, after getting a response you will know the capacitance and the frequency, you can thereby work out the inductance of your unknown. The GDO can now be used as an inductance meter. After establishing the inductance, change the capacitor and find the resonant frequency. You can now work out the new capacitance and use the GDO as a capacitance meter.

One clever trick is to couple an aerial into a GDO via a couple of turn loops and find the resonant frequency of the aerial. This facility is absolutely brilliant for 10m aerials and CB enthusiasts.

How much does it cost for such a wonderfully versatile bit of kit? Second-hand valve ones will cost around ten to twenty quid. Solid state GDOs are more expensive at around fifteen to twenty quid because of their variety of uses. The 'Tradiper' (see photograph) is one I bought five years ago for a tenner and it has often helped get me out of a few tight corners.
News and comment from Glen Ross G8MWR

First of all this month, I would like to mention a couple of items relating to six metres. The first, is that reports are coming in of an opening to South Africa at around lunchtime on 27 September. This event coincided with a massive increase in the sunspot count which took it to the highest levels seen so far in this cycle.

There are no details to hand yet as to just what was worked, but it does seem from the reports available that the opening was restricted to the southern part of Britain. Certainly, by the time I got on the band at around 1.30pm there were no signs of any activity in the Midlands. Within the last year we have had openings to the United States, Canada, the West Indies and now South Africa. With band conditions steadily improving over the next few years, it looks like being an exciting time on six metres in the future.

Nasty noises

We are starting to receive some semi-official noises from the powers that be with respect to certain signals on 50MHz that are, to say the least, just a little larger than might be expected within the current regulations. Linears running 100W and more, were available commercially in the permit days and are obviously still around. It is also not too difficult to build a PA using readily available valves that will easily push out around 200W. Feed these to a pair of stacked four element beams and you have a very large signal.

Out of order

The problem is that unless you are using damp string to feed the aerials, this is completely unlawful. The word is out that the authorities are starting to have a serious look around. I suppose the real problem is that if you are the sort of person who bends the rules simply to get a good squares and countries score then nothing, short of getting caught, is going to stop you.

Information

The DTI does a lot more than simply issue licences to deserving amateurs. Another of their functions is to provide information on many aspects of radio usage. At present, they have ten different leaflets and books which are of specific interest to amateurs. These cover everything from how to become a radio amateur, through to things like how to get a repeater licensed.

The nice thing about the DTI is that the information is available free of charge. To find out just what is available ask for listing BR 81. The address for your enquiry is: Library Service, Room 605, Waterloo Bridge House, London SE1 8UA.

The think tank

The comments I made on the RSGB’s thinking behind the new student licence have certainly raised a lot of interest. As expected, most of those who already have a licence said we did not need a novice grade, while those who are not licensed said we did! The tank is still leaking and I can now give you some more of the ‘behind the scenes’ deliberations. One of the ideas is to encourage youngsters into short wave listening, which is an excellent idea.

To make sure that they are genuinely interested, there is a proposal that they will have to present a number of QSL cards (the actual amount has yet to be determined) before they can take the licence examination.

Examinations

It has been suggested that the exam should be drawn from a bank of about a thousand questions and that the exam should be marked on the spot by ‘accredited’ amateurs and that the candidate should be told their result there and then. This could put the examiner into a few tight spots. It would, however, be a liberalisation of the system and could eventually lead to similar marking in other areas.

Licence types

Three different types of licence have been under consideration. The first goes back to our old friend the ‘Artificial Aerial’ (or non-radiating) licence of pre-war days. This would enable new licencees to build keyed and modulated oscillators of restricted power and on specified frequencies. The second type is the ‘Supervised’ licence. The first stage to this would be to extend the greetings message capability from special event only status to all stations.

One up

The second stage would be to allow a defined class of people supervised operation of any amateur radio station. Just who would make up this defined class is anyone’s guess. Any such general facility would require a revision of the present licences, but there is also the idea of issuing special permits to certain amateurs.

The student

This is the real meat of the job. It seemed likely that this would result in a low power CW licence with a small frequency allocation and this is still a strong possibility. However, there have been thoughts of a much wider base. 50MHz has been suggested as ‘primarily for data’, 430MHz is listed as ‘FM and data’, with 1.3GHz as ‘wideband TV and data’, whilst 10GHz is presented as ‘suitable for lab type experiments, TV and data’.

Incentives

It seems that there must be a limit on the time that the licence can be held. The open-ended approach that is used in the USA has resulted in a huge population of amateurs who own a hand-held and operate through the local repeater. It seems that they are not interested in moving on to greater things. The RSGB recognises this problem when it asks, ‘Do we want a large permanent population in the student licence class?’

The gear

The RSGB thinks that it should be home-made and, to avoid big problems, possibly built ‘under supervision of a technically competent person’. Another way of keeping out of trouble would be to require the use of one of a range of ‘approved designs’ which could be supplied as kits or, and this seems to defeat the idea of promoting home construction, ready-built units.

As far as VFO or crystal control is concerned, the RSGB looks both ways at once saying that there are strong arguments for crystal control’ but that a VFO may be better used in some bands.

New society

At present, the RSGB has about two hundred associate members and they feel that many of the newcomers would not join on this basis. The idea is to set up a new society especially for them. This will probably be known as the Young Amateurs Radio Association, or YARA. It is intended that this should be open to anyone under eighteen who holds any
class of amateur radio licence. Perhaps this signals the death of associated membership of the RSGB? It would be run as a separate organisation and the young members would decide the policies etc of the group. The RSGB says 'Young people are quite capable of doing this if correctly motivated'. Judging by what goes on at the normal AGM, it seems that the same officials do not think that older members have the same capability!

It is also on the cards that a questionnaire asking for views on the subject will be placed in magazines other than Radcom, to obtain ideas of non-members of the RSGB. The mole is still at work and more background news will be brought your way as soon as it is available.

Our awards

This time and update and this time we have claims from G6MXL, who comes from Poole. He goes first for a Gold award on 144MHz where his best DX was 1386km to OK2WCK. Other nice calls noted were L2XGB in Luxembourg and UT5DL in the Ukraine. He next claims a 402MHz Silver award with some nice contacts being made to OE5KMK and EA1BLA; the best distance on this band being 862km. This distance is nearly equalised in his claim for a Bronze award on 1296MHz. His best contact is 819km to HB9AMK. The interesting thing about this is that he only runs two watts on 23cm. This result really shows what a superb band 23cm is when it is open; perhaps this is the signal why so many people bypass 70cm and move straight up to the higher frequencies. If you want information about the awards, send an SAE to the address at the end of this article.

10GHz

This year's cumulatives have now come to an end with some very high scores being returned for the series. An interesting point has been the big increase in SSB activity. Actually generating SSB at these frequencies is not too difficult. Trying to make the signal stable enough to read is a different matter altogether though. The main difficulty is due to temperature changes on hilltops moving the frequency of the crystal oscillator in the transmitter. A slow drift can be tolerated as it simply needs the receiving station to chase you with the RIT control.

The big problem can be best described as 'wobble' as if the signal is trying to make it there and it is very devil to cure. The fact that so many people have managed to get good signals on the band is a great credit to them. Like all good things, the completely built 10GHz station is starting to succumb to the inroads of commercial gear. Perhaps we should not lament this too much, as it shows that a lot of people are interested in the band; otherwise the manufacturers would not make the gear. 24GHz has also seen more use this year, mainly using wide band FM. This is now becoming the home of the 'everything here is home-made, old man' brigade.

Contests

The next VHF contest is on 30 October and is a leg of the 1.3/2.3GHz event. This is followed on 6 November with the 144MHz cumulative. The following day sees the 432MHz cumulative. The Club Class contest is held on 12 November. Two more cumulative finishes the month out, with the 1.2/2.3GHz on the 15th and the next leg of the 432MHz on the 23rd. The rules for all of these events can be found in various editions of Radcom.

Close down

That is it for this month. The postal strike has done nasty things to the incoming mail, but the trusty Prestel machine has been keeping me in touch with the world. Please contact me direct at: 81 Ringwood Highway, Coventry, or on Prestel using 203616941. Good hunting.

Please note: * VAT & carriage (also VAT) must be added to all prices * VISA & ACCESS orders welcome
Integrated circuit technology has made many inroads into RF circuit design and construction. This has been made possible by devices like the Plessey range of RF integrated circuits. Devices like the SL610, SL611, SL612, SL640 and SL641 RF amplifiers and mixers have established themselves with amateurs and professionals alike. In fact, the famous G3ZVC design for a simple transceiver uses them and it has formed the heart of many an amateur project. The use of these ICs has enabled the design to be simplified so that a simple board forms the heart of the sideband transceiver. Only an external local oscillator, RF amplifiers and filters are then required.

Of the ICs in the Plessey range the SL610, 11, 12 and SL640/41 are the most commonly used. The SL610 and 611 are RF amplifiers whilst the SL612 is an IF amplifier. The SL640 and 641 are RF mixers.

Amplifier specifications

The three RF amplifiers; the SL610, 611 and 612 are similar to one another in many respects. They have the same pin connection as shown in Figure 1. However, the gain and bandwidth figures vary to enable them to fulfil a wide range of applications. The SL610 has a gain of 10 and an upper bandwidth of 140MHz at -3dB, whilst the SL611 has a gain of 26 and a 100MHz bandwidth. Finally, the SL612 has a gain of 50 but its bandwidth only extends up to 15MHz.

For all of the ICs a supply of 6 volts is recommended but they will tolerate up to 9 volts. Their supply current is typically 15mA which means they consume about as much as a single transistor stage. Whilst looking at their supply requirements it is worth mentioning that these ICs do have their own internal decoupling. Although this is often adequate for RF decoupling, any low frequency components of ripple need to be properly filtered so that they do not cause any intermodulation.

An AGC facility is provided on all three of the chips. This is controlled via pin 7. If this connection is left open circuit, or it has less than 2 volts applied then the gain remains at its maximum. As the voltage is increased the gain is reduced until the voltage reaches its maximum of 5 volts. At this point the gain is reduced by around 70dB in the case of the SL610 and 611 or 70dB in the case of the SL612.

Operation

These amplifiers are very easy to use requiring only a very few extra components around them to produce the complete circuit. As an example a simple one stage amplifier is shown in Figure 2. From the circuit it can be seen that the two earth pins (4 and 8) are connected to different points. In fact, it is particularly important that pin 4 is associated with the input circuitry whilst pin 8 is associated with the load. If the two pins are directly connected together there is a risk that the common series resistance in the earth line may give rise to instability.

It is also worth noting that it is necessary to use a series resistor in the output if the IC is going to drive low impedances, ie 50 ohms or so. The resistor should be placed in series with C2 and should be around 50 to 100 ohms. This resistor is needed because driving a low impedance load directly tends to remove the internal negative feedback. This results in poor linearity, instability and poor gain control. The inclusion of the series resistor ensures there is always sufficient negative feedback and that the circuit operates correctly.

SL640 and SL641 mixers

Apart from the amplifiers there are also mixers which are available in this series of ICs. The SL640 and SL641 are both double balanced mixers capable of use up to 70MHz. They differ in their output circuitry. The SL640 has two outputs. One includes an integral load resistor and the other is an emitter follower. The SL641 has only one output and does not have an integral load resistor. This is because it is designed as a current drive for a tuned circuit.

The supply for these ICs is basically the same as for the SL620 series amplifiers, ie nominally 6 volts. The current drawn is reasonably low. Typically either IC will draw about 10mA, but it is wise to allow up to a maximum of 17mA in the case of the SL640.

The performance of the SL640 and 41 means that they are more than adequate for the majority of communications applications. They have a gain of approximately unity over the signal path and can

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**Please note:** The images and diagrams are not provided in the text. For a complete understanding, please refer to the original document.
operate with signals up to 200mV rms. In
addition they offer a 'worst case' signal
leakage of -18dB for the SL640 or -12dB
for the 641. Carrier leakage is also
specified and this is -20dB for the 640
and 112dB for the 641. These are worst
case figures and the typical figures mean
that a good improvement on them could
be expected in most cases.

These parameters, coupled with the
ease with which they can be used, means
that these ICs can find uses in receiver
mixers, transmitter modulators, and
even frequency synthesizer phase com-
parators.

Mixer circuits
Like the SL620 amplifiers these mixers
are easy to use. This can be seen from the
basic circuits for using these devices
which are shown in Figure 3.

When designing or building circuits
using them there are a few points which
should be noted. Firstly the supply rails
should be well decoupled for low
frequencies as well as radio frequencies.
This is because even small amounts of
signal on the supply can seriously
degrade the leakage performance or
introduce intermodulation.

Decoupling is also important on pin 2
of the IC. This is an internal bias point
and should be connected to ground via a
capacitor. The value of the capacitor
should be calculated so that it is a low
impedance at any of the frequencies
likely to be used.

It is also necessary to connect pin 1
directly to earth. As this pin is connected
to the can it must be grounded to screen
the IC itself and prevent pick-up of any
unwanted signals.

Apart from the basic precautions
required to ensure the IC operates
properly it is also possible to improve its
performance by adding a few extra
components. In particular, it is possible
to reduce the level of signal and carrier
leakage by the addition of two potentio-
meters. Using the circuit shown in Figure
4, it is possible to obtain a null in both the
level of signal and carrier leakage. Whilst
this facility may not be required in most
applications it can be useful sometimes.

Fig 4: Signal and carrier leak adjustment

For the future
These ICs have been used in many
designs over the years and have proved
to be very successful. They provide a
cheap and easy solution to many prob-
lems and as such they have found favour
in several areas. However, Plessey, the
manufacturers, have not been satisfied
to let new technology pass them by. They
have introduced new ICs on to the
market. In fact some of their chips
contain a single conversion receiver and
are well suited to NBFM applications.
Other ICs of interest are their high speed
dividers which synthesizer addicts may
want to use up to frequencies of 1GHz or
more.
We have all heard the high pitched squawking, chirping, growling and all manner of ‘interference’ from QRM (man made noise). To the listener it can either be a pain in the rump or the target for some research, all depending on your interests.

The many noises we hear can come from a number of sources and, if we are interested, their translation can become a hobby in itself. All you need is a computer to hook up to your receiver and a couple of programs.

First, let’s have a look at some of the noises you will hear while tuning on the radio spectrum and it’s up to you to look for them yourself, or get the necessary guides to help you.

Morse code is the mode we are most familiar with. It is easily identified by its rhythmic ‘dots and dashes’ and is still in use by many ‘official’ sources, as the signals are easily readable even in noisy conditions. The speed at which Morse can be sent enables messages to be passed very quickly and although the amateur examination only requires a speed of 12 words per minute to be sent and received, many amateurs can operate at 50 words per minute! Machine sent code can be 250 words per minute or more.

There are many dedicated ‘code readers’ who can translate Morse quickly and accurately. For those who wish to improve their knowledge of Morse code, there are programs available that are compatible with most home computers. It is best to use a filter between the receiver and computer, as signals close to the one selected can corrupt the translation. Amateur Morse can be heard on the lower ends of the amateur bands (below 20m), Commercial Morse can be heard almost anywhere, including on the amateur bands. Some is sent or received in plain language while much is sent or received in letter code which, unless you have access to secret codes, will be of little use.

Other sources of QRM

RTTY or ‘Radio Teletype’ can be easily recognised from its two-tone ‘warbling’ sound and is used extensively by news agencies as well as embassies and commercial interests. Originally transmitted and received by electro-mechanical instruments (such as the Creed machines), the use of computers has made reception of these signals a simple matter for the interested listener. As with Morse, programs are available for all the popular computers or, alternatively, code readers can cope with RTTY.

Filters are advisable as RTTY can be ‘corrupted’ by close proximity signals, but the filter should not be too narrow as the high and low tones must be present to translate the code. Amateur RTTY can be heard around 80kHz up from the bottom band edge, eg 14080 and 21080 etc. News agencies can be heard around 10433, 10250, 14760, 16341 and many other frequencies.

SITOR is a refined sort of RTTY, offering greater operational accuracy. It is primarily used by marine services for ship to ship and ship to shore communications. An amateur version called AMTOR is derived from the original system by G3PLX. This mode is also translatable by dedicated code readers or computers and can be recognised by their cricket-like chirping. AMTOR can be heard just below the RTTY frequencies and SITOR can be heard around the other bands (try 4344, 6363, 8717).

SSTV (Slow Scan Television) is a method of transmitting low definition pictures within the narrow radio bandwith. Although ‘moving’ pictures are impossible, the complete frame takes too long to build up so movement is extremely jerky. Generally, still pictures are transmitted and these can either be ‘live’ (using a video camera) or computer derived. SSTV amateurs of station will send QCO calls in text and, after making a contact, will transmit test pictures or a test card design showing his callsign. With modern computers, some of these pictures can be very good indeed and, in fact, photographs are often sent between stations. The signal is a very chirpy one and easily recognised. It can be translated using a suitable computer program. The busiest frequency is around 14230.

Fax (facsimile transmission) is used by weather stations, news agencies, security agencies and, nowadays, by businesses; although most of their transmissions are made via a telephone link.

The pictures are produced by scanning a drum holding the original with a spot of light. This is picked up by a photocell or a similar device which converts the picture to radio frequencies (more modern systems use a flat-bed system, similar to a photocopier). The faster the drum speed, the better the quality, so a speed of around 240 lines per minute is used for detailed weather maps and charts. The signal is, once again, easily recognised.

A high pitched tone holds the frequency open and, when the detail is being transmitted, this is accompanied by a ‘grating’ noise which varies with the intensity of the picture being sent. It can also be translated using computer programs. At the moment, there are few of these around and those currently available are mainly for the BBC models.

Now to the ‘how to get into it’ bit. You will have gathered that a computer is a must. How much you spend on the computer is a matter for you to decide. Naturally, a high quality one is going to cost a few bob, but it will ensure good quality results. The trouble with this is that various ‘interfaces’ (non-optimal extras) may be required to make the thing run the programs. There are a number of reasonably priced computers on the market which are suitable for our purposes but, and here’s the next problem, the programmers do not write programs for them. So, unless you can write programs yourself (and how many of us can?) it is best to stick to the popular computers.

A failure in battery powered motoring he may be, but Clive Sinclair really did turn the computer industry on its head. The Spectrum line still has the greatest following of any computer in this country and even the Amstrad versions are basically the same. As a result, programs that are produced for the, say, Amstrad Spectrum Plus 2, are usable on the original Spectrum Plus 128K. Conversely, programs made for the even older 48K Spectrum can be used on the 128K. Although regarded as ‘48s’ as unreliable, much of the
problem was caused by removing printers or interfaces while the computer was still plugged in... instant death of the main chip!

The other main contender in the reasonable price range is the Commodore. In various guises, these have also stood the test of time and are still well catered for by software houses. The 64 is the best buy, but there are plenty of programs for Commodore's Vic 20, C16 and +4. (Interfaces are usually required).

The computer usually regarded as the 'beauti' is the BBC. However, it is not colour, and nearly always requires interfacing. The results, however, are excellent and the 'Wefax' colour pictures (from weather satellites) have to be seen!

The monitor can be cheap or expensive, according to the model of your choice. A 12in monochrome television will give you a reasonable result but, if you have bought a BBC 'B', then you'll appreciate the high definition colour monitor. However, if you have a Spectrum, the quality from a 14in portable colour TV will be quite acceptable.

OK, if your budget is tight, you can buy a second-hand Spectrum 48K+ for £20, a mono TV for another £20 and spend a couple of quid for a cassette recorder, say fifty quid for the lot!

You may well ask why I haven't mentioned other computers like the Atari, Electron, Dragon etc. Well, with the first, there are few programs made for them, and the last two have been out of production for some time. Unlike the Spectrum, these computers have never received enough support from the main software houses, although there are still a few programs available.

That gives you an idea of the sort of signals that are about, and what you need to receive and translate them. But what about programs? The chart gives you an idea of what is available. I have not listed all the programs, just those that are easily obtained. Those requiring interfacing are marked with an asterisk.

So, have fun! Let me know what you find out there on the bands!

Awards

Award claims are still coming in regularly, and this month we have a good crop again.

Peter Cain of Newcastle put in his first claims for North America, South America, Africa, USSR, Asia and Oceania. Nice full set, Peter! Some nice loggings in the Oceania list included P29, T25, F00, AH6, ZK1, T30, and lots of VK/ZLs.

Trevor Newstead of Morcambe claimed South America, USSR, Asia and North America. Some nice stuff in there too with VP2, VP6, CO2, TGG, HH2, EX1, BP6, KP2, LR1V, V31, ZZZ, JB7, AP2, HL9, HS0 and OD5.

Geoff Hughes was next in the queue and the printer quality. At a cost of £31.00 getting into fax.

This resets any 'slip' commands you have used and pauses reception during printing.

There are two ways of committing the program for the Spectrum for receiving fax. Not having tried this mode and being a sucker for anything new, I gave my wallet an airing and bought the program with its 'interface'.

The program is produced by JEP Electronics and consists of the software on tape and a small interface that plugs into the access port at the back of the Spectrum. To set up for reception, you plug in the interface, plug your printer into that and then fit the power plug.

In the manual supplied, a few specimen frequencies are given. Choosing 4.782, I immediately found the signal and, with a little fine tuning, a map began to form on the screen. At this time, I remembered that it is always best to read the instructions first. I had a wide blank strip right down the centre of the screen... not a pretty sight! So, to the handbook. I found that a simple adjustment called 'slipping the picture sideways' was all that was needed.

Once I had sorted things out, it was very interesting to see quite a clear weather map forming on the screen. With a little practice, I was able to recognise the British Isles and the Mediterranean.

The next map received was a 'Sea Ice Chart' clearly showing the positions of icebergs. Over the next couple of hours I received a number of different charts and maps.

One of the controls selects the area of coverage of the picture which enables you to select the area you want and enlarge it to fill the screen.

There are two ways of commiting the picture to memory. One allows you to select which screens you wish to memorise, while the other automatically memorises each screen in turn. Once the screens are in the memory, you can dump these to the printer for hard copy. Screens can be printed as received but this resets any 'slip' commands you have used and pauses reception during printing.

The program certainly does what it's meant to and gives very acceptable results even if limited by the computer and the printer quality. At a cost of £31.00 inclusive, it is a fairly cheap way of getting into fax.
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NOVEMBER 1988
Tony Smith G4FAI takes his bimonthly look at the world of dots and dashes

**Bold's first Morse theorem**

Dr Gary Bold, ZL1AN, writes The Morseman column in Break-in, the journal for NZART. Together, we have a useful arrangement, enabling us to pass on to our own readers interesting snippets from the other’s work. Introducing himself in his first column, June 1987, Gary wrote:

‘Why am I doing this? Am I an anachronism from the past (I can remember back three sunspot cycles) espousing the cause of an archaic form of digital communication? A fervent advocate of days that were? No. I just like Morse. I have been speaking it for 27 years and it has become my preferred mode of ham communication.’

He also formulated his first Morse theorem. ‘Every CW Ham has a preferred range of speeds outside of which he rarely operates or listens. The maximum and minimum speeds are in the ratio 2:1.’ He explains: ‘If you can readily copy 20 wpm, you will almost never listen to anything below 10 wpm. … This is completely sub-conscious. The reason for the upper limit is current ability. The lower limit is more interesting. I’ve heard QRQ operators, after tuning over the CW section of a band populated by a few slow, hesitant beginners, announce “the band is empty tonight”.

‘It seems that, to them, code beneath the lower speed limit may not even be “noticed” as Morse. Some tell me they even have difficulty reading slow Morse! So if a high-speed type does not come back to your careful 12 wpm answer to his CQ, maybe you are not being snubbed, maybe you just “weren’t perceived”. Maybe someone will do a psychological study of this someday.’

**EUCW fraternising CW party**

The European CW Association’s major event of the year takes place on 19-20 November. It is to encourage CW operators, of all abilities, to come on the air, to meet each other in a friendly spirit and to demonstrate that CW is alive and well. It is not a contest in the strictest sense, although certificates are awarded to the first three stations in each class. In the true amateur spirit, and out of consideration for other band users, the times and frequencies have been arranged to cause minimum interference to stations not taking part.

All amateurs are welcome to join in, whether experienced or beginner. For members of EUCW organisations there are QRO and QRP classes, while non-members can use any power. There is also an SWL section. In the past there have not been too many UK operators taking part, even though stations across Europe were waiting to work them. Perhaps this year there will be a stronger UK presence now that FISTS has joined EUCW. Members of the G-QRP Club are eligible to participate in the QRP class, transmitting low power and working stations of any power.

The rules have been published in the journals etc. of the various EUCW member organisations and in Morsum Magnificat. Non-members wishing to participate in this event can obtain full details by sending me an SAE at 1 Tash Place, London N11 1PA.

**Happy birthday**

Two years ago I joined with two Dutch amateurs in launching the English language edition of Morsum Magnificat, a unique magazine devoted entirely to Morse telegraphy, past, present and future. Last year my Dutch friends had to pull out and I found myself producing the magazine single-handed. It has not been easy, but MM is still running and goes to Morse enthusiasts of all abilities in some 30 different countries. If you are interested in the world-wide traditions, practice and culture of Morse telegraphy, write to me for more details and a free back issue of MM (limited offer).

For a Morse enthusiast, I must have one of the most interesting mailbags in the world. Most days I receive correspondence with information, articles, photos etc, relating to varied aspects of telegraphy. One advantage is that I have a wonderful supply of material to share with readers of this column.

**Bastard bugs**

Of interest to users and collectors of bug keys, for example, is an article in the latest issue of MM, Autumn 1988. Apparently, Horace G Martin, inventor of the Vibroplex, had such a successful patent application in 1917 that he put the makers of ‘pirate’ bugs out of business. He was also able to insist that all professional users of such bootleg keys across the United States paid his company a licence fee of $2.00 to ‘legalise’ them. These keys are known as ‘legal bugs’ or, more commonly, ‘bastard bugs’ and are now popular collectors’ items. This story is told by Louise Moreau, W3WRE (a noted telegraph historian, and herself the owner of some 300 keys) in her six-part Story of the Key which is currently running in MM.

**Earth connection only**

In the field of military communications, Louis Meulsteen, ZL1RP, relates the history of the power buzzer. Before the invention of radio, many attempted to achieve telegraphic communication without wires by means of earth and water conduction. These experiments stopped when Marconi successfully demonstrated the commercial use of radio waves, but were revived during WW1 as a means of communication in trench warfare.

The invention of valve amplifiers restored interest in earth current ranges which were quite unattainable previously. A French instrument, the Parieur or power buzzer, was adapted by the British Army and used for Morse communication in 1917/18 in situations where shelling was so intense that cables and wireless aerials were destroyed. When the war ended the experiments stopped again. As with so many other forgotten inventions, one wonders what greatly improved results could be obtained with today’s advanced technology.

**Speed record claims**

In anticipation of the Region 1 Second High Speed Radio Telegraphy Championships, to be held in Hanover in November 1989, the June issue of IARU Region 1 News formally records the record claims of the Russian and Romanian winners of the 1983 Moscow Championships.

The top speed for receiving groups of random letters was 320 characters per minute, while for figures it was 500 cpm. In sending random letters, 219.9 characters per minute were achieved and, with figures, 294.3 cpm. This is the level of performance to be challenged by next year’s competitors. It will be interesting to see what happens. Previously all entrants had to be in teams, but a new individual class is to be created for 1989. The full details of the 1983 record claims for eight different characters, and of entry rules and legs, are included in here, but are reproduced in full in Morsum Magnificat.
Exceptional conditions

In this column last September, I referred to 50MHz SEP and the prospects for cycle 22. The TE Path passes through Namibia and the QTHs of ZS3E and ZS3AT. I explained why we would be more likely to have contacts with these stations, rather than with stations further East (except under exceptional conditions). During September and the early days of October, this prediction was borne out in practice.

New all-time first

On Tuesday 20 September at 1744, Chris Tran, GM3WOJ, had an historic QSO with ZS3AT. This was an all-time first between Namibia and Scotland. The Scottish GB3RMK was heard by ZS3AT for about 30 minutes. As far as I know, this was a selective opening as no other reports have been received to date, although both ZS3E and ZS3AT were contacted many times during this opening from various parts of the UK. This North-South path should remain open until the beginning of November, when the F2 DX season should be in full swing to other continents. More about this next month.

All-time first to Argentina

The unexpected opening on Thursday 7 September was not repeated, although U7UZ and other Argentinian stations have been having regular contacts with Portugal and stations in southern France. Other stations who reported contacts on 50MHz with Portugal include: LU5EX, 8D1O, 6DLB, 1DMA and 4DMX. They are all now looking forward to contacting UK stations. The mode for this unusual form of propagation has not yet been established, but this will probably be TEP, together with other sources of enhanced propagation.

Solar flux sunspots increasing

Solar flux sunspots and F2 MUF are still increasing, according to Geoff Roberts, G3ENY, who has specialised in solar observations, (see Figure 1). The solar flux peaked to 202 on 4 October, the highest during this cycle so far. It all looks very promising for the future!

Hal Lund reports

'Conditions continue to improve with good propagation into the Mediterranean area almost daily, but activity levels in the northern hemisphere are still low. ZS3E's AT, E and DM (JG87) have had good reports from SEP and several reported in the UK. ZS3E runs a beacon around 50.105. TR6DX has returned to France so there will not be any activity from Gabon for the time being.

'DX operating stations on the southern edge of TEP are having difficulty being heard in Europe, but those of us further north in ZS6 can help assuming:
1. That another station off "the back" of your beam is on frequency and anxiously waiting to contact the DX station.
2. That you cannot hear each other and that the band is about to change for the worse.

'After you have exchanged reports and other niceties with the DX station, pause for a few seconds when he turns it over to you before you transmit. The band sometimes changes very rapidly and can abruptly close during a long transmission. Nothing is more frustrating than listening to a DX station rapidly fading into the noise whilst talking about the weather!

'We in the ZS6 area often forget that openings may extend well south of us and stations such as ZS4AA, ZS4NS and even ZS1's 2s and 5s may be trying to get your attention. Don't be branded a DX hog (this is very sound advice which also applies to the UK, as stations to the north have the same difficulty). The only beacon reported to be operating regularly is ZS6PW, which operates during the evening and beams north on 50.010 (KG44).'

Worked all continents (WAC)

Now that QSOs have taken place between the UK and South America, it is realistic to consider the probability of QSOs with Australasia during the current cycle to complete WAC. This has not yet been achieved from the UK. During cycle 21 G4BPY, G3COJ and G5KW had crossband QSOs with VK6OX on 27 November between 0950 and 1010. G3COJ had not at that time had a complete WAC with South America. G5BY was the first to make crossband WAC and he was followed a few minutes later by myself. I had just managed to complete my WAC as the band faded out, with no repeat to date. It will be interesting to monitor events during this cycle, with what more crossband QSOs and even better 50MHz two-way WAC to come.

I received a letter from Gordon Phoeasant, G4BPY, with some historic information. 'My first reception was VK6RTU in Perth on 27 October 1979 from 0858 to 0909 UTC (peakig RST 549). In 1980, I heard VK6RTT in Caernarvon on 26 November from 0959 to 1010 UTC (peaking 589) and I couldn't raise a soul on 28.885. The following day, I received some very weak signals from VS6BE at 1050 (RST 229). On the same day, I first logged VK6RWA at 0924 (RST 459) and finally logged it at 1901 (RST 429). There were no other receptions of VK on 50MHz despite careful monitoring.

'During the last couple of years, my main interest has been in keeping a careful check on 28MHz openings to VK. These seem to occur in the UK even down in the sunspot minimum. The peak time is always from about 25 October and gradually tails off through November and December.

'During 1986 sporadic openings continued into the spring, but only from VK6RWA in Perth for the later openings. Last year I logged VK6RTW in Albany, VK2RSY near Sydney, VK5WI and VK6TEN in Adelaide.

'It should be remembered that it is probably not a good thing to compare 28MHz under low sunspots, with 50MHz under high ones. In the event, you may recall how hard PY2XB tried unsuccessfully to work crossband with us. I have never heard an LU, CX, or CP on 50MHz to this day. That's what makes it so interesting, because you never know

Fig 1: Graphic representation of Solar flux sunspot activity
what you might hear next time you switch on the rig!' (This interesting letter is, of course, topical just now and will help us all when monitoring for that elusive 50MHz WAC).

Longest two-way opening on record

Over the last few weeks, we have had an indication of the big opening which is reported to be 'just around the corner'. Shortly after 1100 on 27 September, I had a telephone call from Mike Walters, G3JVJ, Hayling Island, giving news that the ZS6PW beacon on 50.099 had been S9 at his QTH since 1056 and that the ZS6s were in. I went to my shack and switched on to 50.110.1 put out a call and contacted ZS6PW on 50.099/575, this was followed by a SSB QSO (50.57/57) at 1130. Then I contacted ZS6LN (59/56), ZS6PW (57/55), ZS6XJ (ZS6ANK heard S9 but did not make contact) and finally ZS6WH (58/54) at 1220. A two hour fade-out followed as propagation moved west.

ZS3AT started to break through at 1425 with CW QSO 339/529. I called ZS3E after hearing him 3/5, but he did not reply. ZS3E eventually came in again at 1505 (57/529). ZS6WH was open to Canada and the USA at S9. ZS6LN worked twenty-eight UK stations in one hour and G3MY heard the ZS6PW beacon 559 from 1050 to 1139. Geoff, G4JICD, also had a field day on the 27th and the ZS6PW beacon was heard from 1100 for most of the day. The signals were clear, without flutter, therefore multipath propagation was not in operation. Chordal hop TEP was probably in operation, hence onward propagation would have been possible. It could have been expected to reach further north, but the signal definitely did not reach the Midlands. F-type TEP is therefore the most probable mode, with consistency of the times when openings occurred were highly significant, as the mean mid-point of the openings was at 2138. This accords very well with the time for the TEP MUF.

ZS6 amateurs in the UK worked: ZS6FX, KG33, G3SED, G8HVY, G3JVL, G3XZO, G6VR, G4JICD, PA9RDP and ZZ2DH.

'The ZS6 bands were also active, but Johannesburg appeared to be the optimum location for the opening. In Britain, the opening extended from Devon to Broadstairs and included practically the whole of the south coast and as far south as the Channel Islands.

'The northern limit is not known, although we know the opening extended further north, but the signal definitely reached as far north as the Channel Islands.

It could have been expected to reach further north, but the signal definitely did not reach the Midlands. F-type TEP is therefore the most probable mode, with the exception of novices, are allowed to use 50-54MHz (150 carrier, 400W peo) with the proviso of 'No interference with Zimbabwean TV'.

We can anticipate many more openings and further latitude extensions, as well as TEP (plus Es) into Scotland, northern England and Ireland.

'November is the best month for openings from Britain to South America and North America to Africa. Exceptional F-layer enhancement might even open the North America to Europe path.'

Geoff, G4JICD, from St Helier in Jersey, recently sent in this report. 'Many QSOs were made during September by GJ stations with ZS3 and ZS6. On 9 September, GJ6TMM-ZS3AT was heard at 1732. Other QSOs included: GJ9FTZ/GJ6TMM-ZS3AT and G4JICD-ZS3AT. 15 September saw the biggest 50MHz opening to date. I tried CW tests every five minutes with ZS3AT from 1425 and the breakthrough finally came at 1516 with ZS3AT/SSB/S3. The 516 ZS3E keyer was heard on S2 and ZS3AT was heard until 1607. ZS6XJ/SSB/S5, ZS6WB/SSB/S5, ZS3AT and ZS6E were still there up to S7. ZS4S S3/SSB and ZS3AT/S6/SSB were heard between 1629 and 1637, but they were lost at 1640. ZS6LN, ZS6XL, ZS6OW, ZS6CE/SSB/S2 and ZS6JX/S8 built up to S9++ at 1645 and then the band faded out.

It is becoming quite clear that Jersey is in a good situation for these southerly openings and although I cannot sit by the radio all day, I have caught quite a few openings that were not previously heard in the UK. On 18 September, ZS3E was heard at 1420 calling CO. On 20 September, I worked ZS3AT at S7. On 21 September, ZS6XAP heard me putting out test calls and the next day ZS3AT was heard at S9+20dBs with fade out at 1746. During 2 October, the ZS6PW beacon was heard from 1500-1800. I also heard the ZS3E beacon until 1800. QSOs were with: ZS6XJ, ZS3AT, ZS6XL, ZS6PW, ZS6AXP, ZS4NS and ZS6CE. CUL Ken Ellis, 18 Joyes Road, Folkestone CT19 6NX.

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<td>double page</td>
<td>£2,280.00</td>
<td>£4,560.00</td>
<td>£7,600.00</td>
<td>£15,200.00</td>
</tr>
</tbody>
</table>

### COLOUR AD RATES

<table>
<thead>
<tr>
<th>Depth mm x width mm</th>
<th>Ad space</th>
<th>1 issue</th>
<th>2 issues</th>
<th>6 issues</th>
<th>12 issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>126 x 186 or 263 x 90</td>
<td>1/4 page</td>
<td>£390.00</td>
<td>£780.00</td>
<td>£1,370.00</td>
<td>£2,740.00</td>
</tr>
<tr>
<td>263 x 186</td>
<td>1 page</td>
<td>£715.00</td>
<td>£1,430.00</td>
<td>£2,385.00</td>
<td>£4,770.00</td>
</tr>
<tr>
<td>263 x 394</td>
<td>double page</td>
<td>£1,320.00</td>
<td>£2,640.00</td>
<td>£4,320.00</td>
<td>£8,640.00</td>
</tr>
</tbody>
</table>

### SPECIAL POSITIONS

- Bleed Covers: Facing Matter: 15% extra
- Outside Back cover: 20% extra, Inside covers: 10% extra

### DEADLINES

<table>
<thead>
<tr>
<th>Issue</th>
<th>Colour &amp; mono proof ad</th>
<th>Mono no proof &amp; small ad</th>
<th>Mono artwork</th>
<th>On sale thru</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 88</td>
<td>27 Nov 88</td>
<td>2 Nov 88</td>
<td>7 Dec 88</td>
<td>24 Oct 88</td>
</tr>
<tr>
<td>Jan 89</td>
<td>30 Nov 88</td>
<td>4 Nov 88</td>
<td>9 Dec 88</td>
<td>29 Dec 88</td>
</tr>
<tr>
<td>Feb 89</td>
<td>21 Dec 88</td>
<td>6 Jan 89</td>
<td>1 Feb 89</td>
<td>23 Feb 89</td>
</tr>
<tr>
<td>Mar 89</td>
<td>26 Jan 89</td>
<td>1 Feb 89</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CONDITIONS & INFORMATION

#### SERIES RATES

- Series rates apply when larger or additional space is that initially booked is taken. An ad of at least the minimum space must appear in consecutive issues to qualify for series rates. Previous copy will automatically be repeated if no further copy is received.
- A hold ad is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received. If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.
- COPIES: Except for County Guides copy may be changed monthly.
- No additional charges for typesetting or illustrations (except for colour separations).
- Colour Ad rates do not include the cost of separations. Printed - web offset.

#### PAYMENT

Above rates exclude VAT. All single insertion ads are accepted on a pre-payment basis only, unless an account is held. Accounts will be opened for series rate advertisers. 10% discount if advertising in both Amateur Radio and Radio & Electronics World. Orders subject to satisfactory credit references. Accounts are strictly net and must be settled by the publication date. Orders may be accepted by International Money Order or credit card. For further information contact: Amateur Radio, Sovereign House, Brentwood, Essex CM14 4SE. 02473 279973.

#### CONDITIONS

10% discount if advertising in both Amateur Radio and Radio & Electronics World. Ad text accepted subject to our standard conditions. All single insertion ads are accepted on a pre-payment basis only. Accounts will be opened for series rate advertisers. A hold ad is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received. If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.

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Please mention AMATEUR RADIO when replying to any advertisement. NOVEMBER 1988.
**NEWLY ADVERTISED ITEMS**

- **PET CAPTURERS:** Microphones for ferrets. A Pet spentor is built for an output equivalent to a high bass electronic microphone. The characteristics of a capacitor microphone. External influence by magnetic and electri- cal noise is minimized since none of the capsule is used. The small size of the microphone and the small supply required for operation makes this microphone a very versatile unit. Electrical spec- ifications are as follows: Sensitivity: 80 mV/1000V at 1200Hz. Frequency re- sponse: 40,000 Hz at 0.5%. 56A VU. BRIDGED OUTPUT SWITCH: 2-bit switch, 12 A, 0.5 mm, 7 A, red SMD with chrome foot. **J & N BULL ELECTRICAL**

**POPULAR ITEMS**

- **3.5" BOLI CHINON 330D: 500k. Shutter compatible interface. Stan- dard connections, interchangeable with many 35mm and 110mm Formats.**
- **3.5" BOLI HYPASIA: MCEPHRAX compatible makes on 35mm Format (CD) 250 plus £15 ins.**
- **13A PLUGS GOOD British make with fuse. Parcel of 5 for £2. Order Ref. 2P21.**

**SPECIALS**

- **BURGAL ALARM BELL: 6" gong. OK for outside use if protected from rain. Battery operated. Price £8 Ref. 8P2.**
- **THREE CORE BARGAIN 2 No. 2. Core 25m m in size for long extend- ed cables carrying up to 5 amps or short leads up to 10 amps. Price £25 each. Order Ref. 2P11.**
- **ALPHA NUMERICAL KEYBOARD:** This keyboard has 72 keys giving you a wide range of operations. The main array is a qwerty array and on the right is a 15 key function bar. The keyboard is controlled by a computer, the signals being input by a white tape. The keyboard is complete with mo- torised readout. The keyboard is £251. Order Ref. 2P31.**
- **BIG SMOOTHING CAPACITOR. Sprague powerlytic 39,000uF at 50V £3. Order Ref. 2P41.**
- **NEW ARRIVALS. FIRST TIME OFFERED:**

  1. **EPSON MINI PRINTER 1100:** A self roll paper printer and uses plain paper. Price £30 each. Order Ref. 2P51.
  2. **EPSON 51MK6 BBC compatible £3. Order Ref. 2P61.**
  3. **30CH 3x 10A switch: Brand new and the finish is in addition to the output terminals. Price for complete kit with full instructions is £15. Order Ref. 2P53.**

**SPECIAL OFFER**

- **STEREOS:** Each 10 x 8 £20 plus £20 for each 10: £120. Order £20 each plus £10 post. Order Ref. 2P62.
R. N. Electronics

Professionally designed equipment for amateurs

INTRODUCING

EXCITING ADDITIONS TO OUR RANGE

DON'T MISS THE OPPORTUNITY FOR A DX "FIRST!"

6m TRANSVERTERS

Our market leader 144/50MHz Transverter 25w pep £179 + £4 p&p

* RN690 Power Amplifier. Add to your dedicated 6m rig 3W drive to give 25w pep £75 + £4 p&p

* 7dB Switched Attenuator £22 + £2 p&p

4m TRANSVERTERS

144/70MHz Transverter. 25w pep £230 + £4 p&p

* RN490 Power Amplifier. 25w pep £75 + £4 p&p

144/70MHz Transverter. 10W pep £199 + £4 p&p

28/70MHz Transverter. 10W pep £199 + £4 p&p

RECEIVE CONVERTERS

With your existing 2m or HF equipment these receive converters give you the opportunity to listen in on other bands.

With the switched version you will have the facility for working crossband.

RECEIVE ONLY CONVERTERS at £39 each plus £2 p&p

2m IF/4m
2m IF/6m
2m IF/10m

SWITCHED RECEIVE CONVERTER £45 + £2 p&p

2m TX/RX

Switched Receive Converter

NAVICO

BRITISH DESIGN & MANUFACTURE

AMR1000

- 12.5KHz & 25KHz channelling
- Automatic repeater shift
- Simple to operate
- 5w and 25w
- Dual VFO
- Reversible front panel

£247.25 incl VAT + £4 p&p

DESIGNED FOR TODAY'S AMATEUR. VARIABLE MOUNTING POSITION FOR THE MODERN CAR, EASY TO USE YET PROVIDING EVERY FEATURE FOR THE BEGINNER OR EXPERT.

PLUS INNOVATIVE HANDS FREE UNIT OUT SOON

AVAILABLE AT THE LEICESTER RALLY 28/29 OCTOBER ON STAND 54A

£299 incl VAT + £4 p&p

AMR1000S

All the features of AMR1000 PLUS

- Scanning modes of operation
- Automatic or manual repeater access tone
- Programmable functions
- Memory channels
- Scan rate
- Priority channels
- Plus many more

From

37 Long Ridings Avenue, Hutton, Brentwood, Essex CM13 1EE

See us at all major rallies

For details:

(0277) 214406

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