



# D-i-Y

R A D I O

AN INTRODUCTION TO AMATEUR RADIO - FOR BEGINNERS OF ALL AGES

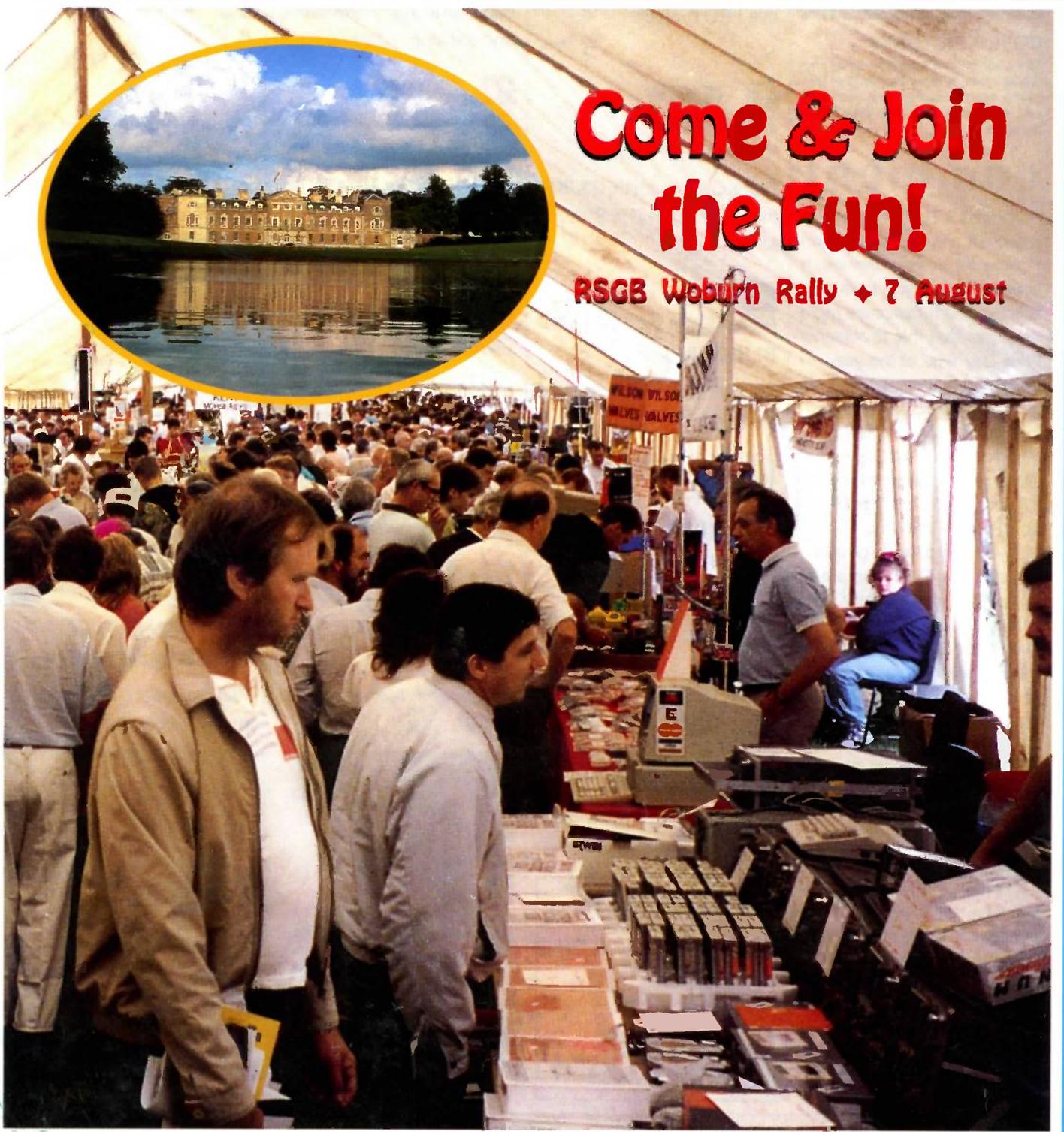
July-August 1994

Volume Four: No 4

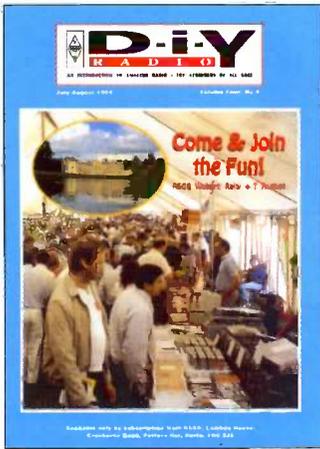


## Come & Join the Fun!

RSGB Woburn Rally ♦ 7 August



Available only by subscription from RSGB, Lambda House,  
Cranborne Road, Potters Bar, Herts. EN6 3JE



**COVER PICTURE:**

The atmosphere and activity at the RSGB Woburn Rally captured at last year's event. Join us this year and you may pick up some very good bargains!

## comment

NOW THAT THE weather has improved and we start to plan picnics out in the sunshine, it seems a good time to remind existing and prospective radio amateurs that this is National Field Day time of the year. In the Diary section (p22) you will see that two field days are coming up - the first is the RSGB VHF National Field Day on the 2 July, and the second is on the 17 July and is the RSGB HF Low Power Field Day.

If you would like to go along and see what Field Days are all about, then contact your local club and see if you can join in - even if you cannot transmit yet, there is always plenty of help required, and you will be made very welcome.

During the winter months I decided to take a Novice Course, and I am delighted to announce that my callsign has just been received - 2E1DAY. One thing this proved was that it is not very easy going 'back to school' - but I did enjoy the course, especially the construction and am planning to build my own simple transceiver. I'll let you know which one, and how I get on in due course!

**Marcia Brimson, 2E1DAY,**  
*Editor.*

**3 NEWS**

Skater Nicola Gets 12-0 for Morse.

**5 CONSTRUCTION**  
**LOW LIGHT INDICATOR**

Steve Ortmeyer, G4RAW shows you how to construct this LED project.



**6 REVIEW**  
**THE G4ZPY STRAIGHT KEY**

Frank Claytons Smith, G3JKS, tries out the G4ZPY Straight Morse Key.

**7 HAM FACTS**  
**PRACTICAL CIRCUIT BUILDING**

Try this method of making your own PCBs.

**8 CONSTRUCTION**  
**J-ANTENNA FOR THE 50MHz BAND**

Robert Snary, G4OBE, shows you how to build this 6 metre version of the J-antenna.



**10 NEWS FEATURE**  
**OPERATION DRAKE - A RADIO HAMS TALE**

Jim Heck, G3WGM, recounts his trip as a radio

operator on the Operation Drake expedition.

**12 POSTER**  
**AMATEUR RADIO - PASSPORT TO ADVENTURE**

An interest in amateur radio can lead to many interesting and exciting activities.

**14 ON THE AIR**  
**2'S COMPANY/LOG BOOK/SHORT MORSE**

Our regular columns for the listener and Novice. Plus more amateur radio abbreviations.

**16 THE WHATS, WHYS AND WHEREFORES**  
**A RELAXATION OSCILLATOR**

John Case, GW4HWR, describes this oscillator used for repeating certain sequences of events.

**17 BOOK REVIEW**  
**RECOMMENDED RADIO READING**

We take a look at some of the books available from the RSGB.



G4RAW's low light indicator.

**18 CONSTRUCTION**  
**A RECEIVER CONVERTER FOR 50MHz**

Extends the range of your communications receiver to cover the 50MHz bands.



**20 TECHNICAL**  
**AMPLITUDE MODULATION EXPLAINED**

Ian Poole, G3YWX, explains the basic principles of AM the first method of transmitting sound signals over radio.

**22 LETTERS AND DIARY**

**23 PUZZLE PAGE**  
**WIN A MORSE KEY**

Win the super G4ZPY Morse reviewed on page 6.

**CONSTRUCTION CODE**

FOR THE COMPLETE BEGINNER . . . . .

REQUIRES A LITTLE EXPERIENCE . . . . .

FOR THE MORE EXPERIENCED



WAB aim to raise £10,000 for a Class 'D' lifeboat for the RNLI.

Managing Editor: Mike Dennison; Editor: Marcia Brimson; Prod Ed: Sid Clark; Tech Ed: Peter Dodd; Draughtsman: Bob Ryan; Prod Asst: Jennifer Preston; Ed Asst: John Davies; Secretary: Erica Fry. D-I-Y RADIO is published six times a year by the Radio Society of Great Britain, Lambda House, Cranborne Road, Potters Bar, Herts. Filmset by JJ Typographics Ltd. Printed by Southernprint (Web Offset) Ltd. © Radio Society of Great Britain, 1994. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior written permission of the RSGB. All reasonable precautions are taken by the Radio Society to ensure that the advice and data given to our readers are reliable. We cannot however, guarantee it and we cannot accept legal responsibility for it. Prices quoted are those current as we go to press. ISSN No: 0959-843X.

● IN 1894 SIR OLIVER Lodge made his first radio transmission from Lewis's department store to the clock tower of the University of Liverpool. To commemorate the anniversary Liverpool Amateur Radio Society is running a special event station, GB00L, from 9 to 13 July.

● CANBERRA COMMUNICATIONS are offering their Turbolog software program at half the normal price to Novices in full time education. More information from John Linford, G3WGV, Canberra Communications, tel: 0734 733745.

● FOR THE 25th Anniversary of the Worked All Britain (WAB) Award Scheme an appeal has been set up to raise £10,000 to provide a Class 'D' Lifeboat for the RNLI. To aid fundraising many special event stations will be operational from lifeboat stations throughout the UK.

● A MORSE CLASS for beginners will run in the Southend area from September to Easter 95, taking students up to 12 Words Per Minute. Details from Steve, G4UOL on 0702 334014 (evenings/weekends).

● AN RAE COURSE aimed at the December 1995 examination is being run at the Lee Valley Leisure Centre, Edmonton, London N9. For further details from the instructor Steve White, G3ZVW, on 081 882 5125.

# Skater Nicola Gets 12·0 for Morse



**14-YEAR OLD** Nicola Mullane started taking Morse lessons in 1993 and has recently passed her 12 words per minute Morse Test. She still attends the Morse class run by Brendan, GMOBWR, and is steadily increasing her speed.

Nicola attends Bannockburn High School and, in between studying for her school exams, she has been attending the Radio Amateurs Examination (RAE) course run by Mervin, GMOGDL.

It all started when her uncle Raymond called in to a local radio club and decided to take the RAE course. When Nicola heard about it she decided to join him, so they both enrolled at the lo-



cal college. She and her uncle took the exam in May.

Her ambition is to obtain her class A licence and to operate on HF. This will be no mean achievement as the youngest age at which you

can hold a full Amateur Radio Licence is 14.

As well as her interest in amateur radio, Nicola is a proficient ice dancer - so she is definitely someone who keeps herself busy!



Wahid Public School is the first school in Pakistan with an amateur radio licence. Many of the 400 students, will benefit from being trained in electronics using amateur radio. The school urgently needs funds/equipment. If you can help, contact Wahid Public School, 1010 - 1011, G/10 - 4, Islamabad, Pakistan.

## A HAM IN JAPAN

WHILST ON a visit to Japan, Ian Marsh, G4INK, whose wife is Japanese, couldn't resist trying to meet some local radio amateurs - despite the fact that he speaks very little Japanese.

On a walk through the local park he noticed JH300I operating, and couldn't resist talking to him - in English. Fortunately, he understood and their friendship led to Ian meeting other radio amateurs, in particular



Yutaka, JA3QS. Now Ian is back home in the UK he is brushing up his Morse in the hope of keeping in touch with his new found friends.

BRITAIN'S BEST SELLING AMATEUR RADIO MAGAZINE

# practical Wireless

ON SALE  
EVERY SECOND  
THURSDAY  
OF  
THE MONTH

Regular features include:

- Novice Natter
- Reviews of the latest equipment
- Transceiver and test equipment construction
- Bits and Bytes – The Computer In Your Shack
- Valve and Vintage
- Antenna Workshop
- Radio diary, competitions and much more



pw publishing ltd.

Arrowsmith Court, Station Approach,  
Broadstone, Dorset BH18 8PW  
Tel: 0202 659910 • Fax: 0202 659950

## THE KITS WITH ALL THE BITS!

Guaranteed complete to the last nut!

### COMPACT 80m CW QRP Tx/Rx

DTR3 Kit — £87.50 Ready Built — £140.00

- ★ Stable VFO ★ Sidetone ★ Audio Filter
  - ★ Requires 12/14 VDC ★ Very detailed instructions
  - ★ Black steel case ★ Printed panel
- Please add £4 p&p to all prices

### COMPANION ANTENNA TUNING UNITS

TU1 Kit — £41.25 Ready Built — £57.50

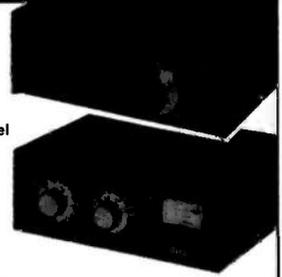
TU2 Kit — £51.00 Ready Built — £72.00

Please add £4 p&p to all prices

- ★ Large dia. coil ★ High grade capacitor ★ Built in balun ★ Circuits to match your antenna
  - ★ Up to 30 Watts of CW ★ TU2 has sensitive QRP/SWR meter.
- Send SAE for brochure or call Alan G4DVW on 0602 382509

### LAKE ELECTRONICS

7 Middleton Close, Nuthall, Nottingham NG16 1BX  
(calls by appointment only)



## KANGA'S QRP KITS

Kits for **RECEIVERS** from only £3.95, **TRANSMITTERS** from just £4.95 and full **TRANSCEIVERS** from just £32.95. A great selection of **TEST EQUIPMENT** too. Including items that have appeared in RadCom such as Ian G3ROO's **COMB CALIBRATOR** (£16.95) and the amateur band **SYNTHASIZER** (£59.95). Lots more so send an SAE for our free catalogue.

### Kanga Products

Seaview House Crete Road East Folkestone CT18 7EG  
Tel/Fax 0303 891106 E-Mail kanga.demon.co.uk

## Novice RAE Classes

For details of a Novice RAE Course starting near you contact the RSGB NOW!



RSGB, Lambda House, Cranborne Road,  
Potters Bar, Herts, EN6 3JE.

## C.M. HOWES COMMUNICATIONS

EASY TO BUILD HOWES KITS!



Mail Order to: Eydon, Daventry,  
Northants NN11 3PT  
Tel: 0327 60178



NEW!

### Experimenter's Medium Wave and "Top Band" receiver.

Complete kit with hardware to build a super portable receiver covering the medium wave broadcast band plus 160M amateurs. Easy to build with good performance. An excellent first project. Includes all parts except the battery. MW1: £29.90 (plus £4.00 P&P).

**TRF3** Easy to build TRF receiver with AM, SSB & CW shortwave reception from 5.7 to 12.8MHz in 3 bands. **TRF3 Kit plus HA33R Hardware: £41.40**

**DcRx** Single Band SSB/CW receiver for 160, 80, 40 or 20M Amateur Bands or 5.45MHz HF Air. **DcRx & DCS2 Kits plus HA80R Hardware: £57.70**

**DXR10** Three Amateur Bands, 10, 12 & 15M SSB & CW receiver with excellent sensitivity and dynamic range. **DXR10 & DCS2 Kits plus HA10R Hardware: £64.30**  
(Companion transmitter kits are also available for our amateur band receivers).

PLEASE ADD £4.00 P&P to your order total.

HOWES KITS contain good quality printed circuit boards with screen printed parts locations, full, clear instructions and all board mounted components. Sales, constructional and technical advice are available by phone during office hours. Please send an SAE for our free catalogue and specific product data sheets. Delivery is normally within seven days.

73 from Dave G4KQH, Technical Manager.

## Amateur Radio and the RSGB

RADIO AMATEURS are qualified radio operators who are licensed to talk to other operators, often in distant countries, from their own homes. Amateur radio is a hobby for all ages but it is different from CB radio because a very wide variety of frequencies (wavelengths) can be used, and contacts can be in different 'modes'; by Morse code or teleprinter, between computers or even television. Many amateurs build all or part of their station equipment.

The **Radio Society of Great Britain (RSGB)** is the national society for all radio amateurs (transmitters and listeners) in this country. It has over 30,000 members, including many in overseas countries.

The Society looks after the interests of radio amateurs throughout the UK. Talks between the RSGB and the Government's Radiocommunications Agency have resulted in the popular amateur radio Novice Licence.

In particular the RSGB is keen to encourage the experimental side of electronics and radio, and the Society's monthly magazine *Radio Communication* is sent free to all members. We're having lots of fun with our hobby, so why not join us?

If you would like more information on the RSGB or the Novice Licence, write for an Information Pack to Sylvia Manco (enclosing a large stamped self-addressed envelope), at:



RSGB, Lambda House, Cranborne Road, Potters Bar, Herts EN6 3JE.

# Low Light Indicator

By Steve Ortmayer, G4RAW



ONE OF THE various construction techniques described in *Ham Facts* (page 7) uses tag boards. The alarm circuit (Fig 1) described here uses such a technique and for this reason is called the 'Tag Alarm'.

This gadget will switch on a flashing light emitting diode (LED) when it gets dark to give an indication that an alarm is in operation, or it can be used on its own as a deterrent.

The operation of this circuit is based on a component called a **Photo-conductive Cell (PCC)**. In bright light the resistance of the PCC is low - about 1kΩ. In the dark its resistance is high, up to 10MΩ. These cells are made from a substance known as Cadmium Sulphide (CdS) and are enclosed in a small glass or plastic container. Cadmium Sulphide is an insulator in the dark. It becomes a conductor when light falls on it due to the

release of electrons within the material.

If a PCC is connected in series with a resistor, across a battery, the voltage across the PCC will depend on the light level. In this circuit the PCC is in series with the variable resistor RV1. In bright light the voltage across the PCC is low because its resistance is low. When it is dark the voltage rises because the resistance of the PCC is high. This increased positive voltage will cause the transistor to conduct, causing

current to pass through the flashing LED. R1 limits the current through the LED so that the transistor and the LED are not damaged. The point at which enough current flows through the transistor to cause the LED to flash can be set by adjusting variable resistor RV1.

## CONSTRUCTION

THE PROJECT IS made on an 8-tag tagboard (Fig 2). The tags need a lot of heat from the soldering iron so take care not to damage the components. The lead of a component being soldered into place should be held using a pair of narrow nose pliers. This prevents heat from the soldering iron damaging the components. When the circuit is complete check, the wiring and connect a PP3 battery. I did not bother with an on/off switch but you can include one if you wish. Adjust RV1 so when you put your finger over the PCC the LED starts to flash. I housed the project in a small plastic box with holes cut for the PCC and LED.

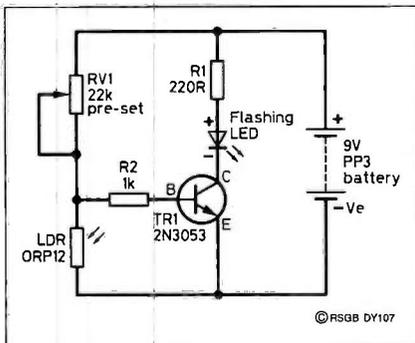


Fig 1: Circuit diagram.

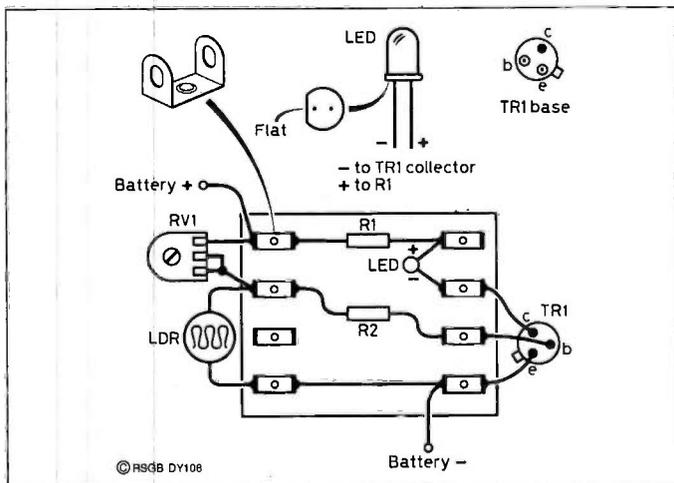


Fig 2: Component layout on tagstrip.

## COMPONENTS

### Resistors

R1	1k
R2	220R
RV1	22k pre-set potentiometer

### Semiconductors

LDR1	ORP12 Light dependent resistor
TR1	2N3053 NPN transistor
LED1	Flashing LED

### Additional Items

Plastic box, tagstrip with 8 tags, and a PP3 battery connector

A kit of parts is available from JAB Electronics (see their address on page 7) at £6.50 inc P&P.

# The G4ZPY Straight Morse Key

By Frank Clayton-Smith, G3JKS



THE FIRST THING you notice about this key is its impressive

appearance, the highly polished brass metalwork standing out magnificently against a backcloth of the grey-green slate base. It brought back memories of the steam locomotives on the old Great Western Railway with their dark green boilers capped with polished brass chimneys and safety valves. There is no doubt in my mind that this key will enhance any operator's shack and it will be natural to want to use it.

## EXCELLENT PERFORMER

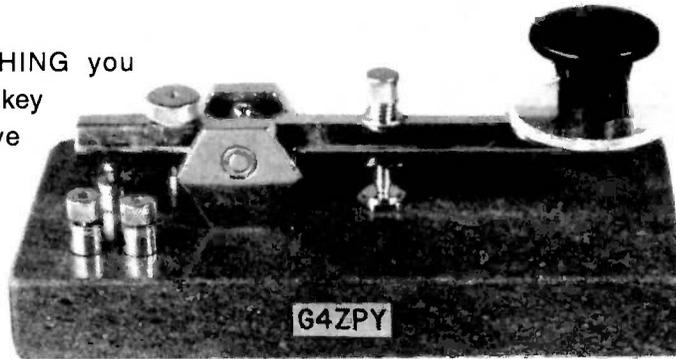
WE ALL KNOW that appearances can sometimes be deceptive, but that is not the case here! The key's fine appearance is matched by excellent performance which makes you want to have more contacts simply for the sheer pleasure of using it.

One of the first considerations when putting a key into use is how to stop it sliding about - the author has made good use of blu-tack for years. In this case the grey-green slate base is not only good to look at but is heavy and is unlikely to move easily. Any further tendency to move is controlled by an anti-slip surface fixed to the underside of the base. It did not slip when I used it.

## LESS FATIGUE IN USE

MANY KEYS ARE designed in such a way that the overall height of the knob above the table surface is excessive. Subsequently the weight of the operator's forearm is not well supported by the table, which results in an aching arm and an urge to cut the QSO short. I felt very little fatigue after several lengthy QSOs.

I like to use fast Morse and experience over many years tells me that the real measure of any key or paddle is found when pushing it to its limits - a design which is satisfactory at 10WPM can be really difficult to operate at 25WPM. The



essential requirements for speed are: little weight and inertia, (long levers have more inertia than short ones of the same weight); no lever flexing; little friction in bearings; no side play in bearings; small contact gap.

This key goes a long way to meeting these needs. It has a relatively short lever, light yet very stiff. The bearings, which are self-lubricating, are very free and have no obvious side movement (some designs use ball bearings but the amount of movement in a key is inadequate for these to do a proper job and they can act as a trap for dirt and grit).

The contacts have a good matching profile as well as being capable of being set accurately with a fine thread adjustment screw of 40 turns per inch (TPI) a feature sadly lacking in some expensive products. Finally, a fine thread is also used for setting the spring tension. With these features I was able to set the key to my liking and operate comfortably at 25WPM.

## ANY COMPLAINTS . . .

APART FROM THE price? Very few. A clamping arrangement for taking any physical strain on the connecting leads would be useful but would probably detract from the appearance as well as increasing the price. During prolonged operating the sharp curvature of the side of the flat topped knob started to irritate the fingers a little. A more gentle profile would probably alleviate this effect. Finally, it was felt that the plastic knob and skirt detracted somewhat from such a quality looking product - it deserves better.

However, this is a first class key, both to use and to look at. I am only sorry this one had to go back.

The G4ZPY Pump (straight) Morse Key costs £45 + £4 P&P (UK), and is available from G4ZPY Paddle Keys, 41 Mill Dam Lane, Burscough, Ormskirk, Lancs L40 7TG. Tel/ Fax: 0704 894299. [See page 23 for how to win this key - Marcia].

# Practical Circuit Building

Using PCB pads will keep your project tidy the easy way.



MOST COMMERCIALY MADE electronic circuits use printed circuit boards (PCBs). These are made by chemically etching the circuit wiring on to copper clad board. Certainly, the PCBs look neat, with those lines and circles of etched copper. The components can be easily fixed into position and all the wiring is taken care of by the PCB.

For the home constructor and experimenter PCBs do have some disadvantages. A corrosive chemical must be used for etching the copper to make the circuit. The safest of these chemicals is ferric chloride but its use still requires a special working area and safety measures, and it is not practical for kitchen table electronic construction. A further disadvantage is that once a circuit has been built on a PCB then it is difficult to make changes or modifications.

## ALTERNATIVES

THERE ARE SOME commercial alternatives to PCBs. These include strip, or Veroboard, which are used in quite a lot of projects described in *D-i-Y Radio*, see page 16 in this edition. Alternatively, there are special prototype boards, described in *D-i-Y Radio*, Vol 3: No 3.

Solder tag boards can also be used to make simple projects. These can be got from Maplins or from Radio Rallies. They are easy to use because the components can be fixed into the tags before soldering so they are less likely to slip just as you are applying the soldering iron. The project on page 5 uses such a construction method.

There are other methods of

making up circuits that are even cheaper and more flexible. One way is to make supports, or pads, for the circuit wiring using small squares of copper clad board (the material used for making PCBs)(Fig 1). The components and wiring are then soldered to these pads. Earth connections can be made by soldering to the nearest convenient point of the main board.

You can use either single or double-sided copper clad board. The size of the pads is not critical but we suggest 1/4in (6.0mm) square. Cut the pads with a junior hacksaw using a small vice to hold the board while you cut it.

Once the pads are prepared they can be fixed to the main board using epoxy cement. In Fig 1a there is a layout for making an oscillator.

Try comparing the layout in Fig 1a with the circuit in Fig 1b.

When you have decided where all the tabs have to go to make up your own circuit clean and tin the tabs. This will make the placement and soldering of the components easier. The base or main board for the circuit can be a piece of copper clad board or an enclosure such as a tobacco tin.

When designing radio frequency (RF) circuits the layout must be arranged to keep the interconnecting wires as short as possible. This flexible arrangement of pad supports is a good compromise between cost and flexibility.

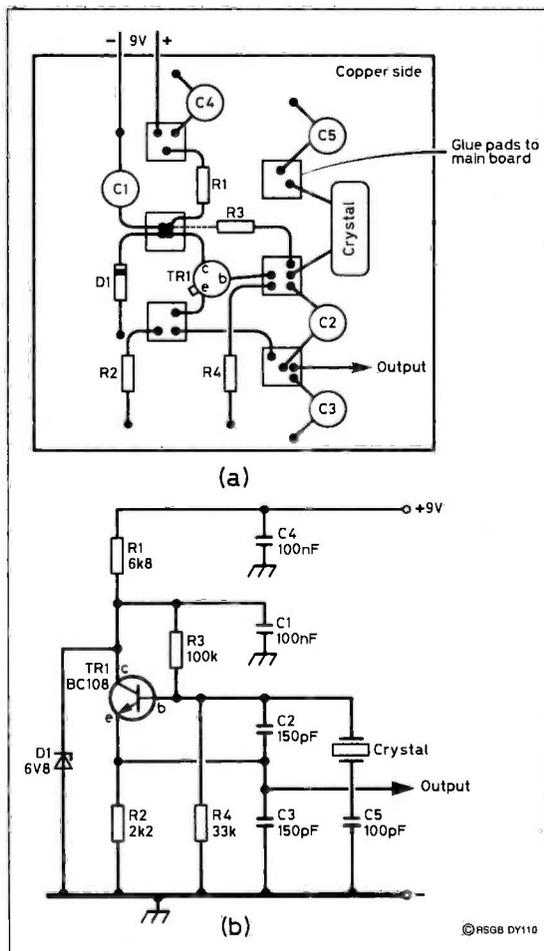


Fig 1: Example of circuit component layout.

PCB off-cuts (approx 300mm square) can be obtained at £2.50 + £1 P&P from JAB Electronic Components, 1180 Aldridge Road, Great Barr, Birmingham B44 8PB.

# J-Antenna for the 50MHz Band

By Robert Snary, G4OBE



THIS ANTENNA is designed for use in the 6 metre (50MHz) amateur band for FM (Voice) operation and Data Communications. For these types of communication a vertical antenna is to be preferred. A vertical is easy to construct, and has an **omni-directional** (all round) radiation pattern.

## THE VERTICAL DIPOLE

THE SIMPLEST VERTICAL antenna is a half-wave dipole. This type of antenna has to be connected to the transceiver using coaxial cable. The cable must be connected at a point where the **impedance** of the coaxial cable and the antenna are similar. Impedance is the 'AC resistance' of a circuit which carries radio frequencies (RF).

Coaxial cable has what is known as a **characteristic impedance** and the cable normally used in amateur radio has a characteristic impedance of 50Ω. A half-wave dipole has a low impedance of around 50 to 70Ω at the centre, so this is the most sensible place to connect coaxial cable to it. This is the well-known centre fed dipole that you will see in most amateur radio books.

For the centre-fed dipole to work effectively the cable must be connected at right angles to the dipole element. This can pose a mechanical problem if the antenna is mounted vertically. It would be more convenient if the

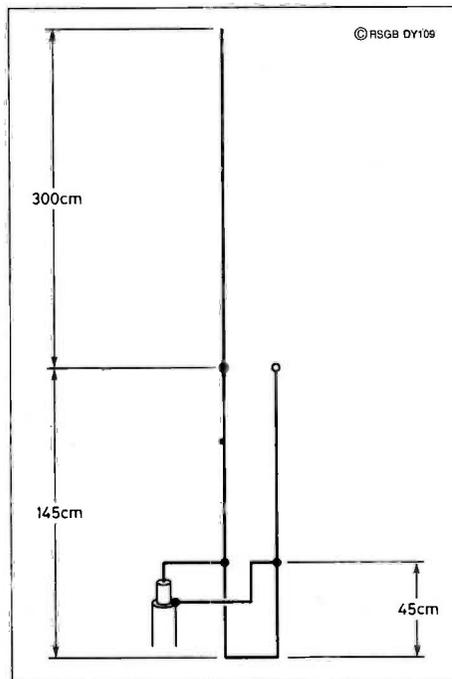


Fig 1: Overall dimensions of the 6 Metre J-Antenna.

dipole could be fed at the end, but the end has a very high impedance and is unsuitable for directly connecting the coaxial cable.

## THE J-ANTENNA

COAXIAL CABLE can be connected to the end of a half-wave dipole using an **RF transformer**. In this case we use a quarter-wave matching transformer.

This is made from 300Ω ribbon cable with one end shorted. At the bottom of the transmission line the impedance is zero (at the point where the ribbon cable is shorted). At the top of the quarter-wave matching section (where it joins to the half-wave dipole element) the impedance is high.

Matching is achieved by tapping (connecting) the coax cable somewhere between these two extremes, at a point where the impedance matches that of the cable.

Fig 1 shows the tapping point for the coax cable where I found the best match to be on my prototype.

This antenna is sensitive to its surroundings and this tapping point may not be the best in your case. You may have to try different points to give a reading on your SWR meter of less than 2:1.

This antenna is made of wire and can be rolled up for transportation to a portable site. It can also be used in a loft or used outside supported by a non-metallic pole or tied to the branch of a tree.

Fig 2 shows how the J-

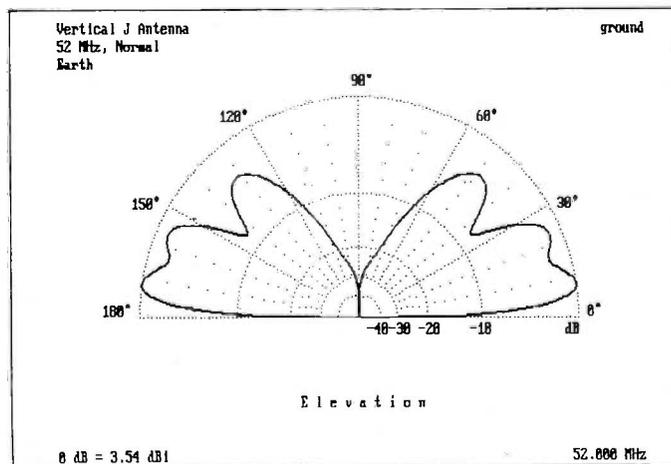


Fig 2: This polar computer diagram plots the antenna's performance.

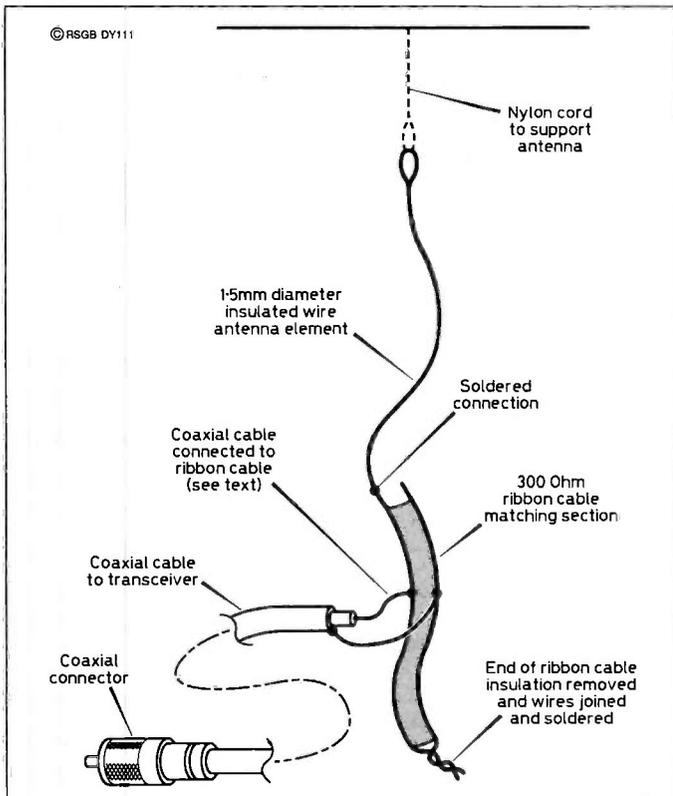


Fig 3: Construction details.

antenna radiates (and receives) looked at sideways on. Very little signal goes upwards which is a direction you don't need. Note that this is just a 'slice' of the radiation pattern, the antenna will perform equally well in all horizontal directions.

### ANTENNA CONSTRUCTION

THE HALF-WAVE element is made from 1.5mm insulated copper wire (Fig 3) as used in household wiring.

The quarter-wave matching transformer can be made from 300Ω ribbon cable. This can be obtained from any Tandy store or by post from Maplin (catalogue available from WH Smith shops).

The insulation is stripped from the part of the wires that form the joints and the wires cleaned and tinned. The wires at the bottom of the quarter-wave matching ribbon are twisted together and soldered. One wire of the quarter-wave matching ribbon is soldered to the half wave element, leaving the other wire insulated and disconnected.

### COMPONENTS

1.5mm Copper wire	300cm (3.0 metres)
300Ω ribbon feeder	150cm (1.5 metres)
50Ω coaxial cable	Length as required
Tape	(To weather-proof joints - see text)

Where the feeder is connected to the antenna the joints should be reinforced either with plastic strips or wooden ice cream sticks. Wrap all the soldered joints, using plastic tape to stop water corroding the cable.

If you would like to make the finished antenna look more professional you could put it inside some white plastic water conduit or pipe, available from many DIY shops. If you use plastic conduit then fittings are available to cap off the end of the tube to make the antenna waterproof.

### SAFETY

HOW YOU FIX the antenna depends on your own location but the following safety rules *must* be applied.

1. Never fix an antenna where it is in contact with, or likely to come in contact with, power or telephone wires.
2. When climbing a ladder to put up an antenna outside, make sure that the ladder is safe and secured.

I hope that this project will encourage you to use six metres and I hope to work a few of you in the future.

[Robert, G4OBE, is the RSGB's Senior Novice Instructor for the Greater London area and we will be seeing more of his articles in future issues - Marcia]

# GUARANTEED!

£1.70  
per issue

Every issue of *Ham Radio Today* for a whole year with our *Direct Delivery Service*.

HRT is always up to date with your needs and interests as a novice or experienced amateur radio user. Product reviews, construction, conversions, packet radio and club news pack HRT from cover to cover –

**This is Ham Radio – Today!**

U.K. and overseas subscription rates available upon request.

Write to us or phone our subscription hotline today on: 0737 768611 and we will send every issue of HRT to you *post free* in the U.K!

Argus Subscription Services, ABP, Queensway House, 2 Queensway, Redhill, Surrey RH1 1QS.

**DIRECT DELIVERY SERVICE**

WIN HRT FOR A YEAR

# HRT

Incorporating SCANNERS

# Operation Drake - A Radio Ham's Tale

By Jim D Heck, G3WGM



**OPERATION DRAKE** was the idea of Lt Col John Blashford-Snell, an experienced explorer who wanted to get young people (17 - 22 years old) involved in adventure and exploration.

A square rigged ship, *The Eye of the Wind*, (see our colour poster) was chartered as a floating headquarters, and where scientific experiments could be conducted during the two year voyage. A few 'directing staff' (DS), twelve crew, and about 24 'young explorers' (YEs) would spend three months with the expedition. During land based phases the numbers of DS and YEs would be increased as necessary. Following a call for assistance, some was provided by the three armed services, but most came from sponsorship from commerce (eg British Petroleum, Kodak, etc).

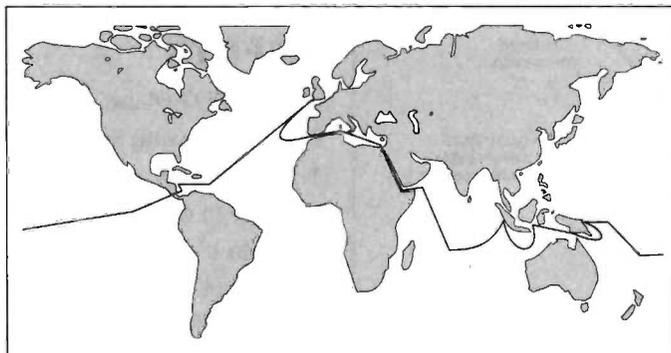
## HOW I GOT INVOLVED

WHILST ATTENDING A course at the Royal School of Signals in Dorset a friend, who knew I was interested in off-shore sailing and amateur radio, asked me to help him set up the communications for Operation Drake. Various manufacturers loaned us a variety of army and commercial equipment. In particular, Radio Shack Ltd (who were then UK agents for Drake amateur radio equipment) supplied a complete amateur radio station.

A small radio cabin and a place for a full-time ship's radio operator had been allocated on board and Cpl Roger Secker, a Royal Signals Radio Operator was selected to stay on board for six months.

## PREPARATIONS

THE SUMMER months were spent preparing the ship for its journey - and fitting out the eight-foot square radio cabin. The radio shack was fitted with four radio systems - two



The route taken by the *Eye of the Wind* on her round the world voyage.

commercial ship-to-shore rigs, an army rig (VRC321 - HF Morse/SSB), and the Drake amateur radio station. The latter proved its worth during the expedition as it was the only radio that was not channelised and allowed free tuning.

As well as the radios themselves we also ensured

that we packed batteries, battery chargers, spares, spare radios, the Admiralty List of Lights and Radio Stations, and a host of other reference books.

We also made arrangements for 30th Signal Regiment based at Blandford to act as the rear link for the expedition, and they set up a base station with some big HF antennas. The staff at Portishead Radio were very helpful in advising us on the communication back-up service they could provide for the trip.

## THE SHIP SETS SAIL

THE SHIP SAILED in September leaving me still on my course. Communications were maintained on a regular basis between the ship and Blandford. The first leg of the journey was across the Atlantic, via the Caribbean islands, to Panama, for 2-3 months supporting various land based expeditions.

It was about Christmas time that it dawned on me that by coincidence my course at Blandford finished at about the same time as Phase 1 of Operation Drake. In that case what was to stop me becoming the ship's radio operator for Phase 2 of the expedition?

So in April I made my way down to Panama to meet up with the ship, and take over from Roger as the radio operator. Good radio communications were a most important part of the expedition as the numerous sponsors wanted to know how the voyage was going, and to have news of the expedition generally. In addition a number of schools were following the progress of the expedition as part of a school project.

## ON BOARD

THE VOYAGE WAS fantastic. The first leg, which took about two months was from Panama to Fiji, calling at Costa Rica, the Galapagos Islands, and Tahiti. During one period of three-and-a-half weeks at sea we were allowed to use fresh water only for drinking so when there was a rare heavy rainfall we all stood on deck with bars of soap!

The radio communications went well; I managed to maintain daily contact with Blandford, passing them news of our progress. I also used the commercial rigs to call up shore based stations for the benefit of the reporter we had on board for *Capital Radio* and, of course, for the all-important daily weather forecast. Not only was I the ship's radio operator, but I also became the ship's accountant - and also ship's electrician whenever anything electrical went wrong, from an electric shaver to the navigation lights - right at the very top of the mainmast!

We spent a month in Fiji, undergoing some repairs, and the YEs went to neighbouring islands to assist with rebuilding schools and homes after a recent hurricane. I was responsible for ensuring that they had radio communications back to the ship, and that they knew how to use the radios.

After Fiji, we headed for the city of Lae, calling at the Solomon Islands and atolls, on which conditions were sometimes quite primitive. We generally bartered for fresh fruit and vegetables, and the 'natives' wanted fish hooks, soap and cigarettes. Fortunately we had stocked up with these items in Fiji! When we arrived in Lae, we had a fantastic welcome from the locals, who put on a special welcome dance on the keyside for us. It was fantastic that in the morning people could be dressed in native garb (leaves, grass skirts, etc) yet in the afternoons, they could be working in a bank.

During the time spent in Lae we had several trips to the islands, where one particular project was to document the use of herbal medicines amongst the tribes living in some of the more remote islands.

## AMATEUR RADIO

THE DRAKE RADIO equipment operated faultlessly throughout the trip. I made many contacts using it, using my own callsign G3WGM/MM (the /MM means maritime Mobile and was used on the high seas), but also whilst in Papua New Guinea waters using the callsign PY29HJ, issued to me by the PNG authorities.

In the Pacific, amateur radio was used as a means of general communications. Many of the smaller vessels carried amateur radio, and there was a daily net on 20 metres for small craft, which I joined most days.

## CONCLUSION

IT WAS VERY sad when I had to say goodbye to the people I had come to know so well during the voyage, who were to spend the whole two years circumnavigating the world. When the ship finally sailed back to the UK over a year after I left it, it did so to a tremendous welcome when it sailed up the River Thames to St Catherine's Dock. I went to greet her, and met many of the people who had been involved during the two years of the trip.



Time for a break on board ship.



Loading the radio equipment on to *The Eye of the Wind*.

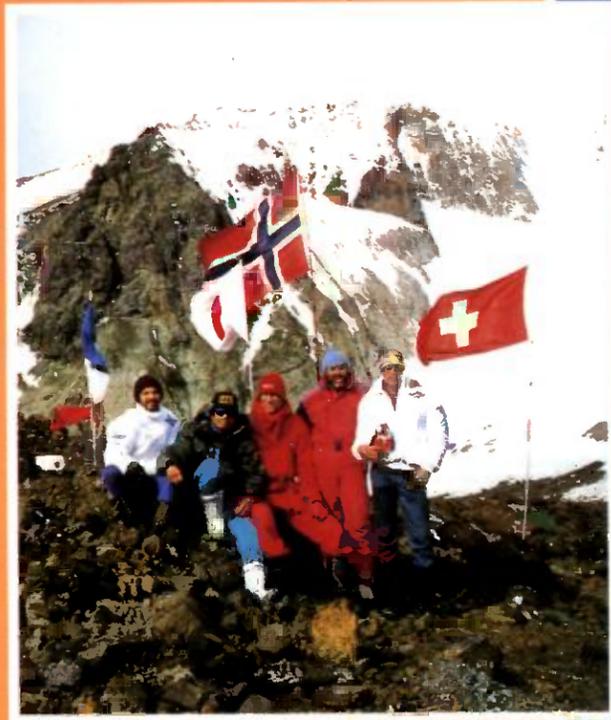


Regular radio contact was maintained with Blandford in the UK.

Operation Drake was over, but the idea was not. From Operation Drake came the idea of Operation Raleigh, which still continues today. Raleigh exists to allow young people from all over the world to have a taste of the sense of adventure and discovery, which so many of them during my involvement in Operation Drake found so rewarding and satisfying.

[We will be telling you more about Operation Raleigh in the September-October *D-i-Y Radio - Marcia*].

# AMATEUR RADIO PASSPORT TO ADVENTURE



Top: F2CW, JF1IST, LA1EE, HB9AHL 'fly the flag' to celebrate the success of their DXpedition to Bouvetoya, a snow-capped and almost extinct Volcano in the South Atlantic.  
Bottom: Lawrence Howell, GM4DMA, on Sredny Is - the base camp of the North Pole '90 expedition.

The Operation Drake clipper *The Eye of the Wind* on her Around-The-World Expedition. Jim Heck, G3WGM, took time off from the Royal Signals to act as Radio Officer, and joined the ship in Panama. Operation Drake was the fore-runner of the more famous Operation Raleigh. If you would like to find out more about expeditions of this kind contact Raleigh International, 27, Parsons Green Lane, London SW6 4HS. Tel: 071 371 8585.

**A**mateur radio introduces you to new friends, a possible career, and you could even get involved in taking part in expeditions, challenges or other exciting adventures, similar to those illustrated here.

Many expeditions require the back-up of a radio officer, and your amateur radio experience could provide the necessary qualifications for you to join the team. Organisations such as the Duke of Edinburgh Award Scheme, Operation Raleigh, The National Geographical Society etc will be able to advise you on how to get involved.

Below: Mike Devereaux, G3SED, in the uncharted jungle in Sabah, Eastern Malaysia during the Camel Trophy expedition in 1992.

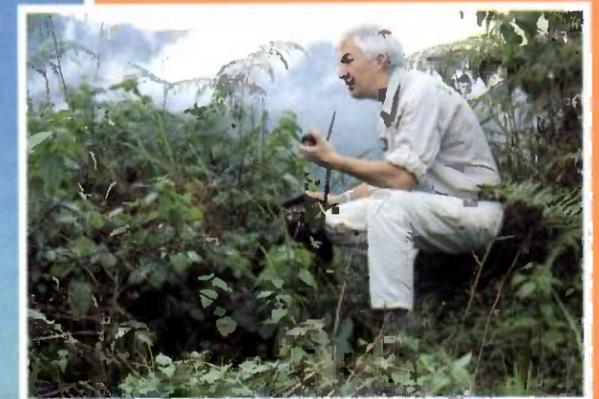


PHOTO: LEE FARRANT



**D-i-Y**

RSGB, Lambda House, Cranborne Road, Potters Bar, Herts. EN6 3JE

# 2's Company

## News and Reports from Novice Licensees



Thirteen year old Paul, 2E1DBI, has had his licence three weeks and is already having great fun, despite being currently restricted to low power 432MHz operation. He is frequently to be heard on his local repeater, GB3VH, which has several Novices amongst its users. He is looking forward to doing some portable operating and to combining his radio and computer interests by using packet radio (see 'Amateur Radio and Computers', *D-i-Y Radio*, Vol 3: No 1).

### FATTENING MORSE?

MICHAEL HINDLEY, 2E0AHY, passed the Morse test on his eighth birthday! His father, G4VHM, discovered his son's interest when he realised that he knew the letters - telling his dad who he was working. Encouraged by prizes of Mars bars at the end of each suc-



Two new licensees at RSGB HQ: Sylvia, 2E1CYL, who has dealt with the Novice training scheme for the last three years; and Marcia, 2E1DAY, *D-i-Y Radio's* very own Editor.

cessful week, Michael learned quickly to translate into Morse car number plates, shop signs etc.

### AWARD SUCCESS

MANY CLUBS sponsor awards. These are colourful certificates confirming that something special has been achieved. Several awards are offered by the G QRP Club, whose members (Novices and Full Licencees) are interested in making contacts with very low transmitter power (QRP). Ken, 2M0ACT,

has been awarded the club's Class 'A' Novice CW Award for making 50 contacts (QSOs) using only three watts of Morse code (CW), with stations in twelve countries. His QSOs were all over the world including with the USA, Canada and Indonesia.

The Novice Services Manager of the G QRP Club, Dave, G0NEZ, says he has heard only praise for Novices and the standard of their operating.

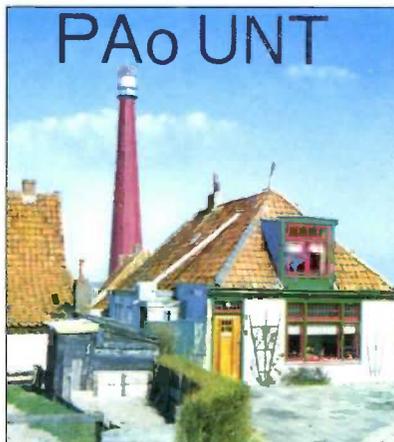
### RSGB OPEN DAY

SEVERAL NOVICES had a look around RSGB Headquarters on Open Day (4 June). The newest licensed was Alex, 2E1DBP, who lives just round the corner in Potters Bar - very handy for buying the latest RSGB books at counter prices. If you missed the Open Day but would like to see RSGB HQ, including where *D-i-Y Radio* is produced, drop a line to the Editor.

### THE LOG BOOK

Contests are a good way to improve your operating skills and to get a lot of contacts in your log in a short time. More and more Novices are taking part in contests, and some are entering. Many contests are organised by the RSGB and you must be a member to compete. But non-members can still send in a check-log to help in checking the competitors' claimed contacts.

Many clubs will be competing in RSGB VHF National Field Day over the weekend of 2/3 July, just as this edition of *D-i-Y Radio* comes out. This outdoor event is always a good opportunity to gain some experience and have some fun.



An unusual QSL card from the coast of Holland.

The RSGB 432MHz Low Power Contest on 24 July has a power limit of 25W output. This means that Novice entrants are not competing with stations running hundreds of watts, and so have a better chance of being heard. The contest allows portable operation so why not head for the hills and see what you can work. The times are 0800 to 1400 UTC (that's 9am to 3pm). You will need to work out the QTH Locator of the site you intend using - use the grid on the large map we sent you when you first subscribed to *D-i-Y Radio* or ask an experienced amateur.

As an example of what you can work in a contact, Margaret Snary, 2E1AQS, who has

# Short Morse

## Codes for Every Occasion Understood All Over the World



WHEN A RADIO amateur sends Morse code it is easier to abbreviate words as far as possible. These abbreviations also help when sending to someone who doesn't understand English. Remember, these codes should be used only when sending Morse - when transmitting in telephony (speech) the full explanations beside each code should be given instead.

See how many of these abbreviations you can recognise when listening to Morse transmissions.

73	Best wishes
88	Love and kisses
ABT	About
ADR	Address
AGN	Again
ANI	Any
ANT	Antenna
BCNU	Be seeing you
BD	Bad
BLV	Believe

CC	Crystal controlled
CK	Check
CLD	Called
CFM	Confirm
CL	I am closing my station
CNT	Cannot
CRD	Card
CUD	Could
CUAGN	See you again
CONDX	Condition(s)
CQ	Calling any station
CUL	See you later
DE	From
DR	Dear
DX	Rare or long distance station
ELBUG	Electronic key
ENUF	Enough
ES	And
FB	Fine business (ie Good)
FER	For
FONE	Telephony
FREQ	Frequency
GA	Good afternoon
GB	Goodbye
GD	Good day
GE	Good evening

GM	Good morning
GN	Good night
GND	Ground
HI	Laughter
HPE	Hope
HR	Here
HW	How
MNI	Many
NR	Number or near
NW	Now
OM	'Old man'
R	Roger or received
RPRT	Report
RPT	Repeat
RST	Readability, Signal Strength Tone - report
RX	Receiver
SRI	Sorry
TFC	Traffic
TNX	Thanks
TU	Thank you
TX	Transmitter
UR	Your
VY	Very
WX	Weather
XYL	Wife
YL	Young Lady

### THE LOG BOOK

featured on these pages before, writes to say that she had two SSB contacts of over 100km during the RSGB 432MHz Trophy Contest on 7 May. From her North London home, she was running 3W PEP output from an Icom IC-471E to a 48-element beam *inside the house*. The stations were GW4BVY/P in North Wales at 192km and G4GCM/P in Norfolk at 110km. A contact with GW8AWM/P was not completed due to fading (QSB).

The HF bands have been rather strange recently. Conditions have been frequently very poor with the reducing sunspot count - some days the count has been zero - and

solar flares disturbing the ionosphere (see 'Amateur Radio and the Sun' and 'Sunspots and the Radio Amateur', *D-I-Y Radio*, Vol 4: No 2). The summer has brought Sporadic E

<b>2EØAFI</b>					
<small>TX _____ RX _____ ANT _____ POWER _____</small>					
TO RADIO	DATE	GMT	BAND/MHZ	MODE	RST
<small>DENNIS SHALLCROSS 17 HAZEL GROVE MATLOCK DERBYSHIRE DE4 3ED PSE/TNX QSL DIRECT VIA RSGB</small>					

Club badges frame this card from seventy-year-old Dennis, 2E1AFI.

conditions which mean many short-range stations on the higher bands, including sometimes 50MHz. The pick of the log has been: F5MDB/7O (Yemen) on 7MHz, 9M2AX (West Malaysia) and TU4SR (Ivory Coast) on 18MHz, VP2MCO (Montserrat) on 21MHz; and at shorter range 3A/DA1AC/P (Monaco) on 10MHz, TK/IK4CIE/P (Corsica) on 18MHz, and HV4NAC (Vatican City) on 21MHz.

Now we're at the height of summer, look out for more Sporadic E on 28 and 50MHz - and maybe even 144MHz. And now's the time to plan your new aerial system for next winter's DX season.

# A Relaxation Oscillator

By John, GW4HWR, Chairman RSGB Training and Education Committee.



YET ANOTHER FEARSOME word - describing a group of oscillators which continually repeat a sequence of events without the use of some oscillatory element such as a tuned circuit or a crystal as would be found in a harmonic type oscillator. There are many types and the example which follows is just one of them.

Look at Fig 1. If S1 is moved to position 2, C1 will charge through the resistor (labelled R2), when the voltage reaches about two thirds of the value of the supply suppose the switch is moved back to position 1.

The capacitor will now discharge at the same rate as it charged. When the voltage falls to about one third of the supply the switch is again moved to position 2 and the capacitor starts to charge again. The waveform (shown in the inset of Fig 1) will be maintained as long as someone is prepared to keep moving the switch at the correct moment in time. Fortunately there is an integrated circuit which will do the job for us - it is the NE555 timer.

The integrated circuit has two inputs - pin 6 (**Threshold**). When the voltage at this pin rises to more than two thirds of the supply voltage the resistance between pin 7 (**Discharge**) and ground, falls to zero. The other input is at pin 2 (**Trigger**). When the voltage at this input falls to less than one third of the supply, the resistance of pin 7 to ground becomes very high.

In Fig 2 assume that the voltage across C1 is low then pin 7 will be at high resistance and C1 will charge through R2 towards the supply voltage. When the voltage reaches about two thirds of the supply, pin 7 will short circuit to ground and C1 will discharge through R2. A little thought will show that if the supply voltage is 12 volts the voltage at pins 2 and 6 will vary between 4V and 8V.

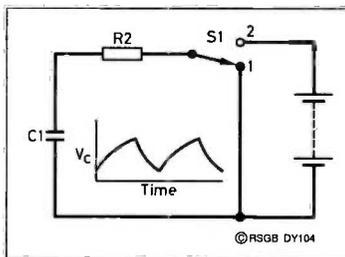


Fig 1: The voltage across C rises and falls as the switch is moved.

Pin 8 is the output of the IC and this switches between supply and 0V as pin 7 switches between high and low.

## MAKE IT!

FIG 3 SHOWS THE position of the components and it must be noted that the diagram shows the components as they are fitted to the plain side of a piece of Veroboard. If you can obtain some vero pins make a start by fitting these in the eight positions marked with a large dot. Push the single ended pins in from the copper side and solder the heads to the track. It is most important that a small soldering iron bit and thin resin cored solder is used to avoid the solder making a bridge between tracks. Fit the integrated circuit only when you have determined which is the correct way round. The NE555 is quite robust and will take a lot of abuse but it can't tolerate the supply being reversed so we must get the orientation correct. Look for a D indentation at one end or a circular dot or both - see Fig 3 and insert the IC as shown. Make the wire links from the ends of the three resistors

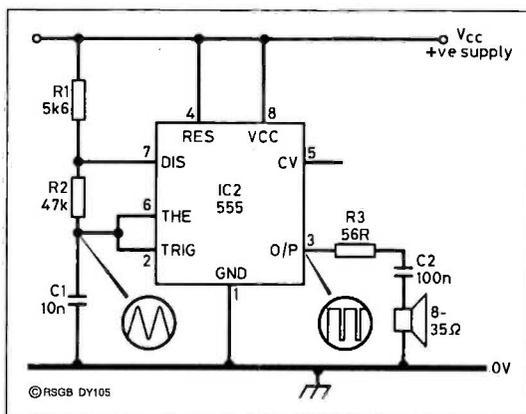


Fig 2: An IC replaces S1 in fig 1.

after they have been fitted. Make the breaks in the tracks where shown using a small drill bit (3mm) used in the hand! The loudspeaker can be any small type but one having a resistance of about 35 ohms will give best results.

R2 and C1 are soldered to the pins and not into the board so that they can be changed to see how the frequency of the oscillation can be changed. Try values between 10k and 470k for R2. If you wish to insert a Morse key, connect it between the battery and the pin marked (supply -).

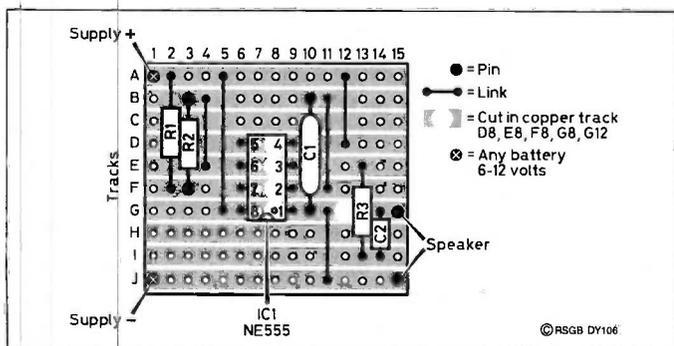


Fig 3: The layout of the components on the veroboard.

## COMPONENTS

### Capacitors

C1	10n	[Maplin 103K1D]
C2	100n	[Maplin 104K1D]

### Resistors

R1	5k6	[Maplin M5K6]
R2	47k	[Maplin M47K]
R3	.56R	[Maplin M56R]

### Miscellaneous

IC1 NE-555	[Maplin QH66W]
35 ohm Loudspeaker	[Maplin YT25C]
Veroboard	10 strips x 15 holes long

# Some Recommended Radio Reading

For Novices and Beginners



NOW YOU HAVE started to construct your own equipment and to expand your knowledge of amateur radio, perhaps you should now take a look at some of the books available. Those recommended here are all extremely useful to new and prospective radio amateurs.



## RSGB AMATEUR RADIO CALL BOOK

THE *RSGB AMATEUR Radio Call Book and Information Directory* is a must. In addition to listing the names and addresses of over 60,000 G and EI calls, it contains a wealth of information on all aspects of amateur radio operating. This includes Countries Checklist, Amateur Band Plans, how to use the QSL Bureau, Morse Practice Transmissions and Testing Service, Clubs, Repeaters, Beacons, Propagation and Packet. **Price: £9.50.**

## PRACTICAL ANTENNAS FOR NOVICES

THE MOST IMPORTANT item of an amateur radio station is the antenna. John Heys, G3BDQ, uses his wealth of experience to describe the construction of simple, practical antenna designs. Four of the chapters are used to describe antennas for the 1.9, 3.5, 10 and 21/28MHz bands. A chapter is devoted to the class B Novice with antennas for the 50 and 432MHz bands.

This book guides the beginner along the lines of 'learning by doing' - the philosophy adopted by those engaged in the training for the Novice Licence. **Price: £5.99.**

## W1FB'S QRP NOTEBOOK

QRP (LOW POWER) and building and experimenting with simple radio equipment go hand in hand. Not only is simple

radio equipment easy to construct and operate but it is fairly inexpensive. In this book Doug DeMaw, W1FB, covers construction methods, receivers, transmitters and accessories and it will have a special appeal to Novices or beginners who lack a technical background and have yet to develop their skills.

**Price: £7.40.**

## MORSE CODE FOR RADIO AMATEURS

IN THESE DAYS of computers and high tech radio equipment Morse code might seem rather out of place. However, Morse (CW) does have advantages. Firstly, the construction of a CW transmitter is relatively straightforward compared with the SSB equivalent and is well within the capability of the home constructor. CW is also very effective because the bandwidth required is only about a tenth of that required for SSB. For example, amateur EME (Earth-Moon-Earth) contacts, working at the very limits of equipment and operator performance, have to use CW. George Benbow, G3HB describes how to learn, receive and send Morse code. It also covers the amateur Morse tests and two chapters are devoted to manual and automatic Morse keys. **Price: £3.99.**

### *How to Order These Books*

Send a cheque or postal order to the address below with your book requirement (RSGB members see *RadCom*). Please add £1.00 P&P (overseas £1.75) per book or £2.00 (overseas £3.50) for two books or more.



**RSGB, Lambda House, Cranborne Road, Potters Bar, Herts EN6 3JE.**

# A Receiver Converter for 50MHz

By Ian Keyser, G3ROO



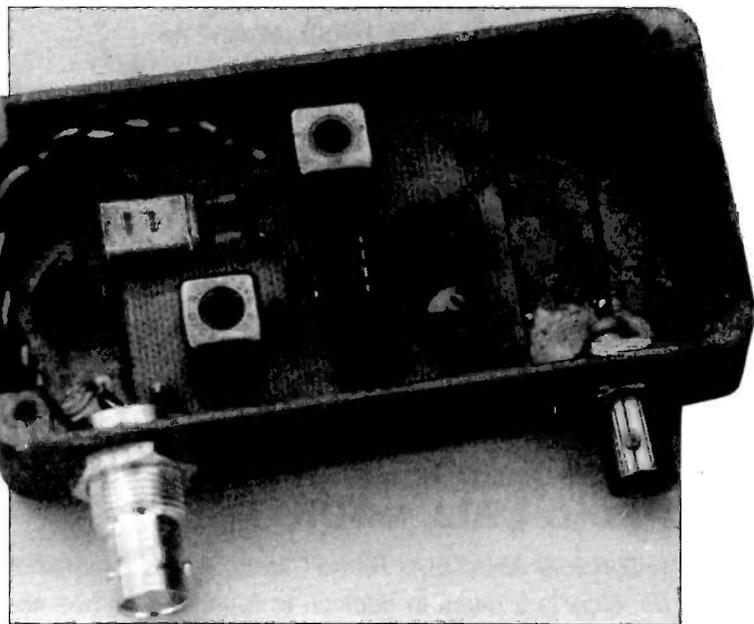
THE 50MHz (6M) BAND gives good cross-town working as well as occasional long range DX contacts. This circuit is known as a converter, the first stages of a superhetrodyne receiver. By using a transistor radio as a tuneable intermediate frequency (IF) and audio amplifier the design is very much simplified.

## SO HOW DOES IT WORK?

TAKE A LOOK AT the circuit in Fig 1. The signal from the antenna is fed into transformer T1, which is tuned to 50MHz by capacitor C1. The signal is passed via C2 to integrated circuit IC1 which contains a mixer and crystal oscillator. The frequency of this oscillator is controlled by crystal (XL1) at 22MHz.

The antenna signal mixes with the one from the crystal oscillator and produces yet another at a lower frequency, which can be heard on your communications receiver (which becomes a **tuneable intermediate frequency** stage).

This means that if you want to listen at the low end of the 50MHz band you would tune your communications receiver



Converter built into a small diecast box.

to 28MHz (50 - 22 = 28MHz). To receive signals at the top end of the 50MHz you would tune to 30MHz. So by tuning from 28 to 30 MHz you will be able to cover the whole of the 50MHz amateur band.

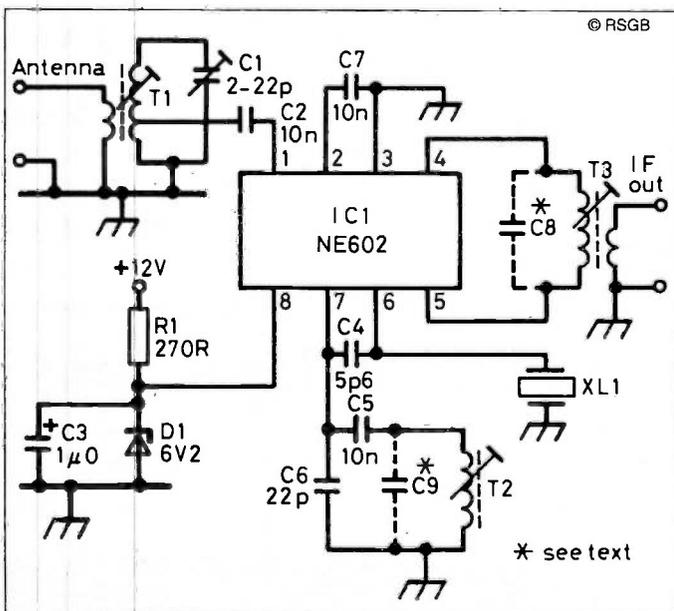


Fig 1: Circuit diagram of the simple-to-build 6 metre converter.

## EASY TO CONSTRUCT

THE 50MHz CONVERTER is shown in the photograph (above). All the components are mounted on a printed circuit board (PCB) as shown in Fig 2 with the track side of the PCB given in Fig 3.

The components for this project are available as a kit from Kanga Products (see opposite).

Before T1 can be fitted it must be modified so that it will tune to 29MHz. Remove the metal can and then remove the ferrite cup. Use a screwdriver to take out the tuning coil core.

## GETTING IT WORKING

CONNECT THE receiver antenna to the IF OUT (right hand socket in the photo) on the converter via a short length of coax. Connect a 50MHz antenna to the ANTENNA socket

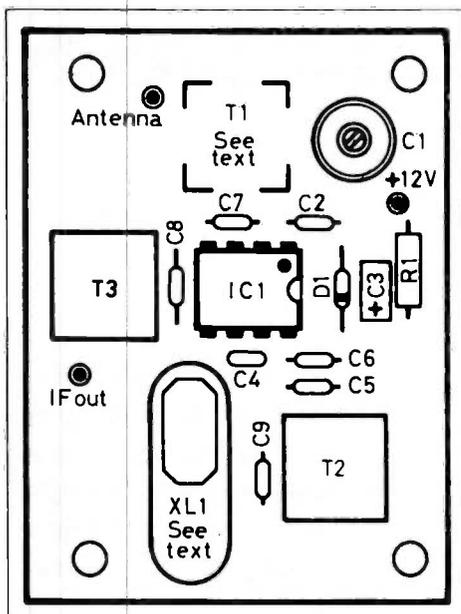


Fig 2: Component layout of the 6 meter converter on the printed circuit board.

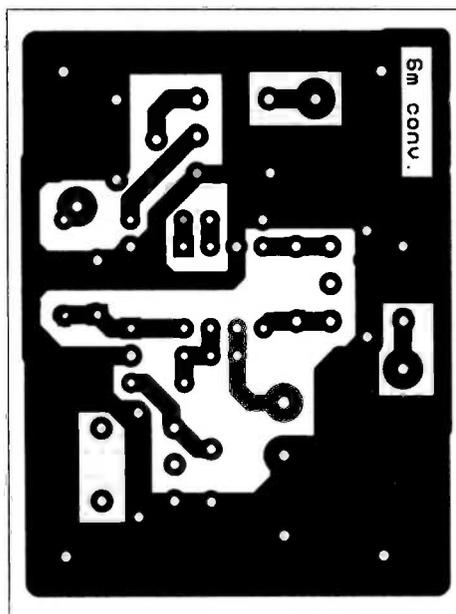


Fig 3: Track side of the printed circuit board. (Reduced to 70% of actual size)

hear an increase in noise level. If you are lucky you may even hear a ham radio signal. You can ask a local amateur to provide a signal, or maybe you live near a beacon on the 6m band. (there is a beacon at RSGB HQ, GB3NHQ, on 50.50MHz. Others are listed in the *RSGB Callbook*). If you do not hear a 6m signal the oscillator may not be working so try adjusting T2. It's easy to tell when the oscillator starts, as receiver noise increases by a noticeable amount.

Tune the band and, when you've found a signal, peak C1 for maximum strength then do the same for T2. Next disconnect the power and then reconnect it.

of the converter. Set C1 to half-mesh half way between fully open (minimum capacitance), and fully closed (maximum capacitance). Use a small screwdriver to set the tuning cores of T2 and T3 level with the top of each coil former.

Switch on the receiver and you will hear general background noise. Switch on the converter and you should

Check that the oscillator starts again and the signal can still be heard. If not, adjust T2 half a turn and try again, it is important that the oscillator runs smoothly. Good luck!

### COMPONENTS

**Resistors**

R1 270R

**Capacitors**

C1 2 - 22pF trimmer cap  
 C2,C5,C7 10nF disc ceramic  
 C3 1µF 25V tantalum bead  
 C4 5p6 ceramic plate  
 C6 22pF ceramic plate  
 C8 33pF ceramic plate  
 C9 33pF ceramic plate

**Semiconductors**

IC1 NE602  
 D1 6V2 zener diode

**Additional Items**

T1 KANK3335 with metal can and cup removed  
 T2 KANK3335 complete (the can is earthed)  
 T3 KANK3335 complete  
 XL1 22MHz crystal

## 50MHz CONVERTER KIT OFFER

Use the coupon on page 23 to save 50p off the price of the above kit from Kanga Products. If the voucher is enclosed at the time of ordering the kit will cost **£13.45 inc P&P.**

**OFFER CLOSES  
31 AUGUST  
1994**

**A kit is available for this receiver from Kanga Products, Seaview House, Crete Road East, Folkstone CT18 7EG; tel 0303 891106. Price is £13.95 inc P&P**

**Become a regular D-i-Y'er**

Get the next six editions of D-i-Y Radio PLUS a bag of goodies for the special price of £9 (overseas prices on application). Send cheque or postal order to:  
 RSGB, Lambda House, Cranborne Road, Potters Bar, Herts EN6 3JE.

# Amplitude Modulation Explained

By Ian Poole, G3YWX



A RADIO signal must be varied or **modulated** in some way if it is to convey any form of information, whether it is sound, vision or data from a computer. One form of modulation is called **Amplitude Modulation** or **AM**. It was the first method used to transmit sound signals over radio and it is still widely used today by the Long, Medium and Short Wave broadcast stations. In addition it is also used on VHF and UHF for communications between aircraft and the ground.

## THE BASICS

AS THE NAME IMPLIES, Amplitude Modulation varies the intensity or amplitude of the radio frequency signal to convey the sounds. The sound vibrations are effectively transferred onto the radio signal itself.

When the modulation is applied the **envelope** of the signal varies as shown in Fig 1. In some cases there may be very little modulation, but in others there will be much more. A maximum point is reached when the envelope falls to zero and rises to twice the original level (Fig 1c). When this point is reached the carrier or signal is said to have 100% modulation. Any increase on this will cause severe distortion and cause the signal to spread or **splatter** over other channels.

Unfortunately even with 100% modulation the use of the power is poor in terms of the amount of actual 'sound power' which is transmitted. To find out why this is so it is necessary

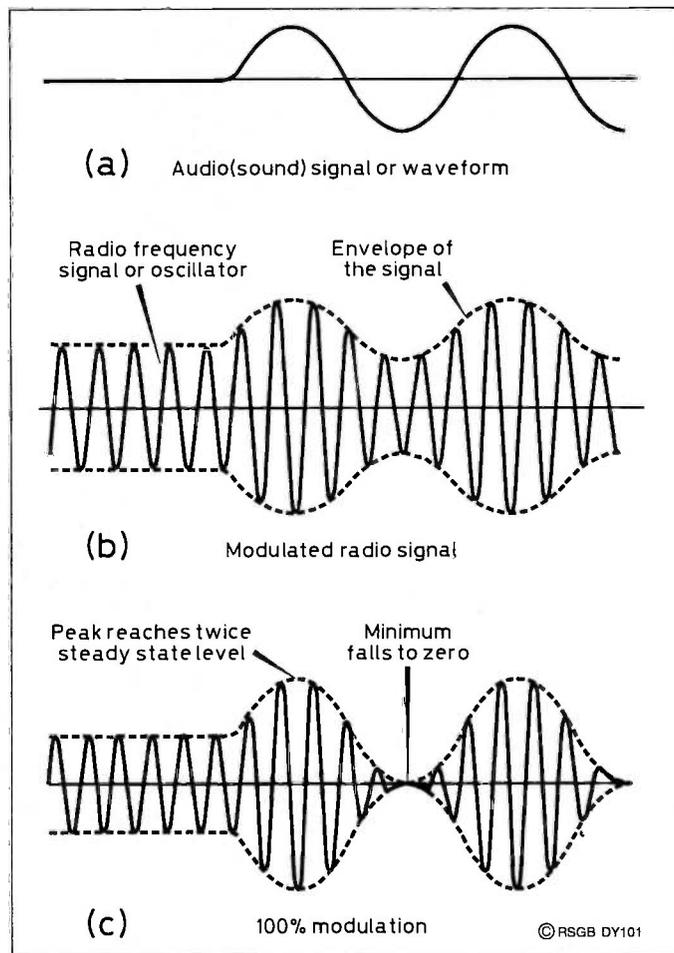


Fig 1: How an audio tone amplitude modulates a radio frequency signal.

to look at the spectrum of the signal ie where all the signals would be if they were tuned by a radio. To simplify matters, imagine the signal is modulated by a 1kHz tone (Fig 2).

When this happens two signals 1kHz either side of the main carrier are formed. These are called **sidebands** and even with 100% modulation they each only have a power equal to a quarter of the carrier.

If the tone is replaced by speech then instead of sidebands on a single frequency they are spread out over a small band of frequencies equal to the bandwidth of the speech as shown in Fig 3. The same poor use of power is obtained. In fact the only real use for the carrier is when the audio signal is

taken off the radio frequency carrier in a process called demodulation or detection. When the carrier is present a very simple detector can be used consisting of just a diode [Such as the one used in *D-i-Y Radio's* fruit-powered radio, Vol 3: No 6 - *Marcia*]. Another disadvantage of AM is its poor use of space. Both sidebands carry the same information and so they just duplicate one another, taking up twice as much spectrum space as necessary.

## CHEAP AND CHEERFUL

THE MAIN ADVANTAGE of AM is its simplicity. Radios which use it can be made more cheaply than ones for other modulation types. Just look at the cost of the very cheap

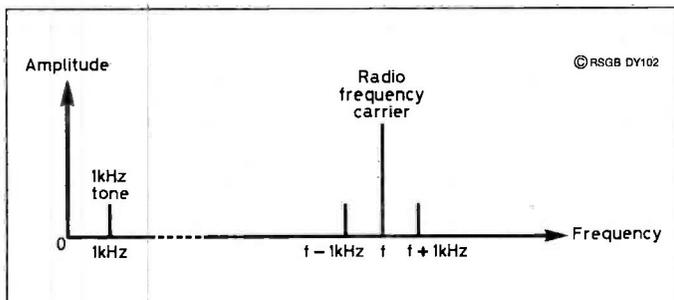


Fig 2: Spectrum of a signal modulated by a 1kHz tone.

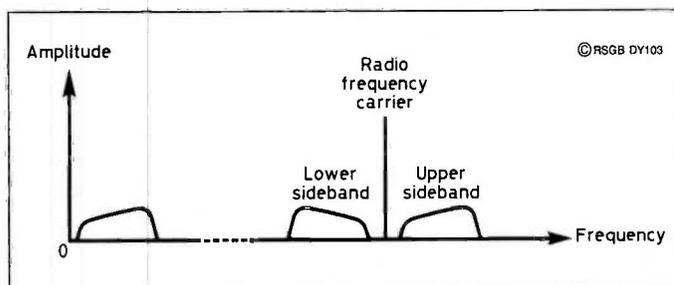


Fig 3: Spectrum of an AM signal modulated by speech or music.

became a standard. However today's technology makes it easier to use other modes but it would mean changing many millions of radios to conform to any new standards which might be introduced.

Despite this, broadcast stations are looking at improving matters. The first step is to transmit only one sideband. This still retains compatibility with the old radios but will enable the signals to take up only half the space.

AM is only used for broadcasting and for aircraft. The reason for this limited use is that it gives poor low signal performance. In addition to this it is also very prone to being picked up by poorly designed TVs and hi-fi systems. In the days when AM was widely used for amateur voice communications this was a considerable problem to radio amateurs.

Even so AM is still very important. It is the basic starting block for some other modes which are in far greater use and are far more advanced. This includes single sideband suppressed carrier (SSB) and narrow band frequency modulation (NBFM), both of which are commonly used by radio amateurs. We will be covering these in a future *D-i-Y Radio*.

radios which can be bought today. Another reason why AM is well established is that, years ago, transmitter technology was simpler for AM than for other modes. As a result it



# RSGB National Mobile Rally

**SUNDAY 7 AUGUST 1994 OPEN 10AM**

**WOBURN ABBEY, BEDFORDSHIRE**

- ◆ **LARGE TRADE EXHIBITION**
- ◆ **RSGB BOOKSTALL WITH SPECIAL OFFERS**

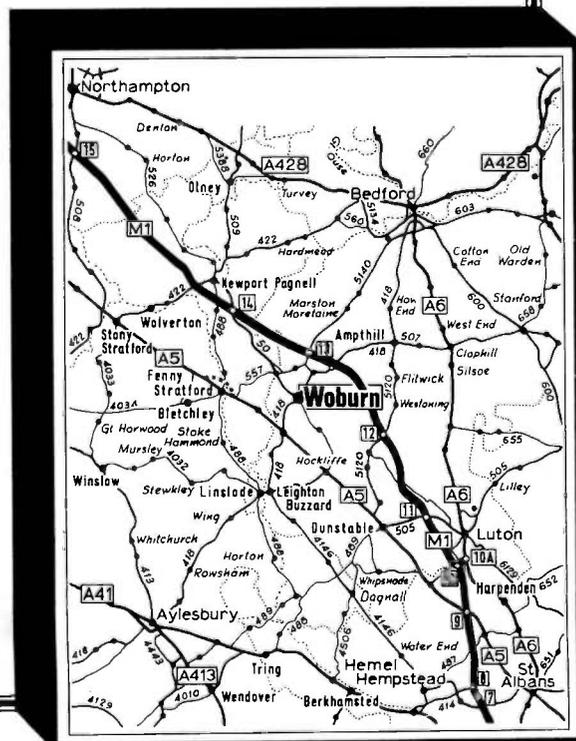
Entrance to Deer Park £5.00 per car (including occupants)  
 Entrance to Deer Park £2.50 per car (driver only)  
 (The RSGB make no charge for entrance)

## HOW TO GET TO THE WOBURN RALLY

Via the M1 - leave the M1 from north or south at junction 13, not 12 as signposted, and then follow signposts through Husborne Crawley to Woburn Abbey.

Avoid routes signposted to "The Animal Kingdom" or "Game Reserve". The rally takes place in Woburn park, and correct routes are signposted to "Woburn Park" or "The Abbey". Also watch for RSGB signs.

**All enquiries regarding this event should be made to Norman Miller, G3MNV, 180 Warley Hill, Brentwood, Essex, CM14 5HF, tel: 0277 225563.**



## Readers' Letters



Keep sending your letters and photographs to the Editor, D-i-Y Radio, RSGB, Lambda House, Cranborne Road, Potters Bar, Herts, EN6 3JE, and we will send a pen to the sender of each letter published.

### TIMELY WARNING

ONE AFTERNOON WE Novices erected a vertical 6m band 'sleeve dipole' at the QTH of our Instructor. We'd just got the coax threaded through the poles that were to support it vertically, with the coax plug peeping out at the lower end.

The horizon to the west is about a mile away and, although we had noticed a dark cloud coming into view, we reckoned that we could complete the work before any rain came.

We had *not* reckoned on the static charge that precedes such cloud formations so, when our very eager and junior Novice stooped to connect a coax lead from the transceiver to the aerial, he got a rude 'rejection slip', such was the static voltage build-up on the aerial.

A short earth-spike close to the mast, with a lead to a large 'crocodile-clip' over the shell of the coax plug, disposed of any more sudden shocking lessons in basic physics.

With Field Days and portable working season coming up, it may be worth issuing a caution, for this was not on an exposed mountain top with a thunderstorm brewing ominously, but on a moist day at 200ft below a ridge from a typical April cloud a mile away.

*Eileen Mainwaring, 2W1BPS*

*Thank you Eileen for this timely warning - radio amateurs take heed - Marcia.*

### MNEMONICS

DID YOU KNOW that Baked Beans Rolled Over Your Garden Bring Very Good Worms?

Actually this is not a gardening tip but a sentence coined by a local amateur (G8RXA I believe) to help beginners to remember something. Can your readers guess what? And do they have any amusing memory-joggers like this?

In our Morse class we try to find phrases to mimic the sound of the Morse - 'how's your Father', 'to Hell with it', 'God save the Queen', 'Charlie Farley' for F, L, Q, C; and to make sure the erase signal contains no less and no more than eight 'dits' we mutter 'iddy biddy iddy biddy' as we tap it out. Do your readers have any phrases to fix other Morse letters in their minds?

Amateur radio is all about self-training in radio communication. But nobody said it had to be all solemn and serious.

*Phil Mayer, GOKKL*

*Drop me a note if you have any funny ways of remembering things - I'll print the best - Marcia.*

### VIVA D-i-Y RADIO

I SORRY FOR my English which is very bad.

I am addicted to your wonderful magazine, also I am member of RSGB. My call is EA3EGV. My photograph is on the first page of *QU-R-PE* magazine edited for the EA-QRP Club. I am founder.

My age 38 years, I am devoted to low power communication. The EA-QRP Club was founded in September 1993.

I'm interested in obtaining Volumes 1 and 2 *D-i-Y Radio*, all copies. I constructed the Hands RX1 Receiver of Page 11, *D-i-Y Radio*, Nov-Dec 1993.

I want to utilize information and articles of *D-i-Y Radio* for inclusion in EA-QRP Club - 'QU-R-PE' magazine?

*Miguel Montilla, EA3EGV*

*Thank you writing Miguel - yes you may certainly include articles from D-i-Y Radio in your magazine - Marcia.*

## D-i-ar-Y

JUL - AUG

### JULY

2/3 Hamfest-UK, Stafford. Details from 0923 893929.

VHF National Field Day (1400 UTC on 2nd to 1400 UTC on 3rd)

9 Cornish Radio Rally, Penair School, Truro. Details from Ken on 0209 821073.

9/10 RSGB Listeners Contest

17 RAIBC (Radio Amateurs Invalid and Blind Club) Annual Romsey Picnic, Broadlands. Details John, G4COM, tel: 0703 693017.

RSGB HF Low Power Field Day Contest (0900 - 1200 and 1300 - 1600 UTC)

24 RSGB 432MHz Low Power/SWL Contest (0800 - 1400 UTC)

30/31 RSGB IOTA Contest (1200 UTC on 30th to 1200 UTC on 31st)

31 Closing date for Young Amateur of the Year Award (see *Comment*, page 2)

### AUGUST

7 RSGB Woburn Rally (see page 21)

21 RSGB 432MHz Fixed/SWL Contest (1700 - 2100 UTC)

21 The Red Rose Rally, Manchester. Details from G1IOO, tel: 0204 24104

## BECOME A REGULAR D-i-Y'ER

### Get D-i-Y Radio for the next year\* plus

- \* An RSGB Map of Western Europe (900mm wide and 1200mm high)
- \* A plastic wallet so you can keep your issues of *D-i-Y Radio* Safe
- \* An RSGB pen and a badge

### ... ALL FOR THE SPECIAL INTRODUCTORY PRICE OF ONLY £9!

RSGB Members see *RadCom* for details of special offer  
Overseas Subscribers write for prices.

Please let us know your age or the age of the person for whom you are buying *D-i-Y Radio* and where you saw this copy.

\* *D-i-Y Radio* is published six times a year

Send cheques or postal orders, made payable to:



RSGB, Lambda House, Cranborne Road, Potters Bar, Herts EN6 3JE.

# DI-DI-DAH-DAH-DI-DIT

## Win a Straight Morse Key



### WINNERS!

**WINNERS OF THE D-i-Y Radio Jumbies Competition (Mar-Apr issue):**

**1st Prize:** Mr A H Gardner, G0NTH, from the Isle of Wight wins the *Getting Started in Amateur Satellites* video.

**2nd Prizes:** Simon Moden from Leicester, and D C Hayward from Horncastle, Lincs, win blank video cassettes.

**3rd Prizes:** Victoria Smith from Jersey, and David O'Neill from Merseyside each win RSGB World Prefix Maps.

**THIS SUPER MORSE KEY** is reviewed on Page 6. G4ZPY Paddle-Keys have kindly donated the review model as a prize in this issue.

**1st Prize:** G4ZPY Morse Key

**2nd Prizes:** RSGB 5WPM Morse Practice Cassettes

**3rd Prizes:** World Prefix Maps

Below are five questions and, beneath each question four alternative answers. When you think you know which is the right answer to each question, write the answers on a postcard. For example if you think the right answer to question 1 is (c) then put '1 (c)' on the postcard. Don't forget to include your name and address. Entries should be sent to the Editor, D-i-Y Radio, Radio Society of Great Britain, Cranborne Road, Potters Bar, Herts EN6 3JE, to be received no later than 31 August next.

### COMPETITION TIME

- 1** For the Novice 'A' Licence, a Morse code pass certificate is required for how many words per minute (WPM)?  
(a) 12WPM      (b) 5WPM      (c) 20WPM      (d) 4WPM

---

- 2** QTH? is a Morse abbreviation which means -  
(a) Where are you going?  
(b) How are you?  
(c) What are you doing?  
(d) Where is your home station?

---

- 3** YL is an abbreviation used in Morse code which means -  
(a) Yankee Lima      (b) Your Letter      (c) Young Lady      (d) Your Lordship

---

- 4** What is the correct prefix for the callsign of a radio amateur from the Isle of Man?  
(a) GM      (b) IM      (c) GD      (d) G

---

- 5** A UK Novice Licence callsign starts with the number -  
(a) 5      (b) 3      (c) 22      (d) 2

### Special Offers

Every *D-i-Y Radio* includes a special offer, indicated by the 50p coin symbol. This issue's offer appears on page 19. If you would like to save 50p off the price shown, then send in this corner token with your order. If you still have any of the old coupons left you can still use these instead, but remember - just one coupon per order.





# More Radio

# Less Cost

## DJ-180E 2M FM £229

- |                        |                          |
|------------------------|--------------------------|
| Expandable Memory      | Ni-Cad Pack & Charger    |
| Function Memory        | Low Battery Indicator    |
| Odd Offsets            | Scanning Features        |
| Auto Power Off         | Rotary Frequency Control |
| Superior Receive Audio | Programmable Steps       |
| Expanded Receive       |                          |

"A wolf in sheep's clothing," a fitting way to describe the ALINCO DJ-180E and DJ-480E transceivers. Probably the most economical and easy to use handhelds ever produced. When funds are limited, yet performance is critical, there's nothing to match their value. And they're packed with features that will make your operation more enjoyable and more fun. Each model is built for reliability and performance. The tough plastic case and advanced circuitry make them a "go anywhere" rig and the low price makes them popular as second rigs for holiday trips. What's more, the 2 Watt signal can be boosted to 5 Watts simply by connecting 12 Volts via the special adaptor. In an instant you have a mobile rig.

*DJ-180E receives 130 - 170MHz DJ-480E receives 420 - 460MHz*



## DJ-480E 70cm FM £249

## DJ-580E 2M FM £419

## 12 Month's Warranty



- Full DTMF
- Auto Repeater Mode
- True AM Airband Receive
- Full Duplex Dual Watch
- Dual squelch/volume

- 42 Memories
- Programmable Scanning
- Low Voltage Operation
- Function memory
- Hod Ni-cad Charger

The DJ-580E handheld is ALINCO's most advanced design ever. You get all the standard features you'd expect such as dual watch, dual controls, scanning, search, priority etc. You also get the superb engineering from ALINCO that is making its competitors envious. The DJ-580E is now being widely used for emergency purposes and its patented low voltage circuit allows it to be used with dry cells when the voltage has fallen by 50%. You also get programmable auto power off, battery saver, digital telephone dialler, and three output power levels. But we've only just started! Key in a special code and your radio turns into a cross-band repeater. Another code gives you AM receive. Little wonder the DJ-580E is ALINCO's best seller.

*DJ-580E Receives AM 108 - 143MHz & FM 130 - 170 / 400 - 470 / 810 - 950MHz*

**Available from all good dealers - or direct**

# Waters & Stanton

Tel: 0702 206835

22, Main Road, Hockley, Essex. SS5 4QS