RADIO D-I-Y

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AN INTRODUCTION TO AMATEUR RADIO - FOR BEGINNERS OF ALL AGES

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D-i-Y RADIO

AN INTRODUCTION TO AMATEUR RADIO - FOR BEGINNERS OF ALL AGES

November • December 1996
Volume Six: No 5

Radio Amateurs Support Polar Expedition

PROJECTS:

50MHz RECEIVER

80M QRP TRANSMITTER

LEVEL PEGGING

PLUS:

NEWS

REVIEWS

ON THE AIR

COLOUR POSTER

CONTENTS

COVER PICTURE:
A dramatic picture of Sir Ranulph Fiennes, who sets off for another record-breaking walk on 1 November. RSGB members Morag and Lawrence Howell, GM0MUV / GM4DMA, provide Ran's communications. See News Feature on page 11.

comment

IN THE SEP-OCT EDITION, we brought you the news that Laurence Howell, GM4DMA, had provided communications and training for charity work in Uganda. Laurence and his wife - Morag, GM0MUV - are old friends of *D-i-Y Radio*, having featured in several articles and posters. And we're pleased to run another story about them (page 11) as they will be supporting explorer Sir Ranulph Fiennes on his attempt at the record for a solo unsupported crossing of Antarctica. Being trained in radio communications can certainly get you to some exciting places.

Congratulations to the winners of the 1996 RSGB Young Amateur of the Year competition (see page 10). The winner, Christopher Davies, M0AAU, has been a *D-i-Y Radio* subscriber for several years.

This time of year we think about Christmas presents. How about dropping a hint that you'd like an *RSGB Amateur Radio Diary* or a *1997 RSGB Call Book & Information Directory* - both advertised in this *D-i-Y Radio*. And we're always pleased to help you give a *D-i-Y Radio* subscription as a present - call 01707 660888 to find out how.

Mike Dennison, G3XDV
Editor

CONSTRUCTION CODE

FOR THE COMPLETE BEGINNER . . . . . 🔧

REQUIRES A LITTLE EXPERIENCE . . . . 🔧🔧

FOR THE MORE EXPERIENCED 🔧🔧🔧

PHOTO: PETER SWYNFORD, G0PUB.

Big Ben and Little Ben? Ben Clarkson, G7WHO, this year's Young Amateur of the Year runner-up, at Legoland in Windsor. See News Feature on page 10.

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ISSN No: 0959-843X.

● 86-YEAR OLD Geoff Yunnie has fulfilled his lifetime ambition and obtained an amateur radio licence. Despite having been interested in radio for over 70 years, Mr Yunnie only took the RAE last year to become G7WIL. He is now studying Morse and hopes to take the RSGB 12WPM Morse test soon. Well done, George!

● THE LECTURE 'Baird - the Man and his Television', including a demonstration of 30-line Televisor equipment, takes place on **18 November** at the Institution of Electrical Engineers, Savoy Place, London. Entrance is free of charge. For further details please contact Ralph Barrett, G2FQS, tel: 0181 845 6807.

● ACADEMY AUCTIONEERS and Valuers of Ealing, London W5, are planning a sale of vintage radios on **13 November** at 2.00pm. A rare 1930s jade green Ekco AD37 will be on offer and is expected to fetch over £1000. Call 0181 579 7466 for a catalogue.

● THE RADIO CLUB Argentino has just celebrated its 75th anniversary. Thanks to new RSGB member Alvaro Iparraguirre, LW7EGO, who informed us of the anniversary.

● SPECIAL EVENT station ON7FF ('Flanders Fields') will be operated by Radio Club Ypres from **2 to 11 November** to commemorate Remembrance Day.

● THE INTERNATIONAL Short Wave League now has a home page on the Internet. Their URL is http://www.aber.ac.uk/~srj5/iswl.html

The Role of the Engineer

MEMBERS OF the Port Talbot Amateur Radio Society in South Wales joined up with a team of engineers from companies such as British Steel and BP to take part in an educational project called 'the Role of the Engineer'.

The team visited a number of schools in West Glamorgan to give pupils an introduction to engineering as a career. The amateur radio exhibit, which proved to be one of the most popular amongst the pupils, involved setting up a complete station - including an HF beam antenna on a mobile trailer tower. Well over 500 pupils have now seen the exhibition and received an introduction to radio communications from the group, as well as learning just how interesting amateur radio can be as a hobby.

Clive Harrison, GW0TWR, with a keen pupil from Cefn Saeson Comprehensive School in Neath, West Glamorgan.

Clive Harrison, GW0TWR, writing on behalf of the group, wished to thank those companies who sent promotional material which helped to make the school visits more interesting for the pupils.

NEW EME RECORD

CHARLIE SUCKLING, G3WDG, and his wife Petra, G4KGC, report working VK2ALU in New South Wales, Australia, by 10GHz moonbounce (beaming the signal at the moon, which acts as a mirror and reflects the signal back to earth). These are the first G to VK and Europe to Australasia earth-moon-earth (EME) contacts on the 10GHz band, and the distance - just over 17,000km - is a new record for 10GHz. Congratulations to all the operators.

TRANSATLANTIC TESTS

THE NIGHT of **9 December** marks the 75th anniversary of the first complete amateur radio message from USA being received in Europe. The callsign of the station heard was 1BCG. To celebrate the anniversary, W1BCG will be on the air from almost the same location in Greenwich, CT, using an exact replica of the original transmitter. The 1996 transatlantic tests, on 1815kHz CW only, begin at 2200UTC on 9 December and continue until 2400UTC on 15 December. W1BCG will also operate on 10 to 80 metres, all modes, from 13 / 15 December. QSL to SARA, PO Box 4225, Stamford, CT 06907-0225, USA enclosing a 9 x 12in SAE for certificate.

Members of the Yeovil Amateur Radio Club in Somerset have built exact replacas of early 1920s receivers and they hope that other UK and European amateurs and listeners will join in with the spirit of the anniversary. Rob Micklewright, G3MYM, points out that a true replica or 'equivalent' receiver *must* use triode valves, as those were the only ones available 75 years ago.

M1CKY M0USE ON THE AIR?

NOT REALLY - but special event station W4D, standing for 'Walt Disney', was on the air from the 'Magic Kingdom' on 1 October. RSGB member Colin Wilson, G4AZM / KD4QFT, who works for Disney in Florida, was one of the operators celebrating the 25th anniversary of Disney's theme park.

KEY ITEMS OF RSGB NEWS FOR HAMCLUB MEMBERS

● THE *RSGB Annual Report and Accounts* for the year ending 30 June 1996 is being sent to all RSGB HamClub members (only) with this edition of *D-i-Y Radio.* The *Annual Report* contains details of what the Society has done for its members over the last year, the audited accounts for 1995/96, and the agenda of the Annual Meeting. The information on candidates standing for Council, and the voting forms are for RSGB Corporate members only. If you are a HamClub member and have not received a copy of the *Annual Report*, please call HQ on 01707 659015 and ask for one to be sent to you.

● THE ANNUAL General Meeting of the RSGB will take place at the Royal Society of Chemistry in London on Saturday **7 December**. For full details please see the *RSGB Annual Report and Accounts.* Please note that HamClub members may attend but they do not have voting rights at the AGM.

● THE RSGB'S INTERNET site is now well established with a large news section, a comprehensive illustrated book catalogue and links to the IARU, the RA and the amateur radio trade, plus several committee sites. A major design feature of the site is that it is lively and up-to-date. New and revised pages are added several times a week. Don't expect to visit once a month and not miss something - you'll need to check the site at least weekly to stay in touch. To help you, a *What's New* page has been added. Take a look at what's on offer at **http://www.rsgb.org** and keep checking the site, as there's much more to come.

● THE RSGB will have a book stall and membership information stand at the North Wales Radio and Electronics Exhibition in Llandudno on **9/10 November;** and the London Amateur Radio and Computer Christmas Rally at the Lee Valley Leisure Centre, Edmonton, North London, on **16 November.** The normal Saturday opening of RSGB HQ in Potters Bar will *not* take place in November, due to the clash of dates with the London Amateur Radio show in nearby Edmonton. In December, the HQ Saturday Opening will be on **14 December** instead of 21 December, because of the Christmas holidays.

● EVERY THREE years, each of the three regions of the International Amateur Radio Union (IARU) holds a conference. This year it was the turn of Region 1 (Europe, Africa and the former USSR) which met in Tel Aviv, Israel, from 30 September to 5 October. Topics discussed included: a new 2m band plan; 12.5kHz spacing for 145MHz; the establishment of high-power beacons for 2m transatlantic propagation tests; guidelines for co-ordinating 29MHz repeaters; packet frequencies on 14MHz; packet-Internet connections; band plans for 1.8MHz; the possible expansion and use of the 7 and 10MHz bands; a clear definition of ITU Zones; contest organisation; and the IARU Monitoring system. The RSGB delegation took a leading and active role in these discussions.

● RSGB LIAISON Officer (RLO) elections take place in three counties on 1 November. The candiates are: **Essex** - M Salmon, G3XVV, M Wheaton, G4ZPE; **Cornwall** - A H Hammett, G3VWK, E J White, G0RJH; **South Gwynedd** - P Allely, GW3KJW, G Rogers, GW0RJV.

● MARTIN ATHERTON, G3ZAY, has been appointed Chairman of the newly-formed RSGB IOTA (Islands on the Air) Committee. His address is 41 Enniskillen Road, Cambridge CB4 1SQ.

● THE RSGB HQ IOTA Co-ordinator, Eva Telenius-Lowe, 2E1FHJ, would like to hear from any RSGB member interested in serving on the new RSGB IOTA committee. If you are interested, please contact Eva at PO Box 9, Potters Bar, Herts EN6 3RH.

● THERE WILL BE A small change to the format of the UK Morse code tests from **1 January 1997.** Following the introduction of the M-series callsigns, Morse test passages will use both 'G' and 'M' prefixes for UK calls. The information sheet *Amateur Radio QSO-Format Morse Tests* which is sent to all candidates booking through the RSGB has been amended to include this information.

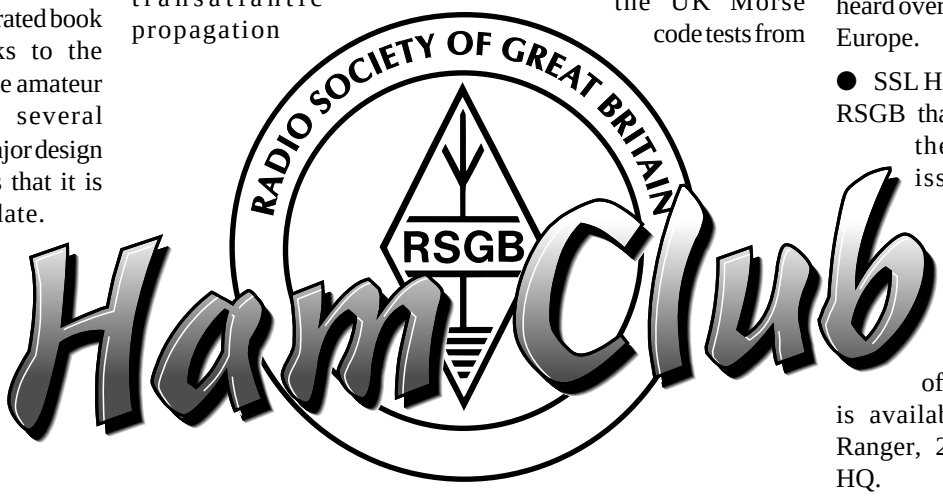
● THE CHAIRMAN OF the RSGB Data Communications Committee, Tom Lilley, G1YAA, has resigned due to increased work commitments. The new chairman is Paul Overton, G0MHD, who can be contacted by E-mail: paul@g0mhd.demon.co.uk or tel: 01342 892803.

● THE RSGB HF Contests Committee (HFCC) has recently redesigned and updated the certificates sent to winners of RSGB HF contests. Certificates for all contests up to the end of 1995 have now been despatched. Would anyone who believes they have won a certificate, but has not yet received it, please contact the Chairman of the HFCC, Chris Burbanks, G3SJJ QTHR.

● THE GB2RS NEWS broadcast on 7047.5kHz was moved to 10.00am local time at the end of September. This broadcast is from the station of Jimmy Porter, GI3GGY in Londonderry, and is widely heard over the UK and Western Europe.

● SSL HAS INFORMED the RSGB that as of 16 October the latest callsigns issued were in the M*0AN*, M*1BC*, 2*0AP* and 2*1FJ* series.

● A LIST OF clubs and colleges offering RAE courses is available from Lynnette Ranger, 2E1EKT, at RSGB HQ.



Level Pegging

SOLDERING components to a printed circuit board (PCB) can be difficult. You have to hold the PCB and the soldering iron, whilst at the same time applying solder and heating the connection. What is required is a way of holding the PCB while you work on it.

The following idea was originally by G0FZW and appeared in the 'Novice Note Book' column by Ian Keyser, G3ROO, in the October 1994 *RadCom.* It is very simple to make and very cheap.

It comprises a wooden board with a matrix of holes, see **Fig 1**. Four clothes pegs, fixed to nails, can be fitted in to any of the holes in the matrix to support any size of PCB while you work on it. This peg clamp requires very few components and, in fact, most of the bits can be easily found at home.

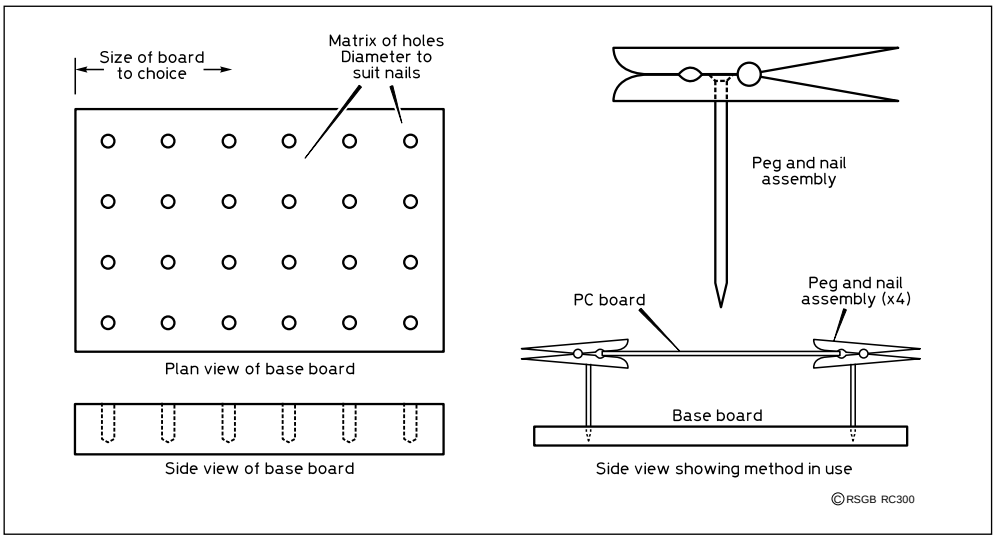


Fig 1: Construction of the peg clamp. The size of the wooden base board can be made to suit the largest PCB that you envisage constructing.

HOW TO MAKE IT

TAKE THE PEGS apart by twisting the top peg half from the bottom half. The peg springs are quite strong, so watch your fingers!

Carefully drill a hole in each one of the four peg halves as shown in Fig 1. A size of drill should be chosen so that the nails are a tight fit. You can use some glue if you don't have a drill that gives a tight enough fit to the nail. You will also have to countersink the hole with a larger drill to take the head of the nail (see the detail in Fig 1). Now re-assemble the peg. Use a screwdriver to open the spring so that you can get the top part of the peg back in place.

The base board size is not critical but should be at least 15mm thick. A board 150mm square was used in the original design but I suggest you make it to suit the largest PCB that you envisage constructing.

Drill a matrix of holes. These should comprise rows with the holes 15mm apart and the rows themselves 15mm apart. The diameter of these holes should be slightly larger than the nail diameter and about 10 mm deep. To make sure that you don't drill right through the board, and that all the holes are the same depth, wrap a piece of insulation tape around the drill bit, 10mm from the tip. Then drill carefully until the tape is level with the surface of the board.

HOW TO USE IT

IN USE, ALL that is needed is to clip a peg to each corner of the PCB and insert the nails into appropriate holes in the board.

When the peg clamp is used for construction, components are inserted on to one side of the PCB, which is then turned upside-down so that the leads can be soldered. Make sure that you bend each of the leads of each component once it is pushed through the hole in the PCB, otherwise the components may fall out when you turn the PCB upside-down. Once the components are soldered into position the surplus wire length can be cut off.

A further use for the board is for fault finding or just taking voltage measurements with a multimeter. It is difficult to apply enough pressure from the test probes to the circuit without the invaluable help of the peg clamp's additional 'hand'.

A useful aid to construction and fault location

ANTENNA TIP

ALAN GORDON, G3XOI, notes in *RadCom,* October 1994, that of four to six links, of plastic garden chain, makes an excellent antenna insulator.

COMPONENTS

- 4 wire nails (50-70mm long)
- 4 wooden spring type clothes pegs
- 1 piece of wood approximately 15mm thick, size see text.

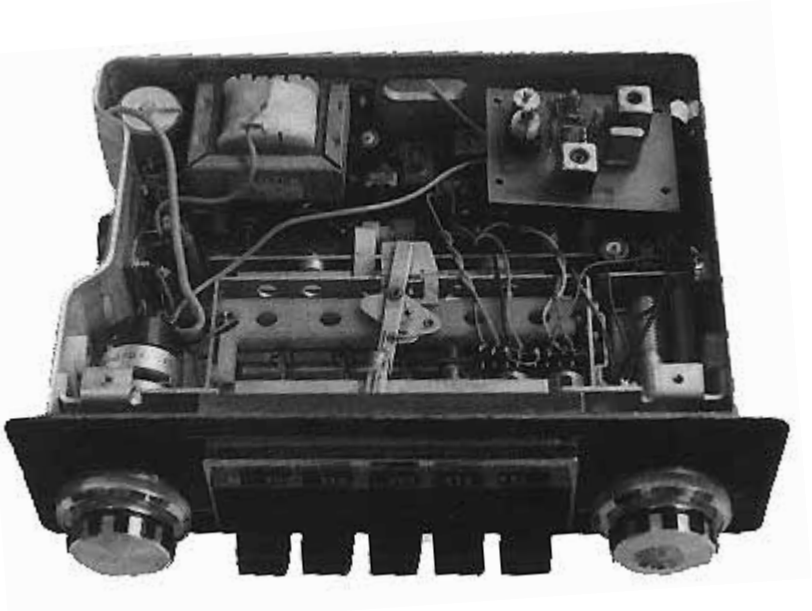
An Experimental 50MHz Receiver

Based on an article by Peter Parker, VK1PK, and Ian Keyser, G3ROO

THIS IS A method of constructing a high performance 50MHz radio at a very low cost. The method was first described in the Australian magazine *Amateur Radio*. The receiver comprises a simple fixed frequency converter and uses an old AM car radio as a tuned intermediate frequency (IF) and audio output stage. A suitable converter was described in *DiY Radio*, July/August, 1994 (Volume 4: No 4) and is used in this design. A kit for the converter is available, see end of article.

Many advantages over conventional home-brew regenerative, direct conversion and superhet are offered by this technique. The most obvious are simplicity and low cost.

We were able to build the receiver at RSGB HQ without any problems and this prototype is shown in the photograph.



HOW IT WORKS

IN MOST SUPERHET receivers the first oscillator is tuneable and the intermediate frequency (IF) is fixed. The receiver is tuned to a specific frequency by adjusting the frequency of the first oscillator.

In our set-up, the first oscillator is fixed but the intermediate frequency is tuneable; the receiver set to a specific frequency by adjusting the second oscillator and is adjusted by tuning the car receiver. This allows us to cover a range of frequencies, while retaining the frequency stability of a crystal-controlled first oscillator. A block diagram of the whole receiver is shown in **Fig 1**.

Listen for amateur NBFM signals on 51.50 to 51.55 by tuning the radio between 1195 and 1245kHz.

Incoming signals in the 50 MHz band are input to mixer IC1. They are mixed with the signal from a crystal oscillator to produce a difference frequency in the range 0.5-1.6MHz. By using an AM car radio on the medium waveband we have a tuneable IF/detector/audio strip, covering 0.5-1.6MHz.

The car radio's 1.2MHz tuning range will tune a 1.2MHz section of the 50 MHz band. The signal is then converted to 455kHz by the mixer and oscillator in the car radio. It is then amplified, detected and amplified again as an audio signal.

The combination of crystal controlled converter and car radio provides good frequency stability, while most old car radios feature push-button 'memories' for your favourite frequencies.

Car radios generally exhibit a higher standard of performance than is usual with domestic portable receivers, and their metal cases are another bonus; with a few precautions, breakthrough from AM broadcast stations can be virtually eliminated.

Old car radios covering the long and medium wave bands are readily available for around £1 each at car boot sales.

THE CONVERTER

THE KIT is supplied with a low-cost crystal of 50.305MHz and a reprint of the *Radcom* article by G3ROO where it was first described.

There are some differences compared with the original article but an up to date circuit diagram is shown in **Fig 2**.

The signal from the antenna is fed into transformer T1, see Fig 2**,** 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 50.3MHz.

The antenna signal mixes with the one from the crystal oscillator and produces an intermediate

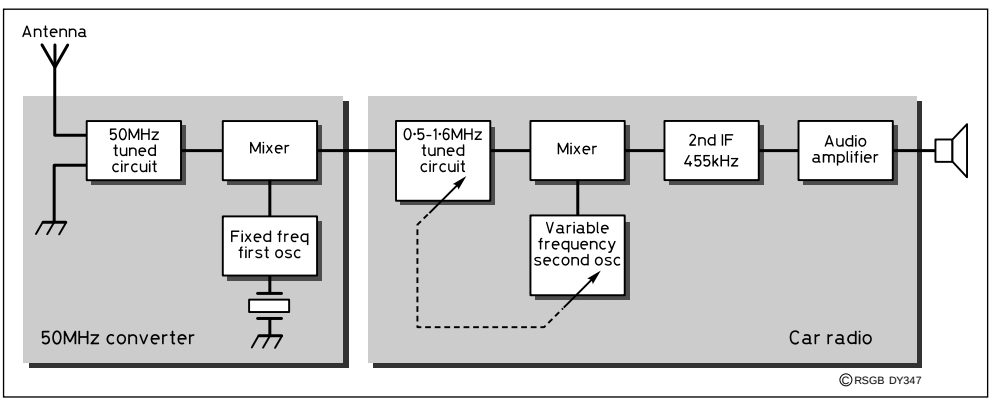


Fig 1: Block diagram of the 50MHz receiver

frequency in the range 0.5 - 1.6MHz, the input frequency to the car radio when switched to the medium wave band.

CONNECTING IT UP

Remove the cover from the car radio. Connect a short length of wire to the antenna socket. Connect a loudspeaker to the radio and connect +12volts to the supply leads. Make sure you get the polarity right - the set must have negative earth, that is the negative lead of the supply must be connected to the chassis.

Switch the set on and make sure that it works.

Remove the cable that connects the antenna socket to the first tuned circuit in the radio. Make a note of this (receiver input) connecting point.

Look for a +12 volt point. This is often found on the on/off switch at the back of the volume control.

Find a point on the chassis where you can connect a wire, either by soldering or by fixing with a screw.

Using Fig 2 from the *Radcom* article supplied with the kit; connect the chassis/negative supply to the earth section of the converter. Connect positive supply to the +12V point. Connect the 'IF out' on the converter board to the radio's 'receive input' identified earlier.

Connect a coaxial cable to the converter input, with the center of the cable to the 'antenna' pin and the braid to earth.

Connect the other end of the coax cable to a coaxial socket to suit your 50MHz antenna.

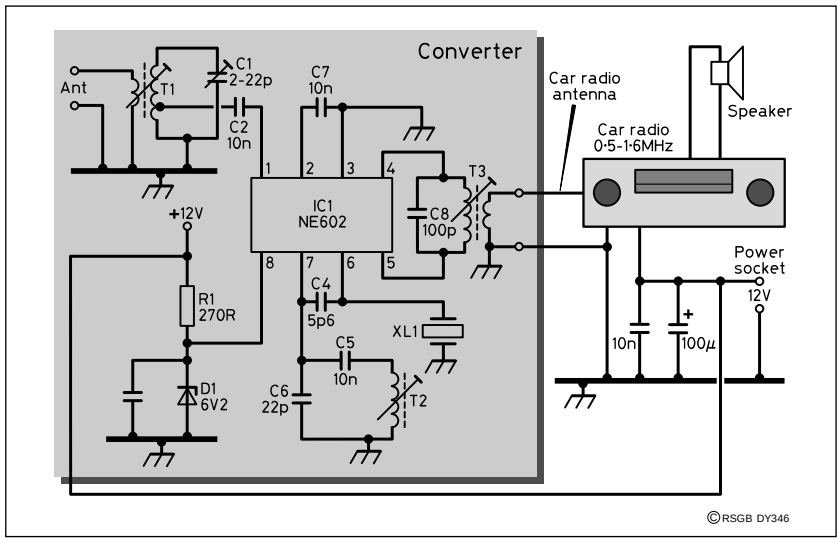


Fig 2: Circuit digram of 50MHz receiver

GETTING IT WORKING

CONNECT A 50MHz antenna to the socket of the converter. Set C1 to 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. Connect power to the converter and you should hear an increase in noise level. If you are lucky you may hear a ham radio signal. You can ask a local amateur to provide a signal,

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 50MHz signal, peak C1 for maximum strength then do the same for T2. Next disconnect the power and then reconnect it. 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.

PERFORMANCE

THE AM CAR radio uses simple amplitude modulation detector but frequency modulation (NBFM), normally used on 50MHz, can be received using 'slope detection' by tuning slightly to one side of the signal.

Audio quality is surprisingly good. Note that using slope detection for FM reception does not offer the impulse noise reduction or limiting properties of a proper FM detector.

CONVERTER KIT

Available from JAB Electronic Components 1180 Aldridge Road, Great Bar, Birmingham B44 8PB

Price: £11.95 *+£1.00 P&P*

Advertisement

2's Company

News and Reports from Novice Licensees

EIGHTEEN year-old **Emma Wills, 2E0AAX,** of Salisbury, Wiltshire, has won the prestigious G5RP Trophy. The trophy is awarded by the RSGB HF Committee and the committee of the Vale of the White Horse Amateur Radio Society for the greatest progress made in the field of HF DXing. Emma is the first Novice to win the G5RP Trophy and she is able to add it to her already impressive list of 'firsts'. She was one of the first licensed Novices, was the first UK Novice to achieve the ARRL DXCC award when she obtained QSL card confirmations from contacts with over 100 DXCC countries, and she is the first Novice member of the Chiltern DX Club - CDXC - the UK DX Foundation.

Emma Wills, 2E0AAX, is this year's recipient of the G5RP Trophy, awarded for the greatest progress in the field of HF DXing.

The new ***RSGB Amateur Radio Call Book and Information Directory*** has recently been published [see back cover - *Ed*] and, as usual, it provides some interesting statistics. From the Novice point of view, the new *Call Book* shows some 2400 class 'B' Novice callsigns, whilst there are only around 230 class 'A' Novice calls listed. Why are there more than ten times as many class 'B' Novice calls than class 'A'? If you're a Novice licensee, please let us know what you think the reason is.

The results of the RSGB's **Affiliated Societies ('AFS') contest** are now out. There are two events, one on CW and one on SSB. The CW contest, on 80m, is a good one for Novices to enter, as there is plenty of activity by full licensees, who are all looking for additional contacts. **P A Williams, 2E0AJE,** was one member of the **North Wakefield Radio Club** team, and he helped to take his club to 31st place out of 92 entries. His individual score was an impressive 1073 points, bringing him in at 153rd place out of no fewer than 304 entries.

The next AFS CW contest is on Sunday 12 January 1997, from 1400 to 1800UTC between 3510 and 3590kHz. The SSB event is between the same times on Saturday 18 January, from 3600 to 3750kHz. If you would like a copy of the full rules, please write to the *D-i-Y Radio* editorial office enclosing an SASE.

THE LOG BOOK

AMATEUR RADIO must be *the* ideal hobby for those people whose work takes them to remote corners of the world. There can be few more remote places on this planet than **Macquarie Island,** an Australian territory hundreds of miles south of New Zealand. Warren, **VK0**WH, has been active from here for many months, but was due to leave the island at the end of October.

Many radio amateurs posted to such remote spots work as meteorologists, or are radio technicians associated with meteorological stations. Chris, **ZS8**IR, works at a meteorology station on **Marion Island,** a South African island some 2000km south-east of Cape Town. He has also been very active recently, and was heard with good signals around 1400UTC on 12 October, on

Once one of the rarest amateur radio countries in the world, Albania is now relatively easy to hear and work, thanks largely to the efforts of this ZA1A group in 1992 in the training of local operators.

what was otherwise a 'dead' 21MHz band.

Such 'north-south' propagation is quite typical on the higher HF bands such as 21, 24 and 28MHz. During solar minima, there is very little propagation from east to west on these bands, but - often - signals can still be good from stations on a north-south path.

This edition's featured band (see 'Band by Band', right) is 70cm, or 432MHz, and there are several operating events taking place on this band in November and December. The **RSGB 432MHz Cumulative Contest** is a series of short contests which take place on weekday evenings. Look out for plenty of activity, mainly on SSB, but on other modes

Band by Band

The Amateur Radio Spectrum: The 70 centimetre Band

SEVENTY centimetres, the 430MHz band, is probably the second-most heavily used VHF / UHF band after 2 metres (see *D-i-Y Radio* September - October 1996).

The full band covers 10MHz: 430 to 440MHz, and is available to full class 'A' and 'B' licence holders. Class 'A' and 'B' Novices may use 432 to 440MHz only. However, almost all the UK activity is in this part of the band and Novices should find plenty of people to talk to.

It is the lowest frequency band on which fast-scan television (FSTV or 'ATV') takes place.

70cm is particularly suitable for mobile operation, as antennas are quite small and yet can be very efficient. There is a repeater network which covers most of the country and which enables mobile stations to communicate reliably over distances of around 50 miles.

Considerable distances can be worked on 70cm under certain conditions. Perhaps the most common form of long-distance working on this band is caused by **tropospheric ('tropo')** propagation (also known as 'a lift'). This typically occurs when there is a high-pressure weather system over the country. When this occurs, strong signals can be heard from Germany, southern France and even Switzerland.

Plenty of commercial equipment is available which covers the 70cm band. When looking for a transceiver, consider purchasing a **multi-mode transceiver** rather than one which only transmits FM. Multi-mode transceivers may be more expensive, but when there is 'a lift on', they will enable you to work **DX (long-distance)** stations on SSB more easily and with greater success than on FM.

If you are interested in working DX you will need a beam antenna and, fortunately, 70cm beams are small and yet can have high gain. A chimney-mounted 9 or even 19-element Yagi mounted on a small rotator will give considerable gain compared with the commonly-used collinear vertical. Yagis for DX work are usually horizontally-polarized, whilst verticals are used for local working.

BAND FACTS

Allocation:
430 - 440MHz Full Licensees, 432 - 440MHz Novice Licensees

UK Band Plan:

430.000 - 432.000	All modes
432.000 - 432.150	CW (Morse code) only
432.150 - 432.500	CW (Morse code) and SSB only
432.500 - 432.800	All modes
432.800 - 433.000	Beacons
433.000 - 433.400	UK FM Repeater Outputs (16 x 25kHz channels)
433.400 - 433.600	FM Simplex (9 x 25kHz channels)
433.600 - 434.600	FM, packet, RTTY
434.600 - 435.000	UK FM Repeater Inputs (16 x 25kHz channels)
435.000 - 438.000	Satellites and fast-scan TV
438.000 - 439.750	Fast-scan TV
439.750 - 440.000	Packet radio

THE LOG BOOK

too, on 8 and 25 November and on 10 December, between 2030 and 2300UTC. Around Christmas, the **70, 144 and 432MHz 'Christmas Cumulatives'** take place. These are short (2-hour) afternoon events designed to offer a form of relaxation after the Christmas festivities, and take place on 26, 27, 28 and 29 December between 1400 and 1600UTC.

There are only two RSGB **HF contests** during November and December, both on 160m (1.8MHz). The **Club Calls Contest** is on **Saturday 9 November** and is on SSB and CW between 2000 and 2300UTC. Entrants are asked to centre their CW activity around 1955kHz to encourage Novices. The other contest is the second **1.8MHz CW contest,** which lasts for four hours from 2100UTC on **Saturday 16 November.**

An amusing QSL card from press photographer Morten Antonsen, LA9GY, from Trondheim in Norway. (You don't need a licence to operate tin-can telephones!)

The ***CQ* World Wide DX CW contest** takes place at the end of November. Over the full 48 hours of 23 and 24 November, thousands of stations all over the world will be competing in what is the world's biggest CW contest. Several groups will be travelling to remote and rare countries to operate in this contest. One such group includes Roger Western, G3SXW, and Rob Ferguson, GM3YTS, who join four American operators for a visit to **Togo** in West Africa, where they have applied for the callsign **5V**5A. Look out for them on all bands from 160 to 10 metres.

Young Amateurs Honoured

14-year olds win prestigious RSGB / RA award

THIS YEAR'S winner of the RSGB Young Amateur of the Year award is 14-year old Christopher Davies, M0AAU, from Shrewsbury in Shropshire. The runner-up is Benjamin Clarkson, G7WHO, also 14 years old, from Reading in Berkshire. Christopher and Ben received their prizes from the Radiocommunications Agency (RA), RSGB, and industry, at a special ceremony on 6 October at the RSGB International HF and IOTA Convention at the Beaumont Conference Centre in Old Windsor. IOTA, which stands for 'Islands On The Air', is an RSGB awards programme for making confirmed contacts with radio amateurs located on island groups around the world.

THE WINNER

CHRISTOPHER FIRST became interested in amateur radio at the age of 12, and started his new hobby by building a direct conversion receiver with his father. After he became completely 'hooked' on amateur radio, Christopher took the Novice course under the direction of the then Senior Novice Instructor, Dave Whalley, G4EIX. He became the youngest Novice licence holder in Shrewsbury with the callsign 2E1DWJ.

Christopher sat the full RAE at the age of 13, but instead of taking out a full class 'B' licence, he waited until he passed the 12WPM Morse test before he applied for his full callsign. Twelve months after obtaining his Novice call he became M0AAU.

Christopher's home station is a Kenwood TS-440S. He is a keen antenna constructor, an enthusiastic amateur radio 'foxhunter' and is now working towards his Duke of Edinburgh Award at school. He has also joined the local Raynet team and helps to run the club ambulance.

Young Amateur of the Year Christopher Davies, M0AAU (left) and runner-up Ben Clarkson, G7WHO, with a certificate and just some of their prizes.

RUNNER-UP

THE RUNNER-UP this year, Ben Clarkson, G7WHO, passed the Novice RAE soon after his 12th birthday, despite having colour blindness and severe dyslexia. He was first licensed as 2E1DHA. Last year, when he was 13, he took the full RAE and gained his G7 callsign on his 14th birthday.

Ben has helped to set up a number of communications links for charity walks and hikes, and also regularly helps the local St John Ambulance Brigade at events in the Reading area. He has also taken part in several Jamboree On The Air (JOTA) special event stations, and last year set up the JOTA station equipment himself. He has also appeared in the BBC TV programme *Activ-8,* where he explained what amateur radio 'foxhunting' is and how the equipment is used.

In his spare time, Ben is also a member of the Scouts. When the first 'M' series callsigns were allocated in April this year, the call M0AAA was granted to the Reading club who were invited to Bristol to be presented with the call personally. Ben was selected by the club to receive the call on their behalf and he appeared on the cover of *D-i-Y Radio* in May - June 1996, when we reported this story.

PRIZES

THE YOUNG amateurs' prizes included cash sums of £300 and £50, 70cm handheld transceivers, a one-week residential course at Wray Castle College and invitations to visit the RA Monitoring Station at Baldock. The prizes were presented by Roger Louth on behalf of the RA; RSGB President Peter Sheppard, G4EJP; Peter Simpson of Wray Castle College; Dennis Goodwin of Icom (UK); and Tom Crosbie of Lowe Electronics. The ceremony was followed by a celebratory lunch. Congratulations to both winners.

If you would like to find out more about the RSGB Young Amateur of the Year award before next year's nominations are due, write to Marcia Brimson, 2E1DAY, at RSGB Headquarters, or call her on 01707 659015 during office hours.

● CHRISTOPHER AND BEN were both lucky enough to *also* win prizes in the raffle at the RSGB HF and IOTA Convention!

Polar Expedition

OUR COVER photo shows the man once described in the *Guinness Book of Records* as "the world's greatest living explorer" - Sir Ranulph Fiennes. On 1 November 'Ran' starts an attempt on one of the world's last unconquered challenges: the first-ever unsupported, no resupply, solo crossing of the Antarctic continent. Being a solo expedition, safety considerations and personal communications are of vital importance. Ran will be using modified amateur radio equipment to communicate with Morag Howell, GM0MUV, at Base Camp in Antarctica, whilst Morag's husband Lawrence, GM4DMA, mans the UK Base.

BASE CAMP

MORAG WILL live in a tent in the Patriot Hills area of Antarctica during the expedition. Both she and Ran will use Hands Electronics HF SSB transceivers which have been specially modified from Hands' range of amateur transceiver kits (such as those advertised in *D-i-Y Radio*).

Because Ran has to pull every gram of his supplies and equipment himself, the efficiency of his equipment is very important. The transceiver produces about 30W PEP output, yet weighs only 1.1kg, including the speaker mic and battery leads! It has been designed to work in temperatures as low as -52°C. Ran will use a specially-designed multi-frequency dipole antenna which has plugs and sockets for lengthening and shortening the array for different frequencies. The aerial will be supported on ski poles just 1m above the ice. Ran will also carry a personal satellite location beacon which can pinpoint his position to within a mile or so.

Morag's main means of communications out of Antarctica will be by Inmarsat satellite, but she will also use a Yaesu FT-80 100W transceiver with terminated sloping-Vee and dipole antennas for links back to the UK. All her electrical power will be derived from solar panels but, if she has spare capacity, she plans to use this equipment for activity on the 14MHz amateur band as VP8CME.

At the UK end, Lawrence will be at the Base Camp in Scotland, using Racal tactical SSB equipment to rhombic antennas fed with 0.875in diameter Andrews Heliax cable. Lawrence says that Heliax is used in preference to open wire feeders due to the destructive influence of sheep!

EXPERIENCE

BOTH MORAG and Lawrence are highly experienced in polar expeditions. In 1990 they took part in the 'North Pole '90' expedition when Sir Ranulph Fiennes and Dr Mike Stroud attempted to walk to the North Pole from the northern Soviet Union. Lawrence wrote an article, 'From Radio Amateur to Explorer', for the second-ever issue of *D-i-Y Radio* in September - October 1991, and he and Morag featured in the poster in that issue. Then, in 1993, Ran and Mike walked across Antarctica and Morag and Lawrence provided the communications support. This was reported in the March - April 1993 edition of *D-i-Y Radio.*

Most recently, Lawrence featured in the September - October 1996 *D-i-Y Radio*, having helped a Raleigh International expedition in Uganda.

FUNDRAISING

RAN ALREADY HOLDS several Antarctic records and has raised millions of pounds for charity with his efforts. His latest expedition has HRH The Prince of Wales as patron and is being sponsored by Dyson Appliances. Called the Dyson Antarctic Solo (DAS) expedition, it is expected to take Ran 100 days to cross Antarctica, during which he will walk a distance of over 1800 miles and will have to climb to over 10,000ft, whilst pulling a sledge containing all his supplies. He will obviously experience extreme temperatures and high winds.

It is hoped that DAS will raise £3 million for the breast cancer charity Breakthrough, which is raising money to establish the UK's first dedicated breast cancer research centre. Dyson has pledged £1.44 million to Breakthrough and Ran is hoping to raise a further £1.5 million through personal sponsorship. You can help him to raise this sum by sponsoring him. For details, or if you simply wish to make a donation, call DAS on 0990 112226.

RSGB members Morag and Lawrence Howell, GM0MUV / GM4DMA, are an essential part of Sir Ranulph Fiennes Antarctic Expedition team.

Lawrence Howell, GM4DMA, holding the tiny Hands SSB transceiver which Morag Howell, GM0MUV / VP8CME (right), and Sir Ranulph Fiennes will use on the record-breaking Antarctic expedition.

Amateur Radio Abbreviations & Symbols

AS WITH MOST specialist pursuits, amateur radio has developed a language of its own, and many of the abbreviations used can be confusing for beginners. This poster explains the meaning of the most commonly-used abbreviations.

SYMBOLS

µ	Micro, or 10^{-6} (Greek letter mu)
λ	Symbol for wavelength, used especially in antenna diagrams (Greek letter lambda)
Ω	Ohms, the unit of resistance and impedance (Greek letter omega)
@	'At' (used in packet radio mailbox addresses)

COMPONENTS, CIRCUIT DIAGRAMS

C	Capacitor (used in circuit diagrams)
D	Diode (used in circuit diagrams)
FET	Field Effect Transistor
IC	Integrated Circuit
L	Symbol for Coil or Inductance (used in circuit diagrams)
NiCd	Nickel Cadmium cell or battery, or 'nicad'
NPN	Negative-Positive-Negative (type of transistor)
PNP	Positive-Negative-Positive (type of transistor)
R	Resistor (can also mean ohms, the unit of resistance, in components lists etc)
RV	Variable Resistor (used in circuit diagrams)
TR	Transistor (used in circuit diagrams)
VC	Variable Capacitor (used in circuit diagrams)

OPERATING

9k6	9600 baud
AM	Amplitude Modulation
BBS	Bulletin Board System, a notice board or 'mailbox' where you can read messages addressed to others
Bd	Baud (unit of speed of data transmission)
BCI	Broadcast Interference
BR68	RA Amateur Radio Licence Terms, Provisions and Limitations Booklet
CW	Continuous Wave (often used to mean Morse code transmission)
DX	An old telegraphy abbreviation meaning a 'long distance' contact
DXCC	ARRL DX Century Club awards program
FM	Frequency Modulation
IOTA	RSGB Islands On The Air awards programme
IRC	International Reply Coupon
JOTA	Jamboree On The Air, an event for Scouts & Guides in October each year
NBFM	Narrow Band Frequency Modulation
RFI	Radio Frequency Interference
RTTY	Radio Teletype, a means of sending text material over radio
Sporadic-E	Sporadically-ocurring propagation in the E layer of the ionosphere
SSB	Single Sideband, a type of amplitude modulation
SWL	Short Wave Listener (or any listener, as opposed to transmitting amateur)
TDOA	Thinking Day On the Air, an event for Guides and Brownies
TVI	Television Interference
U/A	Unattended Operation (of an amateur station)
WAB	Worked All Britain, an award scheme based on map 10km squares
WPM	Words per Minute (Morse code speed)

FREQUENCY

ELF	Extra Low Frequency, below 3kHz
GHz	Gigahertz, one thousand million cycles per second, or 1000MHz
HF	High Frequencies, 3 - 30MHz, or 'short waves'
Hz	Hertz, a frequency of one cycle per second
kHz	Kilohertz, one thousand cycles per second, or 1000Hz
LF	Low frequency, 30 - 300kHz
LF bands	Often used (inaccurately) to mean the 1.8, 3.5 and 7.0MHz amateur bands
MF	Medium Frequency, 300 - 3000kHz
MHz	Megahertz, one million cycles per second, or 1000kHz
SHF	Super High Frequency, 3000 - 30,000MHz
UHF	Ultra High Frequency, 300 - 3000MHz
VHF	Very High Frequency, 30 - 300MHz
VLF	Very Low Frequency, 3 - 30kHz

EQUIPMENT

AF Gain	Audio Frequency Gain (volume) control
ASTU	Antenna (or Aerial) System Tuning Unit
ATU	Antenna (or Aerial) Tuning Unit (more properly called ASTU)
Balun	Balanced to Unbalanced transformer
BFO	Beat Frequency Oscillator
Coax	Coaxial cable: a type of antenna feeder in which one conductor is completely encased in the other
Rx	Receiver
Tcvr	Transceiver (transmitter and receiver in one box)
Tx	Transmitter
VFO	Variable Frequency Oscillator

ELECTRICAL TERMS

AC	Alternating Current
AF	Audio Frequency
dB	Decibel
DC	Direct Current
EMC	Electromagnetic Compatibility
ERP	Effective Radiated Power (transmitted power after the antenna gain is also taken into account)
Hz	Hertz, the unit of frequency, one cycle per second
IF	Intermediate Frequency
k	kilo, 1000, or 10^3 (kilohms when used with a resistor)
mW	Milliwatt, one thousandth of a watt
n	nano or 10^{-9}(nanofarads when used with a capacitor)
Ohms	Unit of resistance or impedance
pF	Picofarad (measure of capacitance)
Q	The 'Q' or 'Quality' of the circuit (nothing to do with the Q Code)
RF	Radio Frequency
RMS	Root Mean Square
SWR	Standing Wave Ratio
TRF	Tuned Radio Frequency (type of receiver)
V	Volts, voltage
VSWR	Voltage Standing Wave Ratio (often loosely referred to as SWR)
W	Watt, the unit of power
Z	Symbol for impedance

Q CODES

Three-letter groups beginning with Q, each with specific meanings, eg:

QRM	Interference (usually from other stations)
QRN	Noise, eg static crashes
QRP	Often used to mean 'low power'
QRV	'Active' or 'on the air'
QRZ?	Who is calling me?
QSL	Often used to mean an acknowledgement card
QSO	Often used to mean 'a contact'
QTH	Usually means 'location'

SOCIETIES, ORGANISATIONS AND CLUBS

ARRL	American Radio Relay League, the USA national amateur radio society
C&G	City & Guilds
DARC	Deutscher Amateur-Radio-Club, the German national amateur radio society
G-QRP	British Low Power users' club
IARU	International Amateur Radio Union
ITU	International Telecommunications Union
RA	Radiocommunications Agency, the UK licensing and radio regulatory authority
REF	Reseau des Emetteurs Francais, the French national amateur radio society
RIS	Radio Investigation Service
SSL	Subscription Services Limited
STELAR	Science and Technology through Educational Links with Amateur Radio

MISCELLANEOUS

DOS	Disc Operating System, the computer software which governs the input and output functions of the PC
NRAE	City & Guild Novice Radio Amateurs Examination
PA	Power Amplifier (or sometimes Public Address system)
PCB	Printed Circuit Board
PMR	Private Mobile Radio
RAE	City & Guilds Radio Amateurs Examination
RS-232	Electronic Industries Association standard for serial cable and plug wiring
TNC	Terminal Node Controller, the interface between computer and radio

MEASUREMENT

p	pico, $0.000\,000\,000\,001 = 10^{-12}$
n	nano, $0.000\,000\,001 = 10^{-9}$
µ	micro, $0.000\,001 = 10^{-6}$ (Greek letter mu)
m	milli, $0.001 = 10^{-3}$ (one thousandth)
k	kilo, $1,000 = 10^{3}$
M	Mega, $1,000,000 = 10^{6}$
G	Giga, $1,000,000,000 = 10^{9}$

D-i-Y RADIO *RSGB, Lambda House, Cranborne Road, Potters Bar, Herts. EN6 3JE*

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The AKD Target HF3 Receiver

AKD's New Radio for Beginners Reviewed

THE TARGET HF3 is AKD's new receiver designed specially for beginners. Costing just under £160, it measures 185W x 180D x 60H mm (about the size of a standard car radio / cassette player) and weighs just 1kg. It tunes from 30kHz to 30MHz in 1kHz steps, with a 'clarifier' control allowing the user to tune plus or minus 800Hz of the centre point, making it possible for the user to tune continuously throughout the band. The front panel is neat and uncluttered, with just three knobs, four small push buttons and a large, clear, LCD display which shows the frequency, mode, and signal strength.

'Up' and 'Down' buttons cycle through three modes: USB, AM and LSB. You can also receive CW (Morse code signals) using either USB or LSB. Two filter bandwidths are provided, and these are selected automatically according to the mode: approximately 3.8kHz on SSB and 6kHz on AM.

A single memory channel is activated by pressing the 'MEM' button and this can be recalled at any time by pressing the 'RCL' ('recall') button. Each time you switch on the receiver it tunes to the last-memorised frequency. There are no bandswitch buttons; all tuning is done just by using the tuning knob. There are four tuning rates - 10kHz, 100kHz, 1MHz and 10MHz per revolution - and the faster you turn the knob, the quicker it tunes.

The back panel of the receiver is as uncluttered as the front, with the power socket, a phono-type socket for the antenna / earth connection, and a switch for the built-in attenuator. There was no headphone socket on the pre-production model reviewed, but AKD tells us that one will be fitted in the final version.

The receiver comes supplied with manual, a 'battery eliminator' type 12V PSU and a wire aerial about 10m (33ft) long, connected to a phono plug. A shorter (1.8m) wire is soldered to the ground of this plug to enable you to earth the receiver if required. The Target comes with a two-year guarantee, and the option of a one or two-year extended warranty.

MANUAL

THE TARGET HF3 IS designed for the beginner, and so its A5 14-page manual is also written with the beginner in mind. It starts with an explanation of electromagnetic waves, the relationship between frequency and wavelength, and how to convert kHz to MHz. A number of useful little diagrams illustrate the manual.

There are a few errors in the manual, as well as some information which is missing altogether. For example, the 20m amateur band is given as '1400 to 1435' instead of 14000 to 14350kHz, and there is no mention at all of the 30, 17, 15, 12 and 10m amateur bands, although the receiver covers all these bands. A listing of all the short wave broadcast bands would also have been useful.

There are several other instances of omissions or inaccuracies, but the manufacturers point out that the manual is intended for the absolute beginner and they did not want to give *too* much information, some of which might confuse the beginner.

IN USE

INSTALLATION WAS simplicity itself: plug the PSU into the mains, plug the PSU lead into the receiver, plug the supplied wire into the aerial socket, switch

on, and that's it. The Target is a very sensitive receiver: even using only the 10m wire antenna provided with the set it was found necessary to use the attenuator when tuning-in to powerful broadcast stations in the 49 metre band (around 6MHz). An indoor wire just 1.5m long was perfectly adequate for listening to 7MHz amateurs from around Europe and strong broadcast stations in the 6, 7 and 9MHz bands.

Numerous broadcast stations were received easily and clearly. Radio Netherlands, Radio Sweden, Swiss Radio International, the Voice of Russia and the BBC World Service were heard with English-language programmes and excellent reception. Amateurs from Europe, North America and Asia were heard at good strength during the day on 20m.

The audio quality of received broadcast stations was excellent, thanks to the quality of the built-in loudspeaker and the relatively wide 6kHz filter used for AM reception. There was a hum on some of the stronger stations, but this disappeared when the set was grounded to an electrical earth, as described in the manual.

Reception of amateurs using SSB on 20m and above was also good, although the filters used on SSB were a little too wide. On a quiet band this was no problem at all, but on crowded bands such as 40m at night there was a lot of interference.

On 3.5 and 7MHz, the Target was not *quite* stable enough to resolve SSB signals properly. Signals were certainly readable, but had a slight 'warble', causing some distortion to the voice. The 1kHz synthesizer steps - whilst fine for AM reception - made tuning-in SSB (or CW) signals a little more fiddly than most amateurs have become used to. Tuning across a band with the receiver set to USB or LSB is really a two-handed operation, one to tune the main tuning knob and the other to 'tweak' the clarifier control once an SSB signal is nearly tuned in correctly.

The digital readout reads the frequency of the centre of the passband to which the receiver is tuned. This means that on AM it displays the carrier frequency, but on LSB it reads about 2kHz *below* the nominal (suppressed) carrier frequency and on USB about 2kHz *above* the carrier frequency.

GOOD VALUE

THE RECEIVER costs less than £160, which makes it very good value. It would be the perfect Christmas present to give to a family member who has shown signs of getting interested in radio, but doesn't know how to get going. The Target is small, lightweight, and neat. Its size also lends itself to mobile use - you could really impress your friends by listening to Radio Japan on the way into work instead of Radio 1! With the exception of multi-band transistor portable radios, there are few, if any, short wave receivers on the market for even twice the price.

For general reception of short wave broadcast stations, the Target would be hard to beat and, whilst its performance does not compare with top-of-the-range communications receivers, it is hardly fair to compare it with sets costing £800 or £1000!

The Target does exactly what it sets out to do - it provides a basic, no-frills, 'first' receiver for the beginner - and does it very well. Despite the few niggles: slight instability making SSB (or CW) reception not as good as it could be, the 1kHz step tuning, and rather too many inaccuracies and omissions in the handbook, at the price you can't go wrong. The few minor problems mentioned above are not likely to worry beginners too much, but they may put off slightly more experienced users. However, AKD tell us that the Target is just the first in a series of new receivers which they will be bringing out over the next few months. Other versions will be designed for marine use, to allow the reception of weather fax pictures, as well as one for 'dedicated' short wave listeners. This receiver will have higher specifications, for example 'tighter' filters, which should reduce interference on crowded bands, and an improved 'front end' performance to reduce overloading caused by very strong signals. This version will also permit the user to control the receiver's functions from a PC, and will allow the received spectrum to be displayed on the computer screen, showing the relative strength of signals received. Wouldn't it be great to see this UK-made receiver in every Dixons or Comet showroom in every High Street? This could be just what amateur radio needs.

The AKD Target HF3 receiver costs £159.95 inc VAT (plus £6 P&P). It is available from AKD, Unit 5, Parsons Green Estate, Boulton Road, Stevenage, Herts SG1 4QG; tel: 01438 351710, fax: 01438 357591.

SPECIFICATIONS

(FROM AKD TARGET MANUAL)

Frequency range	30kHz - 30MHz
Frequency tolerance	± 100Hz
Synthesised	1kHz steps
Clarify	± 800Hz
Bandwidth	SSB = 3.8kHz, AM = 6kHz
Sensitivity	1µVolt
Audio output	2 watts
Input impedance	70Ω
Tuning control	Four rates, as follows: 10kHz / rev, 100kHz / rev, 1MHz / rev, 10MHz / rev.
Power supply	12 volts DC (300mA)
Modes	USB / AM / LSB
First IF	45.000MHz with crystal filter
Second IF	455kHz with ceramic filter
Demodulator	AM - quasi synchronous, SSB - product detector

Magnetic Fields Again

By John, GW4HWR, Chairman RSGB Training & Education Committee

TRANSFORMERS, moving coil meters, moving coil loudspeakers, electric motors and even the cathode ray tubes used in colour television receivers, together with many other pieces of equipment all make use of the effects of a magnetic field. In view of this it is well worth taking another look at this phenomenon.

Whenever current flows through a conductor a magnetic field is set up around the conductor. As shown in **Fig 1** the field is circular, concentric with the conductor and the strength of the field is directly proportional to the value of the current. What happens when the conductor is wound into a coil is shown in **Fig 2.** The field is concentrated and the field pattern has considerable similarity with the field around a bar magnet; in fact if the coil is wound onto a soft iron bar (iron core) it effectively becomes a bar magnet which has a strength many times that of the field with air as a core.

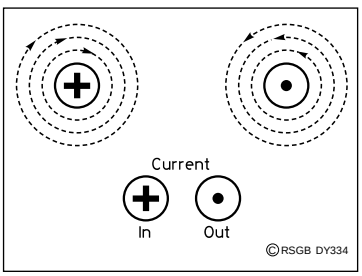


Fig 1: Concentric magnetic fields around a conductor carrying current.

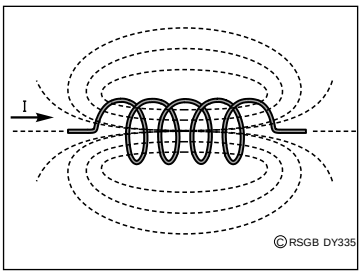


Fig 2: Magnetic field around a coil carrying current.

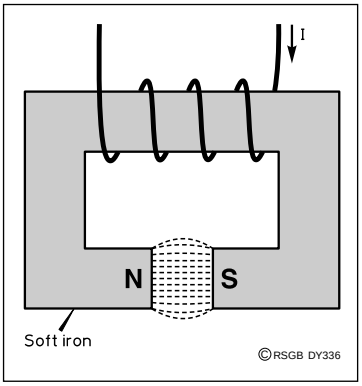


Fig 3: Creating an intense magnetic field.

If the soft iron core is shaped so that the ends are very close together, a very intense magnetic field can be created in the gap. **Fig 3** shows the effect.

The direction of the magnetic lines of force (see Fig 1) is most important and by convention this is always taken as being from the north pole to the south pole of the magnet, and in a clockwise direction around a conductor in which the current is flowing away from the observer. If a current-carrying conductor is placed between the poles of a magnet (permanent or electro magnet) the two fields will interact, assisting on one side of the conductor and opposing (cancelling) on the other. (**Fig 4**). This causes a distortion of the field. Magnetic fields always try to take the shortest path and in doing this a force will be exerted on the conductor which will try to move the conductor out of the magnetic field. If the direction of flow of current is reversed the magnetic field pattern will also reverse and the force on the conductor will be in the opposite direction.

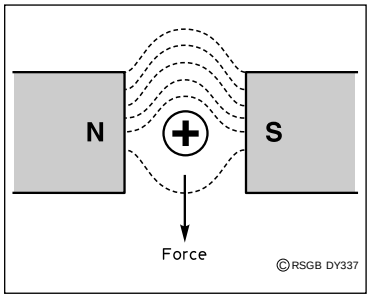


Fig 4: Interaction of a conductor carrying current and a magnetic field.

A magnetic balance (**Fig 5**) is a useful way of demonstrating the effects of interacting fields. It consists of a stout piece of brass wire which is bent into a rectangle with two rather long tails. The rectangle is pivoted between two metal supports and counter-balanced so that it stays in a horizontal position. The pivots also act as contacts so that current can be made to flow through the loop from a suitable supply. As the resistance of the loop is very low, a wirewound resistor is included in series to limit the current to a reasonable but high level.

The horizontal part of the loop is arranged between the poles of a powerful magnet, and the counter weights adjusted to provide balance. The battery is connected to the loop by means of a reversing switch which connects the supply one way round or the other. When the switch is operated the loop will move violently in one direction or the other.

A moving coil meter or loudspeaker makes use of a coil which exploits the force on the conductor when current flows. in the next issue we will look at the way in which magnetic fields influence a cathode ray tube such as may be used in a domestic television receiver.

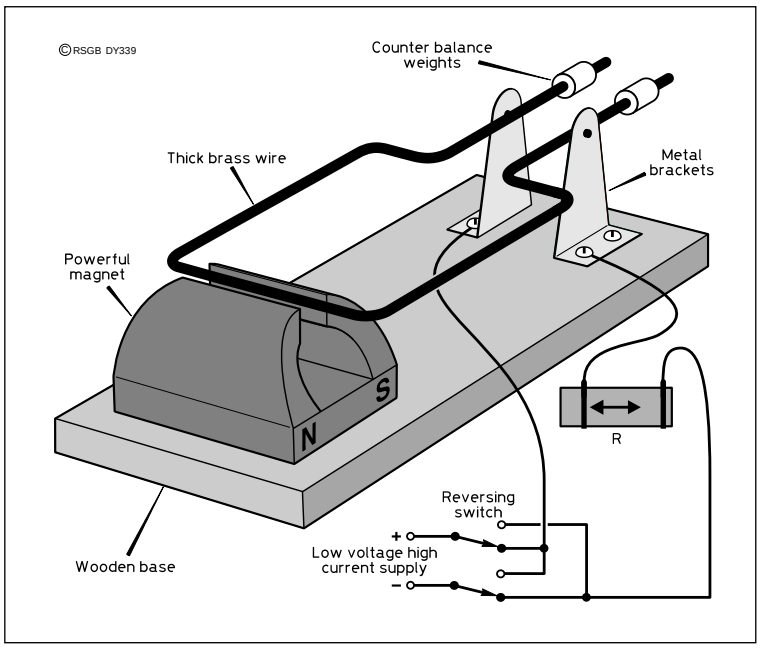


Fig 5: Magnetic balance for measuring current.

80 Metre CW QRP Transmitter

From an article by Peter Parker, VK1PK, *Amateur Radio*, July 1995

IT HAS NEVER been easier or cheaper to construct amateur radio equipment. Modern technology, which has given us 'black boxes' with every conceivable feature, has also provided a host of components which can simplify home construction.

A case in point is the 80m CW (Morse code) transmitter described here. This transmitter covers a range of frequencies and its one watt output is ample for local contacts. A power amplifier can be added later if desired. The basic design is not new and has been described before in other amateur radio publications.

All components are available new and the total cost should not exceed £12 using new components.

CIRCUIT DESCRIPTION

MOST SIMPLE transmitters are crystal controlled *. This assures stability but limits the usefulness of the transmitter. The key to increased frequency coverage on 80m, without a conventional VFO, is the low cost 3.58MHz **ceramic resonator**.

The pulling range of a 3.58MHz ceramic resonator covers the UK Novice 80m sub band and some of the CW segment below 3.525MHz. A ceramic resonator is like a crystal but not quite as frequency stable. The main advantage is the large frequency pulling range.

The transmitter block diagram is shown in **Fig 1**. It is similar to a crystal controlled transmitter and includes an oscillator, buffer, and final amplifier. The final amplifier is keyed and the oscillator remains operating during the time that the operator is sending. Keying the oscillator would make frequency stability difficult to obtain and should generally be avoided. The oscillator must be switched off when receiving to avoid interference. An exception would be in a direct conversion transceiver. Transmit receive switching is by a panel mounted switch which switches both the antenna and power to the oscillator and buffer.

The transmitter circuit diagram is shown in **Fig 2**. An unusual aspect of this transmitter is the use of a digital CMOS IC type 4069 for the buffer and oscillator stages. The IC contains six **inverters** of which four are used in this circuit. One inverter is used as the oscillator. Two inverters are used as the buffer stage. The fourth provides an output should a direct conversion receiver be added.

The frequency of the ceramic resonator oscillator is changed by varying the capacitance in the oscillator circuit. Greater downward shift is obtained by having a small inductor in series with the variable capacitor. The variable capacitor is a standard transistor radio type.

The power amplifier is a small MOSFET (Metal Oxide Field Effect Transistor). The device is capable of providing an output power of two watts but, in this circuit, it is conservatively run to give 1.5 watts. The power output can be adjusted by varying the resistance of the three megaohm gate resistor. Don't be greedy, though, as attempts to raise power by de-creasing the value of this resistance may result in MOSFET failure.

A **pi network** (C8, RFC, C9) provides impedance matching to 50W, plus harmonic suppression. Like all inductors in this transmitter, the pi network inductor is a pre-wound RF choke. [Note: Look at the circuit and see why it's called a 'pi' network]

Keying is accomplished through a PNP transistor switch. Closing the key earths the base and provides 12 volts on the collector of the BC640, allowing the power amplifier to operate.

CONSTRUCTION

YOU SHOULD house the transmitter in a metal box. It is generally poor practice to build transmitting equipment in plastic cases because of the capacitance of your hand can alter the tuning, and because of the increased risk of generating interference due to lack of shielding. Size is not important provided it is large enough to accommodate the transmitter without over-crowding components. While an ultra miniature

*** See 'Simple 80m Transmitters', *D-i-Y Radio*, Vol 6: No 2. Back Numbers available at £2 each.**

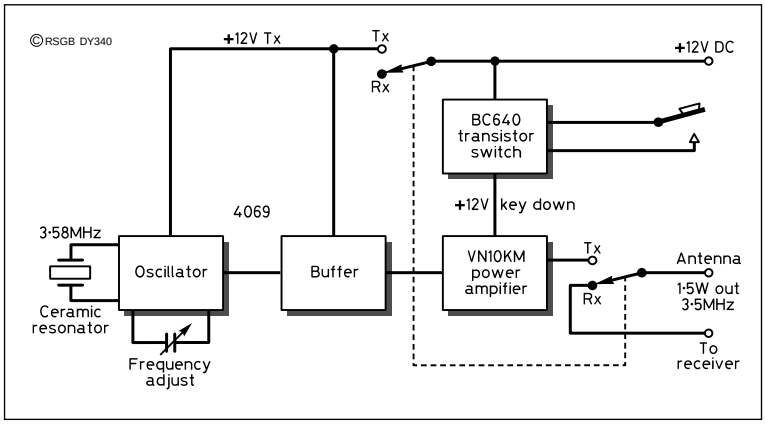


Fig 1: Block diagram of the ceramic resonator controlled 80m CW transmitter.

transmitter may initially appeal to the beginner, it can be a source of frustration if trouble-shooting is later required. You may wish to allow space for future additions and modifications to the rig. These may include a direct conversion receiver, break-in keying facilities, sidetone, or a small power amplifier. A good size is 5 x 15 x 15 cm. Your box can either be purchased or home made. Scrap printed circuit board material and aluminium are both good materials for making cases at home. Biscuit tins from your local supermarket also serve well as enclosures for home-made transmitters.

Both front and rear panel components can now be mounted. The choice of connectors is a personal matter. A wide range is available but I would recommend the following:

12V power socket:-
2.1mm panel socket - centre pin positive.

Key socket:-
6.3mm mono headphone socket.

Antenna connector:-
RCA socket.

Antenna connection to receiver:-
RCA socket.

*** Components for this project available from JAB Electronic Components 1180 Aldridge Road, Great Barr, Birmingham B44 8PB**

All these components are readily available*, cheap and widely used by QRP (low power radio) operators and experimenters. Whatever your choice, make it your standard for all equipment you intend to construct.

Particular caution must be exercised when mounting the variable capacitor. The hole for the shaft must be large enough for it to turn freely. Unfortunately, new capacitors are often not supplied with mounting screws. It may necessary to glue the capacitor to the front panel. Use glue sparingly and keep it away from the shaft and mounting holes.

A board size of 6 x 10cm is sufficient. **Fig 3** shows a suggested board layout. It is up to you how you mount components. I prefer blank matrix board. Do not use strip type board (eg Veroboard) as such boards have high capacitances between parallel tracks. Such capacitances degrade the operation of RF circuits and in this transmitter will reduce the range over which the ceramic resonator can be pulled.

Component leads are passed through holes in the board to be soldered underneath. It may be necessary to use short lengths of tinned copper wire to make some connections. Ensure that connections are rigid to prevent short circuiting. To facilitate servicing and testing it is desirable that circuit board pins be used for connections to the variable capacitor, transmit/receive switch, antenna and power sockets. Use screws and spacers to mount the circuit board to the enclosure. Mounting the board horizontally aids trouble shooting.

A socket should be used for the IC. Particular care should be taken to ensure that no IC socket pins are accidentally bridged when soldering. Excessive heat may damage the ceramic resonator and the semiconductors, so make each solder joint quickly.

The negative earth line running across the bottom of the circuit board must be connected to the metal case by a short, stout lead. This connection could be made to the earthed part of the key socket.

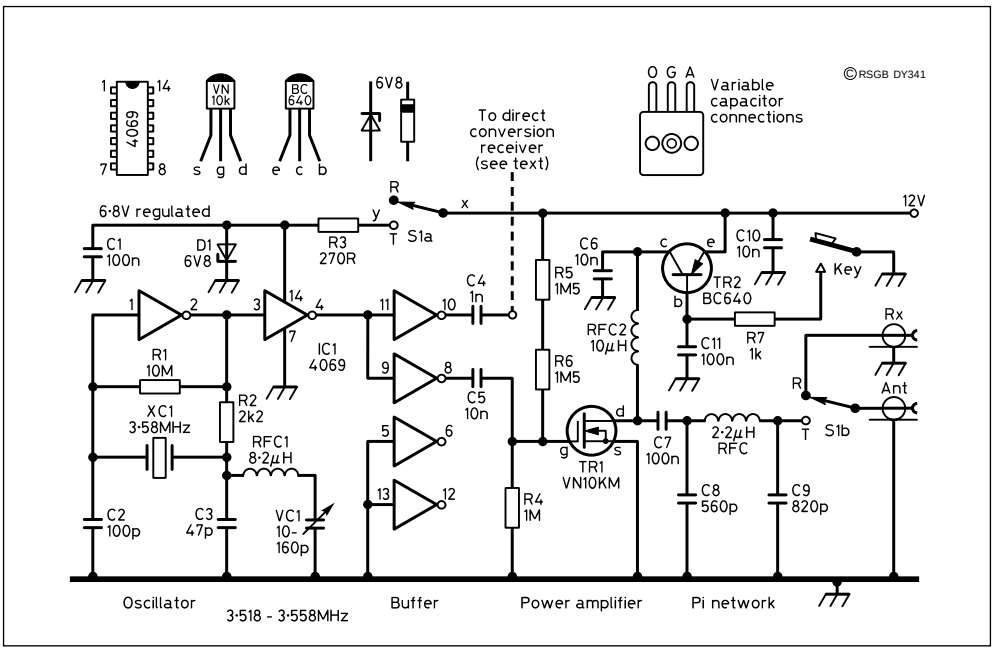


Fig 2: Circuit diagram of 80 metre transmitter.

TESTING

AFTER CHECKING your wiring against both the component layout and schematic diagrams, the transmitter should be tested for correct operation. You will need a multimeter, 80m SSB receiver and a 50W **dummy load**. Such a dummy load could consist of two 100W, one watt resistors wired in parallel. An RF power meter and frequency counter will also be found useful. A one amp, 12 volt power supply, or rechargeable gel battery, is a suitable power source for the transmitter.

With the power connected and transmitter switched to receive, no current should be consumed. Switch to transmit and check that pin 14 of the

4069 is 6.8V above earth. With the dummy load connected to the antenna socket, press the key. The voltage on the BC640 collector should now be 12V, dropping to zero once the key is released.

The ceramic resonator oscillator should now be checked for correct operation. With the rig in transmit mode it should be possible to hear a strong carrier signal in the receiver. Adjusting the variable capacitor should change its frequency.

You may find that, at the lower end of the frequency range, the oscillator is unreliable in starting. This is because your circuit is attempting to pull the ceramic resonator too low in frequency. To remedy this, the trimmer of the back of the variable capacitor should be set to minimum capacity. Most variable capacitors have two trimmers, one for each section. If in doubt as to which one, set both to minimum capacity. If you still experience trouble in getting the oscillator to start, reduce the value of the 8.2mH RF choke. Try 6.8 or 4.7mH.

In all probability the unmodified circuit shown in Fig 2 will not require any of the changes outlined above. It should be possible to achieve a coverage of 3.518 to 3.558MHz and preserve good frequency stability and reliable oscillation.

Pressing the key should result in a stronger signal at the receiver as well as an increase in the transmitter's current consumption. An RF probe [See: 'Seeing Those Invisible Signal & Voltage', *D-i-Y Radio*, Vol 4: No 3. Back numbers available at £2 each] is useful to verify the operation of the power amplifier. Alternatively, an RF power meter can be used. Measured output should draw 200 to 300 mA. If the VN10KM becomes too hot to touch after a few seconds of transmitting, then the three megohm gate resistor should be increased to limit transistor heat dissipation.

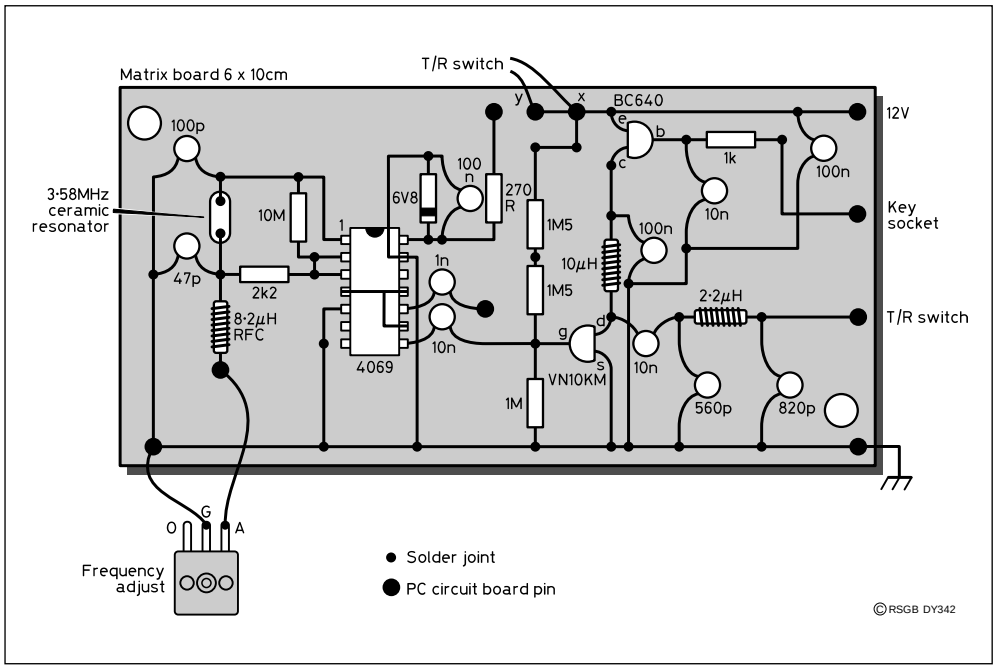


Fig 3: Component layout of the 80 metre transmitter. The Transmit/Receive switch is not mounted on the board and is not shown in this diagram.

Those without test equipment could use a small light bulb across the antenna socket to check operation of their transmitter. A 6.3V bulb is ideal. Depending on the transmitter power output, an orange to white glow on key down is an indication that the rig is operating satisfactorily.

The final test is to monitor keying 'quality'. With the 50W dummy load connected, press the key and listen to the note produced in the receiver. It should be free of 'chirps' and 'clicks' as well as being stable in frequency. Because the oscillator is running continuously during transmit you may notice a backwave when the key is up. Stations you contact will not hear this. If clicks appear on your transmission, try reducing the receiver's RF Gain as strong local signals can cause 'popping' in the receiver AGC system. The quality of emissions from this transmitter design is generally good and no problems should be encountered.

FREQUENCY TUNING NOTES

ALTHOUGH CERAMIC resonators are reasonably stable, one of their oddities is that, every now and then, their frequency may change abruptly by roughly 100Hz, and then remain stable. Such a characteristic has been noticed on signals from ceramic resonator transmitters. Drift of this size is noticeable, but in no way detracts from the quality of the QSO. Because ceramic resonators are susceptible to temperature variations, it is a good idea to mount them away from heat producing components such as power amplifier transistors.

COMPONENTS

Resistors

R1	10M
R2	2.2k
R3	270R
R4	1M
R5, R6	1M5
R7	1k

Capacitors

C1, C7	100n
C2	100p
C3	47p
C4	1n
C5, C6, C10	10n
C8	560p
C9	820p
VC1	10 - 160p

Inductors

RFC1	8.2µH
RFC2	10µH
RFC1	2.2µH

Semiconductors

IC1	4069
TR1	VN10KM
TR2	BC640
D1	6V8

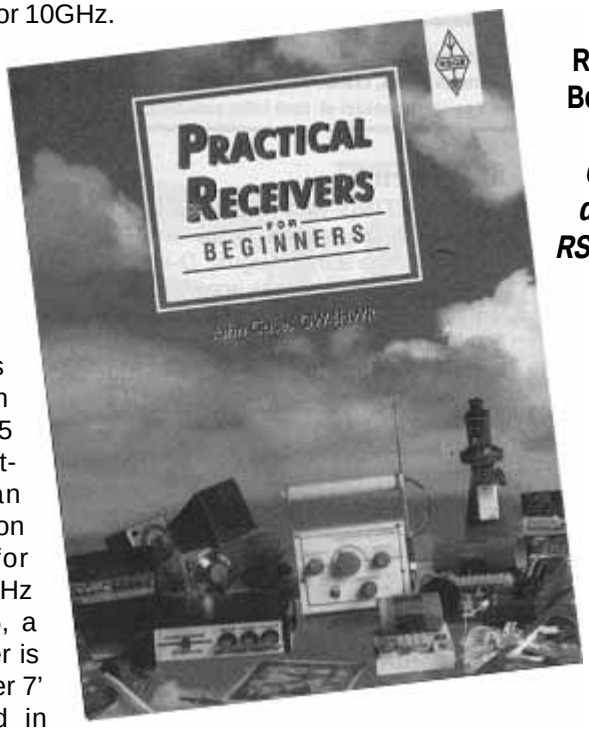
Other Items

Matrix board (see text)
14 pin DIL socket
Pointer knob
1/4in jack socket and plug

Advertisement

Practical Receivers for Beginners

Practical Receivers for Beginners, *by John Case, GW4HWR, is described by RSGB HQ Staff.*



MOST RADIO amateurs began their lifetime involvement with radio by listening to amateur radio transmissions on a receiver. This new RSGB book encourages that tradition, by describing how to build and use receivers.

In Chapter 1 the theory and practice of receiving techniques is outlined to help with understanding the material in later chapters. The workings of various types of receivers, such as the TRF (Tuned Radio Frequency), direct conversion and superheterodyne, are detailed in Chapter 2. This chapter also describes single sideband (SSB) demodulation.

For the beginner to radio, Chapter 3 gives the constructional details of simple receivers, including a crystal set, a medium wave TRF, and an audio amplifier for use with these two simple receivers. These projects use very simple construction techniques, such as using screw connection strips to provide all the interconections between wires and components. The last seven pages of this chapter are devoted to the construction of a simple receiver for 10GHz. The construction of this receiver is more advanced, requiring the ability to do simple metal work and to solder.

A direct-conversion receiver, designed by Steve Price, G4BWE, for the 20 and 80m bands is described in detail in Chapter 4. Chapter 5 gives the constructional details of an amateur radio direction finding receiver for 'topband' (the 1.8MHz band). In Chapter 6, a 6m band FM receiver is described. The 'Super 7' receiver, described in Chapter 7, is a direct-conversion tuneable IF (Intermediate Frequency), with a fixed frequency converter front end for the 7MHz amateur band.

The last two chapters are devoted to microwave receivers. Chapter 8 contains a wide range of information regarding the microwave bands, including propagation and operating techniques, assembling a station, antennas and feeders, general construction techniques, and miscellaneous subjects such as making a tripod, coaxial cable plugs and sockets, and attenuators.

The various types of microwave receivers are described in Chapter 9 and include wide-band receivers for 1.3GHz and 10GHz television (ATV), preamplifiers for 1.3GHz, 10GHz receivers for wide-band FM, and a high quality 10GHz to 144MHz receive converter.

The book also has three appendices: Appendix 1 is a comprehensive description of tools and how to use them. Most of the projects in the book rely on printed circuit boards and, where they are used, a PCB screen print is provided. Appendix 2 describes in detail how to use these to make PCBs using the etching techniques. The construction of a UV light box is also described. The final appendix is a list of suppliers of most of the components used in the projects in this book.

CONTENTS LIST

Practical Receivers for Beginners *by John Case, GW4HWR, is published by Radio Society of Great Britain, Lambda House, Cranborne Road, Potters Bar, Herts EN6 3JE. It is available from RSGB Sales, price £10.63 (RSGB members and HamClub members), £12.50 (non-members). ISBN 1-872309-35-6.*

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.

SAFETY FIRST

I AM WRITING with reference to the article 'Nuts and Bolts and Things' in the July / August *D-i-Y Radio*. This process was known as 'squirrelizing' and I agree that it is a valuable source or way of getting components.

However, there are dangers to consider. Old equipment used processes which are not generally allowed any more. In my former employment there were Health and Safety notices that stopped the use of some very common materials. One of these related to cadmium plated components. Nuts and bolts and chassis etc were protected by cadmium plating. After a time the cadmium was attacked and poisonous compounds were produced. There is much equipment available which still consists of this material. Be careful of screws covered in a white powdery substance.

I think that articles in *D-i-Y Radio* should address the safety aspect, especially as young folk may be involved.

Other materials to beware of include PTFE and Beryllium Copper. Even lightweight magnesium alloys produce highly flammable powder and toxic fumes when drilled. I apologise for the negative tone of this letter and I should add that, with care, 'squirrelizing' is an effective way of acquiring useful stocks. Thanks for your excellent articles.

A J F Gasking

A GOOD IDEA

I WOULD like to share my idea - a refillable solder tube - with readers. The idea occurred to me after my sister managed to unwind one which I bought from a shop. Of course, I was unable to get it back in its container so I went in search of something else.

The best thing to use is one of those plastic containers which photographic films are placed in. A hole is pierced through the top and the solder is wound by turning it round a candle or something of a similar shape.

The solder is popped into its container and the end pushed through the hole.

Howard Mustoe

D-iar-Y NOV-DEC

NOVEMBER

1	Bangor & DARS Annual Surplus Equipment Rally. Bangor, Co Down. Details 01247 466557.
2 / 3	RSGB 144MHz CW Marconi Contest 1400 - 1400UTC.
3	RSGB 6 Hour 144MHz CW Contest 0800 - 1400UTC.
8	RSGB 432MHz Cumulative Contest, All modes 2030 - 2300UTC.
3	Great Northern Hamfest. Details 01226 716339. Metrodome Leisure Complex, Barnsley.
3	North Devon Radio Rally, Holsworthy. Details 01409 241202.
3	Thames Valley Electronics Rally, Kempton Park Race Course, Sunbury on Thames, Middx. Details 0494 450504.
8	3.5MHz YU Beograd 96 Nikola Tesla Memorial Contest, CW / SSB.
9	RSGB Club Calls Contest, CW / SSB 1.8MHz, 2000 - 2300UTC.
9 / 10	OK / OM Contest (Czech/Slovak), CW / SSB / mixed, 1.8 - 28MHz, 1200 - 1200UTC.
9 / 10	North Wales Radio & Electronics Exhibition, Llandudno. Details 01745 591704.
10	MARS - Birmingham Radio & Computer Rally. Details 0121 443 1189.
15	RSGB 1.3 / 2.3GHz Cumulative Contest, All modes 2030 - 2300UTC.
16	London Amateur Radio & Computer Christmas Rally, Lee Valley Leisure Centre, Edmonton, North London. Details 01923 893929.
16	Rochdale & DARS Traditional Radio Rally. Details 01706 376204 evenings only.
16 / 17	RSGB 1.8MHz CW Contest, 2100 - 0100UTC.
17	AGCW-DL Homebrew / Oldtime Equipment Party, CW 1300 - 1500 7MHz, 1500 - 1700 3.5MHz.
17	Bishop Auckland ARC Rally. Details 01388 766264.
23 / 24	*CQ* World Wide DX Contest, CW, 0000 - 2400UTC, 160 -10m.
24	Bridgend DARC Radio & Computer Rally. Details 01656 864579.
24	Red Rose Rally, Horwich Leisure Centre, Horwich, nr Bolton. Details 01204 62980.
25	RSGB 432MHz Cumulative Contest, All modes 2030 - 2300UTC.
28	Lincoln & DARS Grand Electronics & Computer Junk Sale. Details 01522 537751.

DECEMBER

1	RSGB 144MHz Fixed Station / AFS Contest, All modes 0900 - 1700UTC.
6 - 8	ARRL 160 metre Contest, CW 2200UTC Friday to 1600UTC Sunday.
7	RSGB AGM, Central London, 2.00pm. Details 01707 659015.
8	Portland ARC Annual Rally & Craft Fair, Portland, Dorset. Details 01305 823373.
8	SDX Cluster Support Group Rally, Glasgow. Details 0141 638 7670.
14	RSGB HQ Saturday Opening, Potters Bar, Herts. Details 01707 659015.
14 / 15	ARRL 10 metre Contest, CW / SSB / Mixed 0000 - 2400UTC.
15	Verulam ARC Rally, Watford Leisure Centre, Watford, Herts. Details 01923 262180.
19	Oldham AR Mobile Rally. Details 01706 846143.
26 - 29	RSGB 70 / 144 / 432MHz Christmas Cumulative Contest, All modes 1400 - 1600UTC.
28	Lancastrian Rally. Details 01524 64239.

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