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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

March • April 1996
Volume Six: No 2

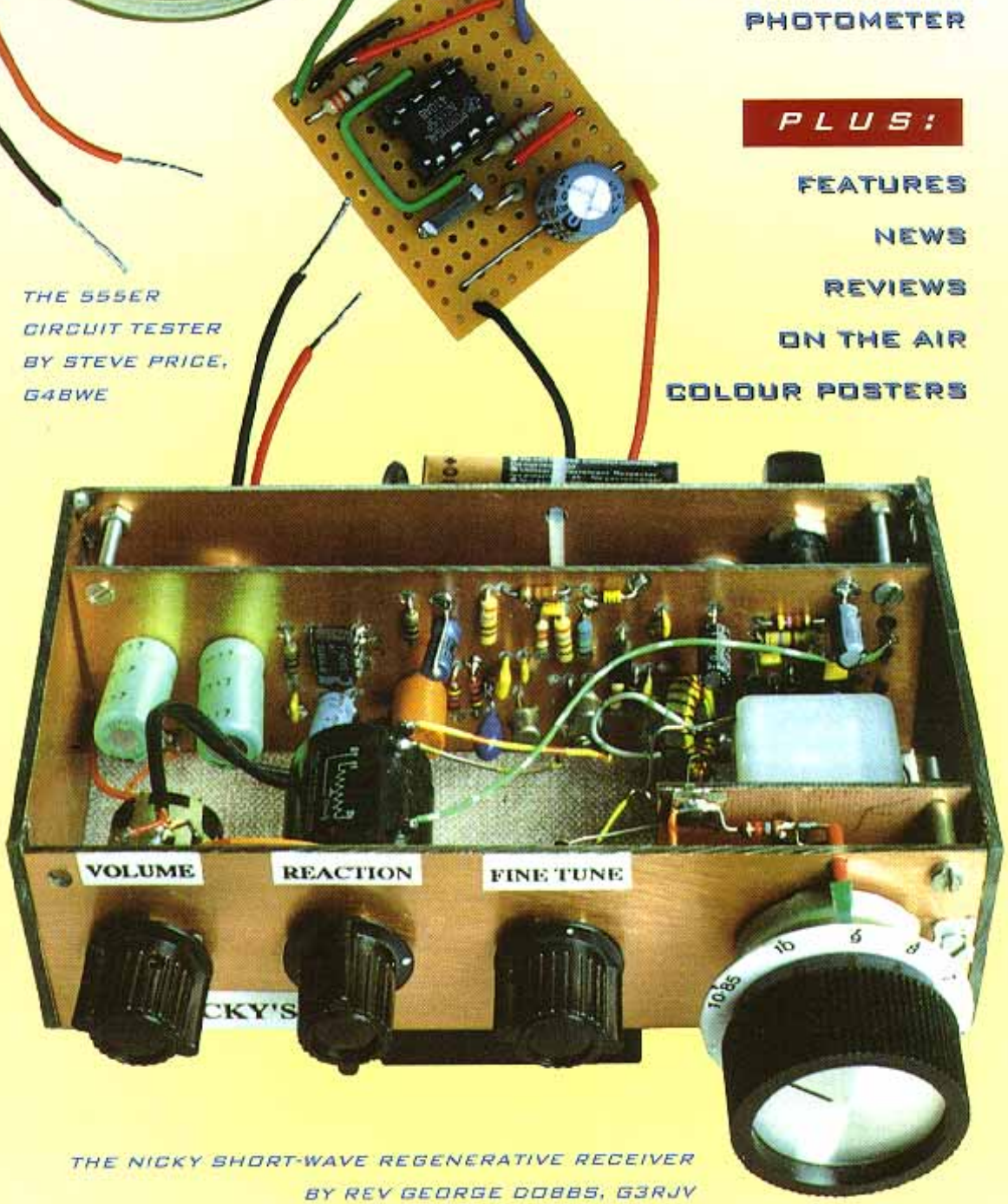
PROJECTS:

- SHORT-WAVE RECEIVER
- 70CM QUAD ANTENNA
- AM PORTABLE RADIO
- AUDIO OSCILLATOR
- 80M TRANSMITTER
- LOW PASS FILTER
- PHOTOMETER

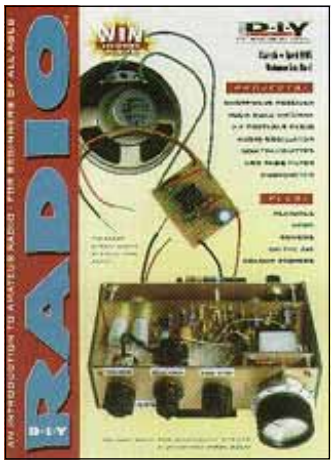
PLUS:

- FEATURES
- NEWS
- REVIEWS
- ON THE AIR
- COLOUR POSTERS

THE 555ER CIRCUIT TESTER
BY STEVE PRICE, G4BWE



THE NICKY SHORT-WAVE REGENERATIVE RECEIVER
BY REV GEORGE DOBBS, G3RJV



Another Bumper Edition

INCORPORATING

The Very Best of D-i-Y RADIO

AN INTRODUCTION TO AMATEUR RADIO - FOR BEGINNERS OF ALL AGES

THE DOUBLE-SIZED November-December 1995 edition proved so popular that we've produced another bumper *D-i-Y Radio*. And we have taken the opportunity to bring you more of the best projects from previous magazines as well as plenty of new material.

Every normal-sized *D-i-Y Radio* includes three construction projects (one of each type - see below), technical theory, a colour poster, a prize competition, a special offer, news, operating details, letters and a two-month calendar of events.

You can now subscribe in three different ways.

- For those who are not members of the RSGB, a subscription to *D-i-Y Radio* costs £9.
- If you are under 18, you can choose to join the RSGB HamClub for just £10. This provides almost all of the benefits of RSGB membership but with *D-i-Y Radio* sent to you every two months instead of the members' monthly magazine *RadCom*.
- If you are already an RSGB member, you can have *D-i-Y Radio* as well as *RadCom* for an additional £7.65.

All of these subscriptions come with a joining pack, and further information can be found on pages 10 and 46 of this edition.

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PHOTOGRAPH: RNLI

The Margate Lifeboat which rescued fishermen in distress, thanks to radio (see main story opposite).

Managing Editor: Mike Dennison; Production Editor: Jennifer Crocker; Technical Editor: Peter Dodd; Technical Illustrator: Bob Ryan; News Ed: Steve Lowe; Prod Asst: Wai-Yee Man; Secretary: Samantha Ralph. *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.

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comment

THIS EDITION of *D-i-Y Radio* has thousands of new readers, thanks to being distributed with the April 96 *Ham Radio Today*. If you are one of them, welcome.

The Radio Society of Great Britain launched *D-i-Y Radio* in 1991 as a subscription-only magazine published six times a year. It covers a more basic level of radio and electronics than *Radio Communication* which is sent to members every month.

The slogan of *D-i-Y Radio* is 'For Beginners of All Ages' and it is remarkably popular with beginners and Novice licensees, as well as very many more experienced amateurs who like its down-to-earth style. We have subscribers aged 8 to 80 and in many overseas countries.

Every edition (normally 24 pages) is packed with information, including three construction projects (very easy, easy and not so easy) a colour A3-size poster, theory, operating info, news, reviews, diary etc. As the title suggests, the aim is to encourage practical amateur radio; each project is supported by either a kit or details of where to get the components. There's always a prize competition and a special offer voucher.

Details of how to subscribe can be found on page 46, and information on the Radio Society of Great Britain is on page 13.

I hope you enjoy your first taste of *D-i-Y Radio*. Please write and let us know what you think of it, and tell us about yourself and your interest in radio - photographs are most welcome.

Mike Dennison, G3XDV
Editor

RSGB - SUPPORTING AMATEUR RADIO

Novice Licensee Helps Sea Rescue

PHOTO COURTESY OF *ISLE OF THANET GAZETTE*, MARGATE

A NOVICE RADIO amateur Brian Tutty, 2E1DEU, who is a member of the Thanet Raynet group, was of great assistance to the marine rescue services recently. When Brian heard the Margate lifeboat maroons, he switched on his CB and 70cm amateur radio equipment. A boat with two fishermen on board had engine problems and was lost in dense fog. Light was fading and the fishermen had been out for five long hours. Their failure to return was reported and Dover coastguard requested Margate lifeboat to carry out a search in the fog.

Brian Tutty, 2E1DEU, in his Margate shack.

The anglers were calling for assistance on Channel 9 of their CB radio. Brian picked up the call and then acted as liaison between the coastguard, the Margate lifeboat, and the lost fishermen. The anglers could only give an approximate position, which was passed to another Thanet Raynet member on 70cm and then relayed to Dover coastguards. They then passed the information to the lifeboat by VHF marine radio. Both the coastguard and the lifeboat were given Brian's phone number, and direct contact was established by portable telephones.

Brian suggested to the anglers that they should conserve their CB batteries, but over the course of the next 45 minutes he called them periodically in order to give them up to date information on how the lifeboat search was progressing. He also suggested that the lifeboat should sound their siren frequently and asked the anglers to report when any sound was heard. The fishing boat was made of fibreglass which gave a poor response on the lifeboat's radar.

After eventually landing safely ashore the anglers were especially grateful for Brian's competence when they learned that he was a registered blind operator. Brian is planning to take the full Radio Amateurs' Examination in May this year. Meanwhile, he performs an invaluable service as control operator at Thanet Raynet events, with logging being carried out by whoever is acting as his supervisor until he obtains his full licence.

The story of the rescue was reported widely by local newspapers with headlines such as 'Blind Brian in amazing radio rescue' and provided some good publicity for amateur radio and CB. We are grateful to Dave Arter, G1NLQ, who is also a member of the Thanet Raynet group, for bringing this story to our attention.

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Advertisement

SENIOR NOVICE INSTRUCTOR CHANGES

THE RSGB has recently appointed new Senior Instructors in the Novice training scheme for Avon, Buckinghamshire and Oxfordshire. If you live in one of those counties and want to know more about Novice licence training courses in your area you should phone or write to:

Steve Hartley, G0FUW, 5 Sydenham Buildings, Lower Bristol Road, Bath, Avon BA2 3BS, tel: 01225 4643945.

Verdon Webley, G0RKV, 1 Bates Close, Willen, Milton Keynes, Bucks MK15 9HZ, tel: 01908 672920.

Brian Fisher, G0SAG, 6 Northolt Road, Carterton, Oxon OX18 3QH, tel: 01993 843875.

If you live elsewhere you can find out who is the contact for your area by ringing Lynnette Ranger, 2E1EKT, at RSGB Headquarters. The number is 01707 659015.

RAE / NRAE REPORTS

CITY & GUILDS has issued reports on the December 1995 Radio Amateurs' Examination and Novice Radio Amateurs' Examination. Anyone wanting a copy of either report should send a 19p SASE to Lynnette Ranger, 2E1EKT, at RSGB HQ, specifying which one is required.

NEW EXAMINATION CENTRES

THE GORDON Schools Amateur Radio Club, GS7TGS, is now authorised by City & Guilds to act as an examination centre for both the RAE and Novice RAE. External candidates are welcome. For further information write to the Gordon Schools Amateur Radio Club, Huntly, AB54 4SE or tel: 01466 780739.

The Bishop Auckland Radio Amateurs' Club is also a new City & Guilds examination centre for both examinations. The club also offers regular courses of tuition. For further details please contact Tim Bevan, G6WBA, 6 Buttermere Grove, West Auckland, Bishop Auckland, County Durham DL14 9LG.

MEET THE RSGB

AN RSGB REGIONAL Open Forum meeting will take place on 12 May 1996 at Rivenhall Village Hall, Church Road, Rivenhall, Witham, Essex. RSGB President Peter Sheppard, G4EJP, will be attending, as well as other members of RSGB Council. For further information please contact Fred Stewart, G0CSF, Shingles, Ingleborough Ln, St Mary's Platt, Sevenoaks, Kent TN15 8JU, tel: 01732 780721.

And RSGB HQ in Potters Bar will be open to visitors on Saturday 16 March and Saturday 20 April, between 10.00am and 4.00pm. The bookshop and GB3RS shack will be available to visitors, as will the National Amateur Radio Museum and Library.

UN 50TH BIRTHDAY ON THE AIR

Denise Wild, Timothy White, Oliver Lockwood and Chris Ward with their GB50UN certificates, which were presented by Mr Charles Colvington, the chairman of the Isle of Man United Nations Association.

ISLE OF MAN SCOUTS celebrated the 50th anniversary of the United Nations during Jamboree On The Air (JOTA) last year with special event station GB50UN. JOTA, which takes place in October each year, and Thinking Day On The Air, which takes place in February, are events in which Scouts and Guides from around the world communicate with each other by amateur radio.

Because of the UN anniversary, the Scouts had asked Denys Hall, GD4OEL, if they could have a UN theme for JOTA. Thanks to Mr Charles Colvington, the Chairman of the Isle of Man United Nations Association, and the UN Information Centre office in London, they were able to obtain the extra special callsign GB50UN.

The station was set up at Eary Cushlin, near Dalby on the Isle of Man, an excellent site for radio, and over the weekend communicated with Scout stations in South America, USA, Canada, Europe, and the British Isles. One disappointment was that the Falkland Islands Scouts weren't contacted.

Mr Colvington visited the station while they were in contact with a Scout group in the British Isles and saw how the details of the station log were kept on a computer by one of the Scouts. He spoke with the Scouts about the station and the history of the UN and the UN Association on the Isle of Man. After the event, Mr Colvington kindly presented GB50UN certificates to all the Scouts who had taken part in JOTA.

The GB50UN QSL card, which was provided by the Isle of Man Bank and the Isle of Man Post Office, is pictured in our *On The Air* feature on page 42.

Denys Hall, GD4OEL, is putting on another special event station, GB4MGR, which stands for 'Manx Guide Radio', for the Guides Thinking Day On The Air on 24 - 25 February.

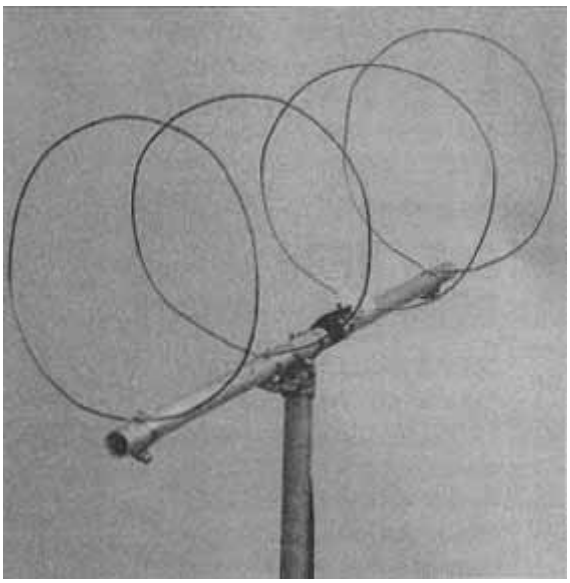
● TV IS NOW 70 years old! John Logie Baird gave the first demonstration of television to members of the Royal Institution in London on 26 January 1926. Ten years later the BBC started the world's first high definition TV service, and to celebrate this, GB60BBC will be on the air from various locations throughout 1996.

70cm Quad Antenna

The Very Best of D-i-Y RADIO

An Easy-to-construct UHF Beam

THIS IS A description of how to make an antenna with gain compared with the rubber duck or a dipole antenna. Additionally this antenna can be dismantled for carrying to a hill-top location and assembled with ease. Antenna gain is described in *D-i-Y Radio* Vol 4: No 5.



HOW DOES IT WORK?

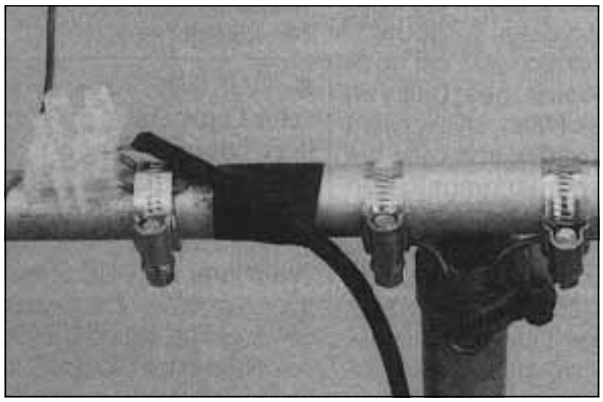
THIS ANTENNA USES the principle of the **Yagi parasitic array**. You can see a Yagi antenna on nearly every house in the UK, used for receiving television signals. Antennas have the same characteristics whether they are used for transmitting or receiving - that is why you can use the same antenna for transmitting or receiving on your rig. It is easier to describe the principle of the Yagi antenna as a transmitting antenna.

Although there can be quite a lot of elements used on a Yagi only one is connected directly to the coax cable and the transmitter, and is known as the **driven** element. The other elements, known as **parasitic** elements, because they are not directly connected to the transmitter, pick up the radio frequency (RF) energy from the driven element and re-radiate it. One of these elements is physically longer than the driven element and is called the **reflector**. The phase of the re-radiated RF, combined with the RF from the driven element causes it to be reflected away from the reflector element.

Other elements are made shorter than the driven element. The phase of the re-radiated RF from these elements, combined with the RF from the driven element, causes the RF to be directed towards these **director** elements.

The combined effect of all these elements is to cause the RF to be concentrated in one direction. By building the field strength meter, described on page 8, you will be able to experiment with this antenna and measure its **directivity**.

Instead of using straight elements as used in the Yagi this antenna uses wire loops. This is a very well known antenna in amateur radio and it is called a **quad**. Normally, these wire loops are square. For the lower frequency bands the elements are much larger and have to be supported on an X frame. In our case a quad antenna for 432MHz is very small so the elements do not need a supporting frame and can be made in a circular shape.



Detail of construction method.

CONSTRUCTION

THE ANTENNA IS very easy to construct. The design allows you to use any type of metal tube or even wood for the antenna boom (the support for the elements) and the mast. The antenna elements are made from 14SWG hard drawn copper wire; you can use other gauges of copper wire. 16 SWG hard drawn antenna wire has been tried and worked very well. If you use thinner wire the antenna elements might get a bit floppy. All the separate parts of this antenna are fixed together using hose clips (sometimes known as jubilee clips).

The driven element is fixed to the boom using a hose clamp, with a white plastic connector block (with three terminals) to enable the coax to be connected to the elements. This element should be made 70mm longer than shown in **Fig 1**. The ends of the elements are then bent at right angles, formed into a loop and the ends pushed through the connector block and the screws tightened. The long 50mm end is formed into a loop and pushed back though the third connector. This loop is

used to connect the driven element to the boom. All this might seem a bit complicated but it is probably easier to see how it is done by looking carefully at Fig 1 and the photograph.

The parasitic elements should be made 40mm longer than the lengths shown in Fig 1. Bend the ends of the wire at right-angles and then form the wire into a loop. It is preferable, but not essential, to solder the ends of the wires together, which makes it easier to assemble the antenna.

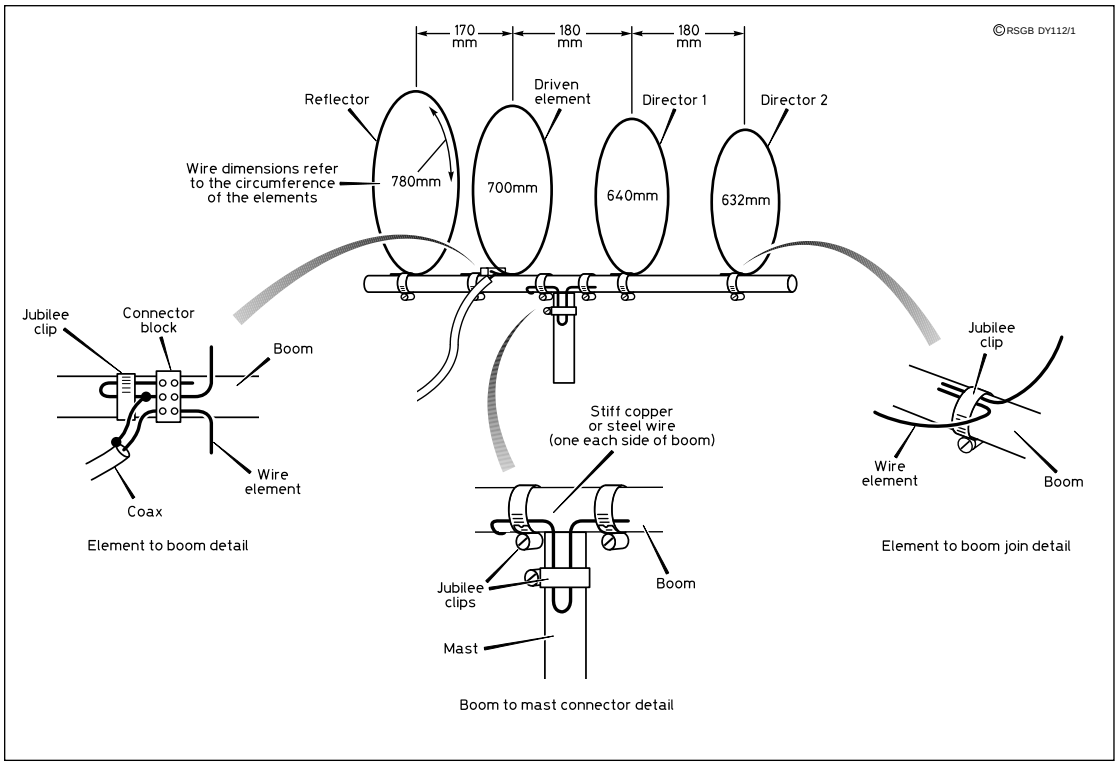


Fig 1: 70cm 4 element quad construction, with detail of how hose clamps are used in the construction.

The antenna is fixed to the mast using hose clips and wire as shown in Fig 1. Finally the coax cable is connected to the driven element connector block, with the braid of the coax connected to the end of the element fixed to the boom and the centre of the coax connected to the free end of the element.

You will have to fit a coax plug on the other end of the coax cable to suit your transceiver or SWR meter if you are using one. See for instance the *Novice Licence Student Notebook*, for information on how to do this.

TESTING THE ANTENNA

YOUR ANTENNA CAN now be tested. It is best to try antennas outside away from buildings where possible. At these frequencies signals bounce off walls and metallic objects and can give misleading results.

It is best to try the antenna on receive first. Switch on your rig using the rubber duck, or some other antenna that you normally use then tune around the repeater or beacon channels and listen for any signals that might be on. Now disconnect the normal antenna and connect the quad - remember that this antenna is directional so point the antenna at your local repeater if you know where it is. If you can hear a repeater and the signal strength varies as you turn the antenna then it would appear that it is working to some degree, particularly if the signal is stronger than with the original antenna. You should be able to locate the direction of the repeater if you didn't know where it was in the first place.

Now try it on transmit. It will be useful to have a 'standing wave ratio' meter (SWR meter), when the matching is good it generally means that the transmitted power is going to the antenna.This instrument is used to measure that the coax cable and the antenna are **matched**. If the meter reads 1:1 then the match is excellent. Provided the reading is less than 1.8:1 the match is acceptable. Some cheap CB SWR meters that have been tried gave good results on 70cm [1].

You can check the directivity of your antenna using a field strength meter (FSM). This instrument measures the level of RF energy around your antenna. How to construct one and how it is used is described on page 8.

REFERENCES

[1] The SWR meter and its use in checking UHF antennas was described *D-i-Y Radio* Vol 4: No 6.

MATERIALS

4 metres of 14 gauge hard drawn copper wire

Copper tubing

15 amp connector block

7 hose clips

A kit of parts comprising 5 metres of RG58CU coaxial cable, 5 metres of hard drawn copper wire and a coaxial plug (BNC or PL259) can be obtained from W H Westlake, West Park, Clawton, Holsworthy Devon EX22 6QN at the special price of £5. Please mention *D-i-Y Radio* when ordering.

The rest of the materials can be obtained from hardware stores.

A UHF Field Strength Meter

Measure the RF radiating from your antenna

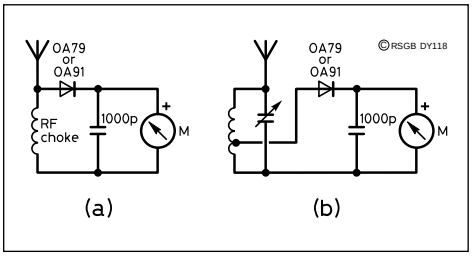


Fig 1: Construction of the UHF field strength meter.

A FIELD strength meter (FSM) measures the level of radio frequency (RF) energy from a transmitting antenna. It is a simple receiver which has a meter connected to the output instead of a loudspeaker. An FSM can be a simple broadband detector as shown in **Fig 1a** or a detector with a tuned circuit in front of it as shown in **Fig 1b**. The broadband FSM will detect RF fields over a wide range of frequencies. An FSM with an RF choke at the antenna socket will be sensitive to frequencies in the HF band. A loop of wire at the antenna socket will be required to give adequate sensitivity in the VHF/UHF range.

An FSM with a tuned circuit will only detect a transmission on the frequency to which it is tuned. If the tuning circuit variable capacitor has a calibrated dial you will then be able to measure the frequency of the radiated transmission. An FSM with a tuned circuit is sometimes called an **Absorption Wavemeter**, which is useful for measuring the frequencies of any spurious signals, such as harmonics, radiating from a transmitter. Because we want an instrument for checking the performance of a UHF antenna we want an FSM that is sensitive around 433MHz. You can use this instrument for comparing the signal strength of the rubber duck antenna on your rig with any experimental antenna that you might like to make.

CONSTRUCTION

THIS INSTRUMENT IS very simple to make. It comprises a loop of wire, 600mm long, which also acts as the antenna. The other items required are a diode, a capacitor, a connection block and a length of twin wire. The FSM components are not mounted in a box in the conventional way but fixed to a pole with a hose clip (jubilee clip), as shown in **Fig 2**. It does not have a meter built in but has leads from the FSM components that can be connected to any sensitive 50 or 100μA meter, or you can use a multimeter. By selecting different ranges on the multimeter you have an FSM with adjustable sensitivity.

USING THE FSM

CONNECT A METER to the FSM circuitry. Place the hand-held transceiver about two metres from the FSM and press transmit. If there is no reading on the meter, check the wiring of the FSM. If the meter reading appears to go negative in the presence of a signal just connect the leads to the meter the other way round. If the reading is too high, move the transceiver further away from the FSM.

Now try altering the orientation of the transmitter antenna relative to the FSM and note how the signal varies.

If you build the UHF quad, described on page 6, connect this to the transceiver and note how the signal varies as the antenna is rotated.

COMPONENTS

Capacitor	100p
Diode	0A79 or 0A91
Connector block*	10 amp
600mm long wire*	16SWG
Hose clips*	

*These can be obtained from most hardware stores.

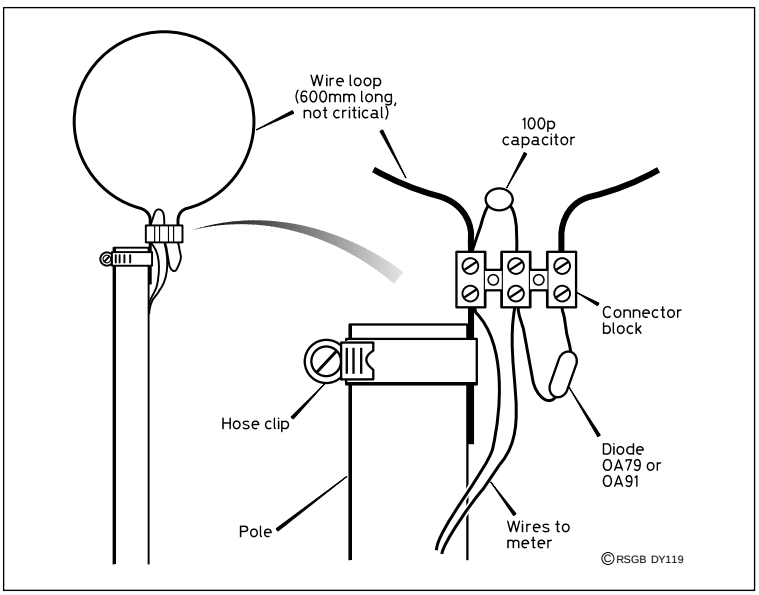


Fig 2: Broadband and tunable field strength meter.

The Light Measuring Photometer

BEFORE THE days of automatic cameras a photographer would use a light meter (Photometer) to measure the light level and then manually convert the light reading to shutter speed and lens aperture settings to ensure that the film exposure was correct.

Most modern cameras have a light measuring meter built in, which controls the aperture setting of the camera lens automatically.

HOW DOES IT WORK?

THE OPERATION OF the circuit in **Fig 1** is based on a component called a **Light Dependant Resistor** (LDR). In bright light the resistance of the LDR is low - about 1kΩ. In the dark its resistance is high, up to 10MΩ. When an LDR is connected in series with a battery and a meter the rate of current flowing will depend on the light intensity at the LDR. In this circuit a variable resistor, RV1, is connected in series with the LDR, battery and meter. This is so that the range of the meter can be set. In other words you want the meter to read full scale deflection when the light intensity is at maximum and to read zero when the light level is very low.

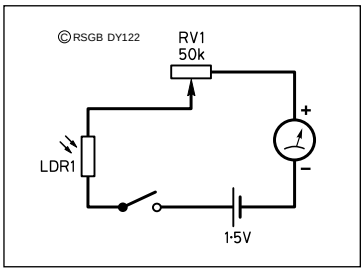


Fig 1: Circuit diagram of photometer.

This instrument is very simple to make. The items required are an LDR, 50kΩ variable resistor and any sensitive 50 or 100µA meter. You could use a multimeter for M1. The connections of RV1 are the centre tab and the left-hand tab, viewed from the rear.

THE PHOTOMETER

WHEN THE PHOTOMETER is connected up you will find that it will probably give a reading straight away due to daylight reducing the resistance of the LDR. This instrument is quite sensitive to light. You will probably have to find a dark room where the light is low enough for the meter to read zero.

We can use our photometer to make a graph of the light intensity of a battery-powered torch. Draw a circle on a large sheet of paper and then divide the paper into segments as shown in **Fig 2**. If you have a protractor then you could make a line, say every 10°. Generally the more divisions you have the more accurate the plot will be. The measurements will have to be made in a darkened room with the meter a short distance from the LDR, connected by two wires.

Beam the torch directly at the LDR and set the meter reading to maximum (10 or 100) using RV1. Point the torch to the next segment and take another reading, making a note of it. When you have made all the measurements you can use the data to construct a light intensity pattern as shown in Fig 2.

There is a similarity between light and radio frequency waves. Both are known as **electro-magnetic radiation**. Can you think of a way of using the Field Strength Meter (FSM), described on page 8, for making a similar plot of a directional antenna?

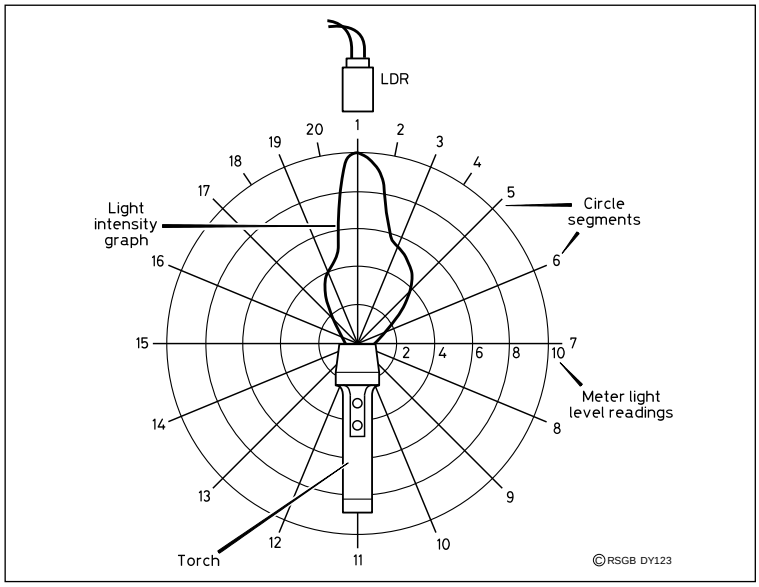


Fig 2: Torch light intensity pattern plotted at RSGB HQ.

The Very Best of D-I-Y RADIO

An Instrument for Measuring Light Intensity

COMPONENTS

Resistors

RV1	50k potentiometer

Semiconductors

LDR1	ORP12 Light dependant resistor

Additional Items

PP3 battery connector

Advertisement

Communicate by Invisible Light

INFRA-RED LIGHT (see **Fig 1**) has similar properties to radio waves in the microwave region (see our colour poster) and visible light. However, like radio waves, infra-red waves can't be seen. Infra-red is used in virtually every house, these days, to transmit signals from a remote control unit to a television, video-recorder or hi-fi. Less well known is that infra-red light, generated by special lasers, is used for telecommunications links via glass fibre cables.

For our purpose, it can be used to experiment with wireless transmission without the need to obtain a licence. It is even possible to 'amplify' the effective light by using a magnifying glass to focus it (**Fig 2**).

A licence-free way to transmit speech, music or data over short distances

THE KIT

THE RAMSEY ELECTRONICS Infra-red Light Beam Communicator has a claimed range of up to 10m (30ft) or a quarter of a mile "with simple lenses", so it could be used to set up a link across a road, from one school building to another, or within a room (for 'cordless' headphones for instance).

The kit includes all components, a Printed Circuit Board (PCB) and full instructions. A hardware kit of knobs, box etc is also available. The only additional things needed to make it work are an audio source (eg microphone), headphones or loudspeaker and a battery.

The instructions are amongst the best we have seen at *D-i-Y Radio*, giving in 16 A5 pages some information on infra-red, step by step construction details, a parts list with a description of each component (including the resistor colour code for each one), a layout diagram, a circuit diagram and suggestions for experiments. The tone is helpful and friendly - "Congratulations, your IR light beam receiver is completed" - and hints are included such as "Don't worry too much about heating the component with your iron."

In order to be able to use two kits as transceivers, or just one as a transmitter and separate receiver, the PCB can easily be split into two parts (see photograph).

CONSTRUCTION

ONLY TWO TOOLS are needed to build this kit: a pencil-bit soldering iron and a pair of thin-nosed pliers, though miniature wire cutters are also useful. Care must be taken in identifying the

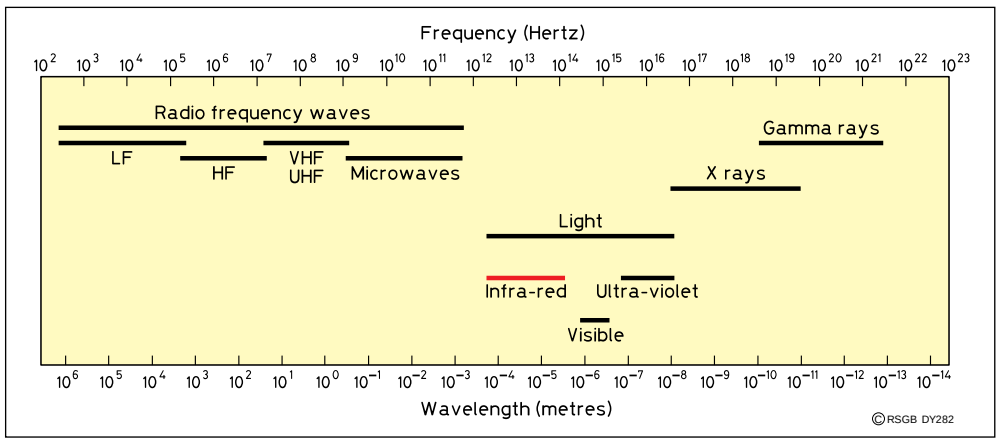
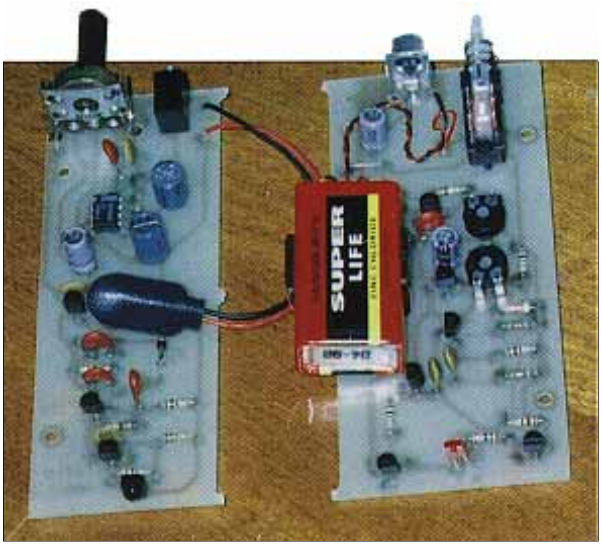


Fig 1: Infra-Red light is lower in frequency than visible light.



components; we made a few silly mistakes in our haste to complete the project. Some parts needed their leads bending a little in order to fit them into the board.

Construction took about four hours, including checking component placing and solder joints (important this, one of our joints looked OK until it was examined closely with a magnifying glass). If you want to split the PCB into separate receiver and transmitter, note that the supplied on-off switch and battery are on the transmitter board only; another switch and battery connector are needed for the receiver.

The Ramsey Electronics Infra-Red Light Beam Communicator Kit costs £22.95 from Waters & Stanton Electronics, 22 Main Road, Hockley, Essex SS5 4QS, who are thanked for providing the kit for review.

EXPERIMENTS

THE FIRST THING you'll want to do having finished the receiver is to test it. This can easily be done by pointing a remote control unit at the receiver's 'eye' from a metre or so away. A pulsed buzzing sound should be heard. Try moving the remote control and receiver apart - we found a range of 3 or 4 metres with the signal rapidly fading away at the furthest range.

Next try placing a magnifying glass lens a few centimetres from the receiver, exactly in line with the remote control. The signal is greatly amplified once the lens is in the right place.

Having proved that all is OK, the transmitter can be built and you are all set for some communications experiments. The transmitter works with 9 to 12V but we found it worked very much better on a 9V mains power supply (battery eliminator), and better still on a 12V supply (though care must be taken at the setting up stage). An ordinary 9V battery wasn't really adequate, though a re-chargeable one would be OK.

When tested, the range was about 4m, rather less than the claimed 10m, but the addition of a simple lens (a child's plastic magnifying glass) improved this greatly. Another magnifier placed in front of the receiver made the signal better still, though the beam was so narrow that everything had to be carefully aligned. The audio output was loud with little background noise.

SUMMARY

ALTHOUGH WE weren't able to achieve the claimed ranges with this kit, it was very straightforward to build, the instructions were excellent and the project well thought out. We had a lot of fun experimenting with lenses, too. If you want to build something different, set up a secret communications link, or try out the properties of optical instruments (magnifiers, telescopes, mirrors etc), this is the project for you.

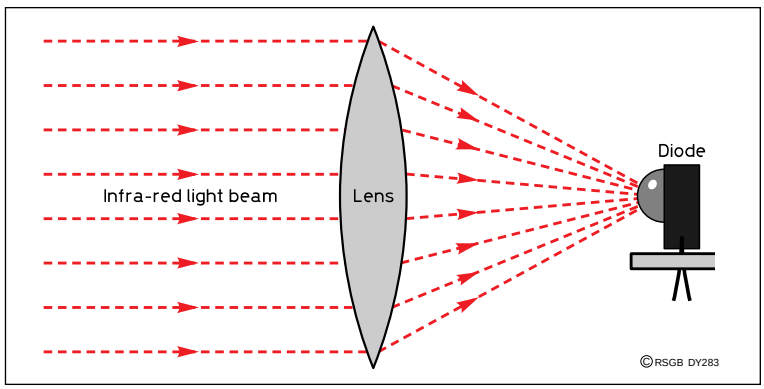


Fig 2: A simple lens focuses the infra-red light to improve the signal.

Amateur Radio and the RSGB

THE RADIO Society of Great Britain represents all UK radio amateurs nationally (in frequent meetings with the Radiocommunications Agency) and internationally (as a member of the International Amateur Radio Union - IARU); it has done so since 1913. Protecting our bands is even more important in today's crowded spectrum, but the RSGB aims not only to protect but to expand; the Class B licence and the 6 metre band are two examples of licence improvements brought about by RSGB initiatives.

A full-time staff of 30, backed up by more than a thousand specialist volunteers, provides advice, assistance and technical publications to some 30,000 members worldwide.

At your service: part of the bookshop and reception area at RSGB Headquarters. The shop is open on weekdays (9.15am to 5.15pm) and every third Saturday in each month between 10.00am and 4.00pm.

How* your *national society has supported amateur radio for more than 80 years.

LICENSING

THE RSGB CARRIES out all Novice licence training and Morse testing, and issues special event (GB) callsigns. It provides news broadcasts and Morse practice transmissions under the callsigns GB2RS and GB2CW. Many on-the-air activities are co-ordinated by the RSGB, such as awards, contests and repeaters.

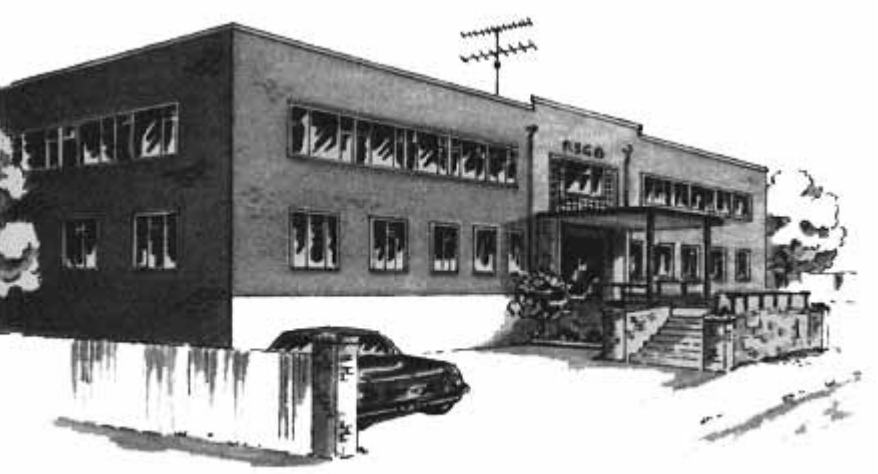
It also provides the British part of the worldwide QSL Bureau system. RSGB members send QSL cards in bulk to RSGB Headquarters for sorting and onward distribution to amateurs all round the world. Incoming QSL cards are posted to UK amateurs in packs of 20 or so, using envelopes which they provide. An active operator can save a considerable amount in post-age by using the Society's QSL Bureau.

INFORMATION AND ADVICE

AS WELL AS being the country's largest publisher of amateur radio books (see page 10), the RSGB also stocks more than 100 books from other sources. In addition, there's *RadCom* - which is, a monthly 100-page colour magazine sent free to all members - *D-i-Y Radio*, and specialist newsletters for the HF and Microwave enthusiast.

Expert volunteers are on hand to advise not only the Society's negotiating teams, but also individual members. Specialist committees cover HF, VHF, Microwaves, Licensing, Propagation, Membership Services, IARU, Direction Finding, Data Communications, EMC (interference), Exhibitions, Contests, Planning Permission, Repeaters, Education and Publications.

Each county has a RSGB Liaison Officer who is available to provide members with advice or tell them how to contact the appropriate expert.



RSGB Headquarters at Potters Bar, just off the M25 north of London, houses the administrative offices, the publishing and sales operations, the QSL Bureau, an extensive bookshop, the National Amateur Radio Museum and Library, and a well-equipped radio station using the callsign GB3RS. Guided tours of the whole building are on offer at the Annual Open Day (4 May this year).

RSGB - WE'RE HERE TO HELP YOU

WHY SHOULD I JOIN THE RSGB?

IN ADDITION to helping to support the only organisation in the UK representing amateur radio nationally and internationally, members enjoy many privileges:

- *RadCom*: A minimum of 100 pages every month, delivered to your door, and packed with construction projects, the very latest news, special interest articles, an extensive Diary of events and the largest selection of commercial and small advertisements.
- Advice when you need it: Help with technical problems, planning permission or interference is available from the country's top specialists - absolutely free to members.
- Save money: Use of the QSL Bureau cuts out the huge cost of individually mailing your cards.
- Save more money: Every member receives a 15 per cent discount on more than 150 books or items of software.
- Insurance: This essential safeguard has been arranged specially for members at advantageous rates.

Active amateurs and listeners need the RSGB

❖

Active amateurs and listeners join the RSGB

WHAT DOES MEMBERSHIP COST?

FULL CORPORATE membership costs just £34 per year (UK or overseas) including a subscription to *RadCom*. Other rates are: Senior Citizens £27 and Full-time Students £20.

If you are under 18, we can offer you membership of the RSGB HamClub at just £10 a year and we'll send you *D-i-Y Radio* instead of *RadCom*.

AMATEUR RADIO

THE HOBBY of amateur radio is as old as Marconi. Yet it remains as exciting as ever with the use of computers and satellites. There are over 60,000 amateurs in the UK and well over two million worldwide, and this number is increasing.

Radio amateurs are *qualified* radio operators. They are enthusiasts who have passed a City and Guilds examination in radio theory and practice which allows them to hold a transmitting licence issued by the Radiocommunications Agency of the DTI. The licence, which allocates a unique callsign, lists the rules under which radio amateurs are allowed to transmit. This includes the permitted frequencies (depending on the class of licence held) - there are more than 25 bands of frequencies allocated to the Amateur Service, covering the short waves, VHF bands and Microwaves.

There are four types of licence: two for the beginner - the Novice Licence, and two for the more qualified operator. A Morse test must be passed to qualify for a Class A licence which allows the use of frequencies where worldwide contacts are available, but lots of fun can still be had with a Class B licence which doesn't need a Morse pass.

Although a wide range of types of transmission can be made, from Morse code (still widely used) to computer data and even television pictures, radio amateurs may not transmit such things as music, commercial or political messages. There's still plenty to talk about, though, including of course radio itself.

Radio amateurs are the only users of the radio spectrum who are permitted to build their own transmitters. This is because they are exam-qualified. Most amateur radio stations have a mix of home-built and commercial equipment.

Amateurs are frequently called upon to assist in times of disaster. Their compact and simple equipment is frequently more suitable in an emergency than today's complex commercial gear. Help has been provided at earthquake sites, train disasters, plane crashes, and so on. In recent years, amateurs provided the only means of communication to and from some of the besieged towns in Bosnia.

Radio amateurs have designed and built over 25 communications satellites. Astronauts and cosmonauts frequently operate amateur radio stations from space and many schools have been able to talk directly to space in this way.

I am interested in joining the RSGB and receiving the full benefits of membership.

Name: .....

Address: .....

I enclose ❑ £36 (Corporate Membership) ❑ £27 (Senior Citizen) ❑ £22 (Student) ❑ £12 (under 18s HamClub)

Credit Card No. ❑❑❑❑ ❑❑❑❑ ❑❑❑❑ ❑❑❑❑ Expiry Date: ❑❑ ❑❑

❑ Please send me details of how to subscribe by Direct Debit.

Simple 80m Transmitter

IN THE EARLY days of radio many items of equipment where built on a wooden baseboard. All the parts were screwed down to the board. These were called **breadboard** radios because often that is what was used.

Recently I had need to knock up a simple amateur bands transmitter for display purposes. I turned to a well known amateur radio circuit called the ONER. It was so called because the original design, by George Burt, GM3OXX, was built on a one inch square circuit board. The circuit appeared in the G QRP Club journal *SPRAT* and since that time many hundreds of ONER kits have been bought and used on the air. This is a well proven circuit.

This simple transmitter circuit has no selective tuned circuits in the power amplifier. This means that the output from the transmitter has rather a high **harmonic** content and must be used with a low-pass filter such as that described on page 17. If a low-pass filter is not used, interference will be caused to other stations.

The transmitter has simple antenna change-over switching that works with the transmitter on/off switch. This allows it to be used with any of the 80 metre receivers described in earlier editions of *D-i-Y Radio*, such as the Colt. It can also be used with any kit or commercial receiver for the 80m band.

THE CIRCUIT

THE CIRCUIT OF the transmitter is shown in **Fig 1**. The circuitry around TR1 forms a crystal oscillator, the frequency of which is controlled by crystal X1. A small trimmer capacitor TC1 is added to allow the frequency of X1 to be varied by a small amount. If this capacitor has a control knob on the front panel it is useful to allow the transmitter to dodge any stations already on the frequency of the crystal. The resistor, R2, in the collector of TR1 can be varied to allow more, or less, power from TR1. A value of 3.3k seems to work well on 80 metres to give the transmitter the legal Novice output of 3 watts.

TR1 is directly coupled to TR3, a VMOS transistor (a type of Field Effect Transistor). This acts as the power amplifier stage. TR3 should give a power output of some 3 watts which is coupled to the output by C3. The Radio Frequency Choke (RFC) which provides the drain load of TR3 is a few turns of wire on a ferrite bead.

TR2 is an interesting addition to the circuit. This transistor is used as a switch, to key the power amplifier TR3. It would be possible to build the transmitter without TR2 and just place a Morse key between the top of RFC and the 12 volt supply. Adding TR2 is helpful because it means that one side of the Morse key can be joined to ground and also some **shaping** of the keying is added with R3 and C1. This makes the Morse transmission sound a little better. TR2 is an PNP type transistor. This type of transistor is connected the other way around from the more common NPN transistor, like TR1. Notice that the emitter of TR2 goes to the positive [+] side of the supply.

Some form of change-over switching is needed for the antenna. A **double pole** (two part) changeover toggle switch can be used. One pole is used to switch the antenna between receiver and transmitter. The other pole is connected in the 12 volt supply line. The switch is labelled RECEIVE/TRANSMIT-NETTING and its use is described under 'Using the Transmitter'.

In this simple circuit, when the key is open the power amplifier cannot work because there is no supply voltage at RFC. On closing the key contacts, TR2 is **switched on** and the supply appears at the top of RFC. C2 is a **decoupling capacitor** which prevents any

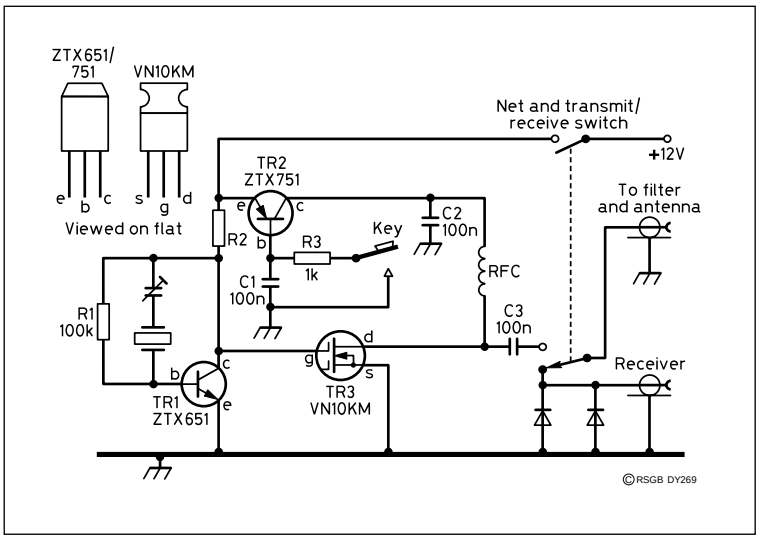
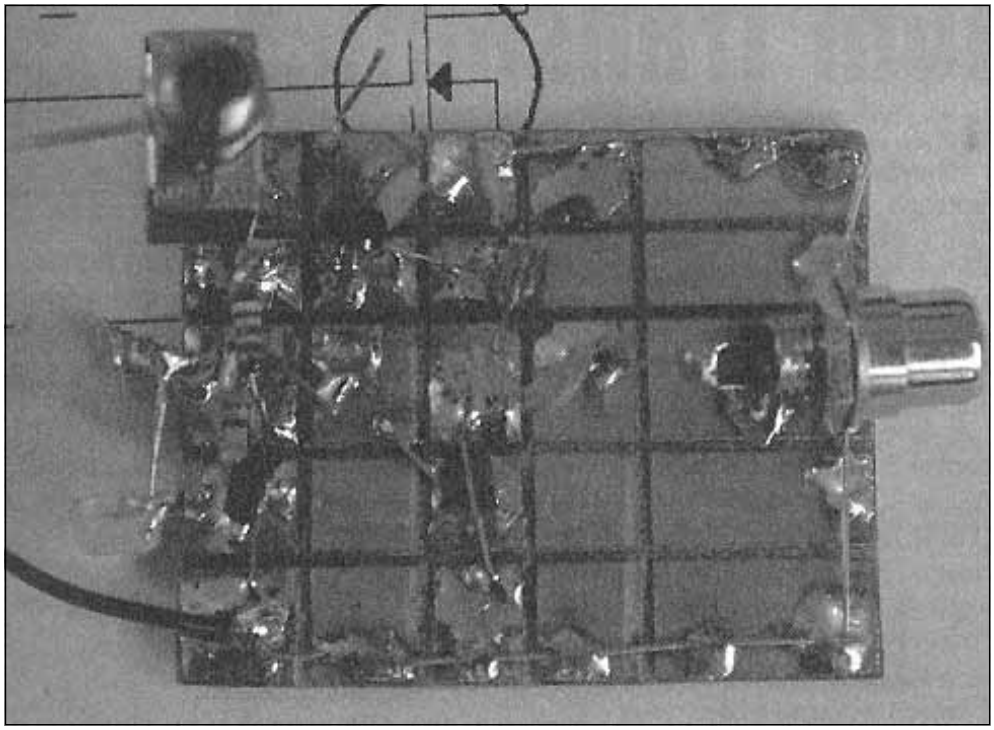


Fig 1: Circuit diagram of the breadboard transmitter.

The Very Best of D-i-Y RADIO

Two articles by the Reverend George Dobbs, G3RJV



The breadboard transmitter, showing its construction on PCB pads.

radio frequency signals getting into the line between RFC and TR2.

BUILDING THE TRANSMITTER

FOR SPEED of construction I decided to build the circuit in the old breadboard style using a piece of printed circuit board. I cut a piece of blank printed circuit board material to measure 5cm by 4cm. Then taking a junior hacksaw and placing the teeth flat on the surface of the copper surface of the board, I cut a pattern of square pads as shown in the photograph. This is best done with a new, sharp, blade drawn gently across the surface in a series of slow movements.

The method of building the transmitter is shown in the photograph. All the parts are soldered directly to the square pads made on the printed circuit board material. This is a form of surface mount construction. It is important to make good clean solder joints. To this end **tin** the square where connections are to be made. Before a solder joint is made to a square pad, firmly place the soldering iron tip on that pad to heat it up. Then touch the end of the solder onto the pad: not the soldering iron tip. The heat will melt the solder and it should flow cleanly over the square pad. This provides a good surface for making the soldered joints.

The easiest way to join the leads of the components to the square pads is to cut them to about 1cm long and bend about 2mm of the end at right angles. Tin this bent portion, place the lead firmly on the pad and melt the solder with the iron tip. When the joint has cooled, tug the lead to check that the connection is firm. Each transistor has to straddle three pads, so the centre lead needs to be a little shorter than the outer two leads. Do take care to mount the transistors the right way round on the board (see Fig 1).

When the wiring of the board is complete closely inspect all the connections and check them against the circuit diagram. Also check that no solder has run between the pads. Plug in a crystal for the 80 metre band. The oscillator can be tested by switching on the 12 volt supply and listening on a receiver for the signal. Do not test the full transmitter without a 50 ohm load connected to the output.

Winding RFC is a simple task. It uses a small ferrite bead as a former. Seven turns of thin enamelled wire are threaded through the bead and wound round the outer edge. This does require some care. The bead is small and the wire is thin. It is important not to scratch the enamel coating off the wire because this could lead to shorted turns. When the turns are completed trim the ends of the wire back to about 1cm from either end of the bead. Scrape these ends clean of enamel and tin them. That is, heat them with the soldering iron and coat them with a clean layer of solder. If you can manage to get a couple

COMPONENTS

Resistors	
R1	100k
R2	see text
R3	1k
Capacitors	
C1	100nF
C2	100nF
C3	100nF
CT1	3 - 60pF Trimmer
Semiconductors	
TR1	ZTX651
TR2	ZTX751
TR2	VN10KM
Additional Items	
RFC	see text
SWITCH	double pole miniature toggle
Crystal Holder	HC25 type
Crystal	HC25 3.579MHz

Components available from JAB Electronic Components, see page 30.

A 7-Element Low Pass Filter

The Very Best of D-i-Y RADIO

By the Reverend George Dobbs, G3RJV

A SIMPLE LITTLE transmitters often use circuit short-cuts which result in not only the required frequency being generated and amplified but also harmonics: the signal times two, the signal times three, the signal times four . . . . and so on. These harmonics can be quite strong and it may be possible for a station which is transmitting on 3.5MHz to be heard on the 7MHz amateur band; both at the same time!

The answer is harmonic filtering: adding a circuit that will reduce the harmonics without a lot of reduction of the required signal. Even when using a low power transmitter, a **low pass harmonic filter** should be used.

A low pass filter is a circuit which allows frequencies below a chosen frequency to pass through but greatly reduces (**attenuates**) signals above that frequency. This is called the **cut-off frequency** and is usually designed to be just above the required frequency of the transmitter.

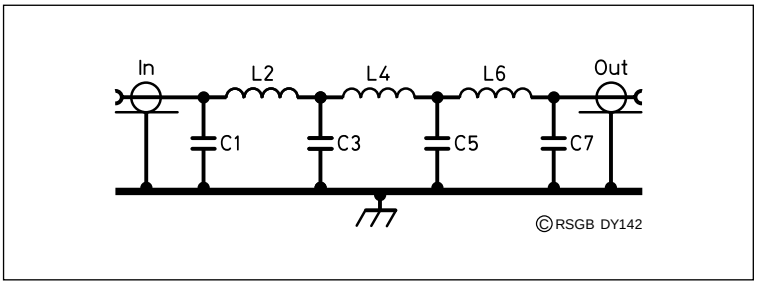


Fig 1: Circuit diagram of filter.

DESIGN OF THE LOW PASS FILTER

THE CIRCUIT FOR a seven-element low pass filter is shown in **Fig 1**, so called because it contains seven parts (or circuit **elements**). Three-element and five-element low pass filters are also common. The three-element would only contain the part of the circuit shown in C1, L2 and C3. This is often called a **pi network** because the three parts of the circuit look like the Greek mathematical symbol pi (π). Fig 1 is like three pi elements in a row. It is worth the extra complication of a seven element filter to obtain a cleaner signal.

The Low Pass Filter circuit in Fig 1 is designed to have an

of extra turns through the bead, do so, a little extra inductance can be helpful. Who says radio is an exact science!

USING THE TRANSMITTER

CONNECT THE antenna to the transmitter's ANTENNA socket via the filter (see opposite). Connect the receiver to the transmitter RECEIVER socket.

Set the RECEIVE/TRANSMIT-NETTING switch to Receive. You should hear some signals on the receiver.

Set the RECEIVE/TRANSMIT-NETTING switch to Transmit-Netting but do not press the key. The signals on the receiver should have almost disappeared because the antenna will have been disconnected by the antenna changeover contacts on the switch.

Tune the receiver until a loud signal from your own transmitter is heard on the receiver. This is known as NETTING, which is a term used to describe tuning your transmitter and receiver to the same frequency.

Your station is now set up to enable you to call any station on, or close to, your crystal frequency. To transmit just press the key with the RECEIVE/TRANSMIT-NETTING switch in the Transmit-Netting position and switch to Receive for signals coming back to you.

A KIT IS AVAILABLE

KANGA PRODUCTS sell a kit of parts for this transmitter in its original ONER form. That is, all the parts and a one inch square printed circuit board. It might sound difficult to build on such a small board but the layout is such that anyone capable of making good solder joints should have no problems.

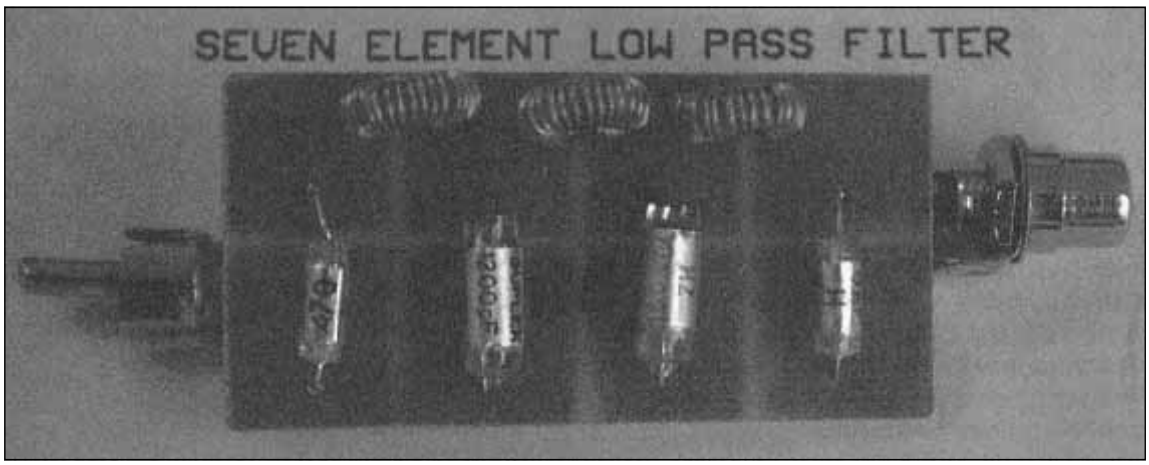
Kanga can also supply a suitable crystal in the 80 metre Novice Band.

Kanga Products, Seaview House, Crete Road East, Folkestone, CT18 7EG. Telephone: 01303 891106.

IMPORTANT NOTICE

You must have an Amateur Radio Licence before you may operate a transmitter. The maximum penalty for transmitting without a licence is an unlimited fine and two years in prison.

Fortunately, it's easy to qualify for a licence. See 'Become a Licensed Radio Amateur' in *D-i-Y Radio* Vol 2: No 4, or write to: Novice Licence, RSGB, Lambda House, Cranborne Road, Potters Bar, Herts EN6 3JE.



Filter components soldered to PCB board pads.

input and output impedance of 50Ω which means it can match any common transmitter. It simply connects to the transmitter's antenna socket. Working out the correct values for a low pass filter can be quite complex. Not only has the filter got to have the correct cut-off frequency but it also has to have the correct input and output impedance and at the same time reduce the required signal as little as possible. To make life even more difficult, cheap capacitors come in a limited range of **preferred** values.

Some years ago Ed Wetherhold, W3NQN, who is the Filter Consultant for the American Amateur Radio Relay League (ARRL), designed a very useful set of seven element low pass filters. His computer calculations used preferred capacitor values to give good filter characteristics and cut-off frequencies for the amateur bands.

They have become a standard for many builders of amateur radio equipment. The values of the inductors and capacitors required for filters for the main amateur radio bands are given in **Table 1**. The inductors (coils) are wound on standard toroidal cores. The table shows the capacitor values with the number of turns of wire and the core for each inductor.

MAKING A LOW PASS FILTER

THE WAY I made a low pass filter is shown in **Fig 2** and in the photograph. As with the Breadboard Transmitter, I used a scrap piece of printed circuit board with square pads cut using a hack saw. The photograph shows that I drilled holes through the board and mounted the components in the same way as a normal printed circuit board. There is no need to do this, the components could be soldered directly on the pads, breadboard fashion. I also mounted a plug and socket on each end of the filter so it can be plugged directly into the output of the Breadboard Transmitter.

Making the low pass filter is very simple. Just remember that each time the wire passes through the core counts as one turn. Also remember to scrape the enamel off the ends of the coil and tin the bared wire. Short wire links are added between the pads on the 'ground' end of the circuit board.

COMPONENTS

THE TYPE OF CAPACITORS used in the filter are not very critical but they do have to handle some power. I have found that polystyrene capacitors work well in these filters. The component values for the different bands are shown in **Table 1**.

A component pack is available from JAB Electronic Components, 1180 Aldridge Road, Great Barr, Birmingham B44 8PB, price £3.50 inc. postage.

Band Metres	C1,7 pF	C3,5 pF	L2,6 turns	L4 turns	Core type	Wire SWG
80	470	1200	25	27	T37-2	28
40	270	680	19	21	T37-2	26
30	270	560	19	20	T37-6	26
20	180	390	16	17	T37-6	24
15	82	220	12	14	T37-6	24
10	56	150	10	11	T37-6	22

Table 1: Filter component values for each band

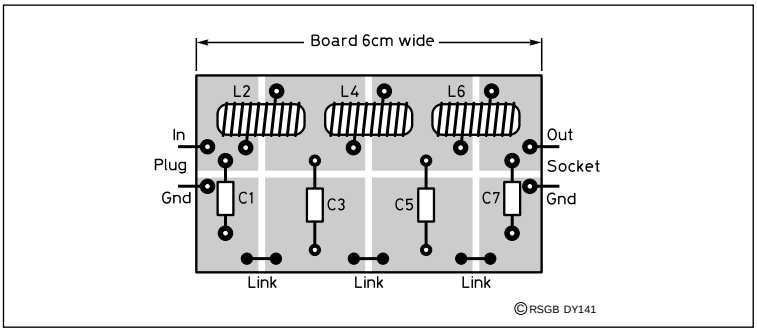


Fig 2: Layout and construction of filter.

Decode Morse / RTTY on Your PC

WHILST TUNING on the HF (short-wave) amateur bands you are likely to have come across Morse code, and perhaps wished you could have a machine which would read it for you. Or perhaps you've heard strange buzzing or warbling noises and wondered what they are. Now CommSLab have produced the RSD 116 Interface which will solve these problems for you at a very reasonable price. All you need is a PC with a 3.5in disk drive, and a receiver. In many cases the most basic computer is suitable - and you can pick up an XT for a few tens of pounds these days.

The Interface is a tiny unit built into a 25-way 'D' plug which can be connected directly to the RS-232 (serial) socket on the back of your computer, or via a cable (beware not all 25-way cables are suitable, for instance, a 'null modem' cable which has the transmit/receive pins reversed). It requires no power supply or battery, taking its power from the computer itself.

Wires from the back of the Interface connect to your radio. There are three screened leads: receiver audio (a low level is required so this can come from an auxiliary socket if fitted on your radio), transmitter audio and a transmit/receive switch. Plugs need to be fitted to suit your radio.

EQUIPMENT REQUIRED

HamComm

Computer: Any IBM-compatible: PC, XT, 286, 386 etc with a 3.5in drive. Hard disk is useful but not essential. 370kB or spare RAM is required. A mouse is not needed.

Screen: Mono or colour, MDA, CGA, EGA, VGA or Hercules.

Operating System: DOS, not Windows.

Radio: Communications receiver or transceiver capable of SSB reception.

SOFTWARE

SUPPLIED WITH the RSD 116 is the necessary software, on a 3.5in diskette. Some is 'shareware' which means that you can try out the programs for a while but that you are expected to make a small payment ($30) to the author if you want to use them long-term. Three programs are provided: HamComm for Morse and RTTY (teleprinter) signals; JVFAX for FAX signals; and PKTMON for packet data. PKTMON is receive-only, the others will work on transmit as well. This review deals mainly with HamComm.

It makes a refreshing change for software to be easy to install, and you will be pleased to hear that HamComm and PKTMON couldn't be easier. JVFAX was not tested.

HamComm, written by a German amateur, DL5YEC, has a number of screens. The main one (**Figs 1 and 2**) shows received messages on the lower part and transmitted messages on the upper part. It contains a number of drop-down menus covering modes of transmission, speeds and so on.

Other screens display the incoming signal graphically, and these are extremely useful when setting up the equipment.

MORSE

BECAUSE MOST Morse code is sent by hand it is far from perfect and this makes it very difficult for a machine to read it. The human brain, on the other hand, is extremely complex and is quite capable of sorting out badly sent Morse in the presence of strong interference.

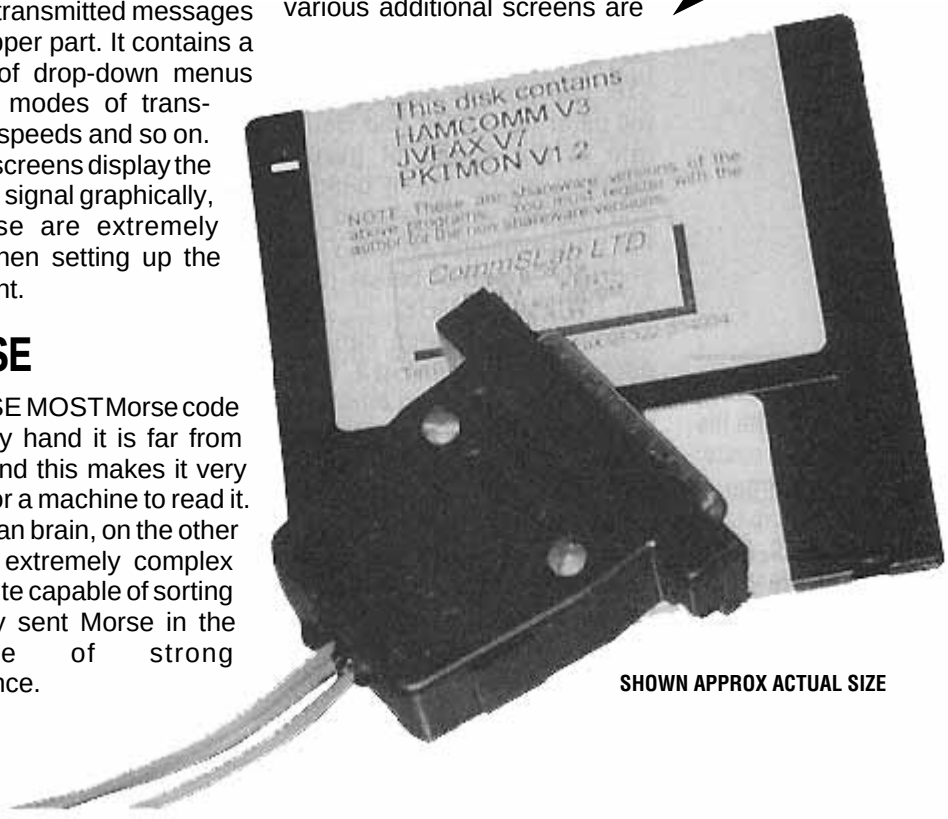
For this reason, don't expect this set-up to be a substitute for learning Morse code. It does, however, decode well-sent Morse, especially if it is sent at high speed and it is a strong signal. The spectrum display screen is useful for tuning in the signal initially. HamComm and the RSD 116 transmit Morse well.

RTTY

RTTY STANDS FOR Radio TeleTYpe, or the sort of transmission that was once sent and received on huge typewriters known as teleprinters. Nowadays, although RTTY is still a very reliable method of having a radio contact by typing, the teleprinter has given way to the computer. RTTY signals have a characteristic "diddle-diddle-diddle" warbling sound.

In contrast to hand-sent Morse, all RTTY is sent by machine and is very easily decoded automatically. HamComm performs very well on RTTY (see Fig 2). Again the various additional screens are

HINT: HamComm can be used for Morse practice



The RSD 116 Interface from CommSLab.

SHOWN APPROX ACTUAL SIZE

helpful in getting your radio on exactly the right frequency.

HamComm will also read AmTOR which is Amateur Teleprinter Over Radio - a way of using RTTY resulting in almost error-free reception. This has a rhythmic chirping noise.

PACKET RADIO

A MUCH MORE modern way of communicating with computers is packet radio (sometimes known as AX25). Put simply, packet radio sends computer data (messages, programs etc) in short bursts, and waits for the receiving station's equipment to reply "received OK", or "please send again". This results in totally error-free communication, but it can take some time for the whole message to be transferred successfully. Packet radio is especially suitable for bulletin board use.

Supplied with the RSD 116 is PKTMON which is a very basic method of taking a look at packet radio signals. It is receive-only, and is no substitute for a proper Terminal Node Controller (TNC) or even CommSLab's own PKTCOMM modem interface which we expect to review in our next edition. The program is 'freeware' ie no extra charge is needed to continue using it.

Despite its limitations, PKTMON, used with the RSD 116, can provide some fun. It will cater for 300Bd (the Baud rate is the speed of transmission) used on the HF bands, and 1200Bd which is used for FM transmissions on the VHF and UHF amateur bands (50, 70, 144 and 432MHz).

Some idea of what can be decoded is shown in **Fig 3**. This was read on the 20m amateur band using a 286 AT computer. Although callsigns were easily decoded, we could not read the text of the messages. CommSLab tell us that they had no trouble decoding 1200Bd packets on the VHF bands, though a fast computer (eg 486) was essential. The program includes a clever routine to sort out which transmissions are for which person and it can store them in separate files.

The RSD 116, together with the software, costs £19.95 from: CommSLab Ltd, PO Box 19, Erith, Kent DA8 1LH, telephone 01322 330830.

Fig 1: Detail of the HamComm Morse receiving screen. Some callsigns are visible, especially the CQ call from a French station at the bottom. Note the printed dashes and dots which appear when the program can't decipher the Morse character.

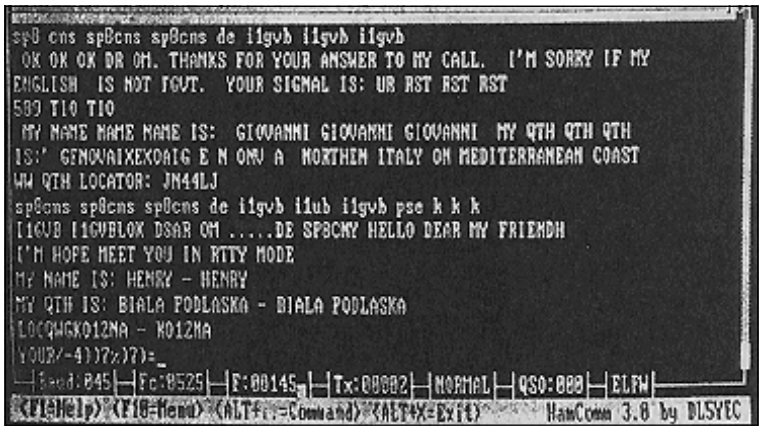


Fig 2: The HamComm receive screen on RTTY, by far the most successful mode. The errors are caused by signal fading and interference.

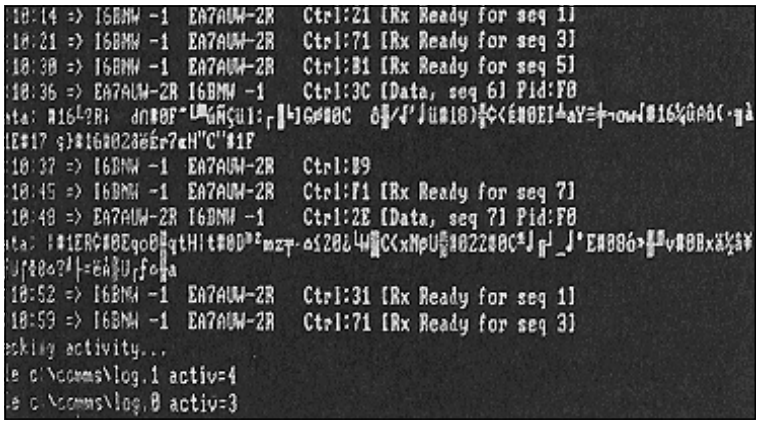


Fig 3: Detail of the PKTMON screen showing accurately received packets but unreadable 'data' lines. The lines starting with c:\comms\log report on which files are collecting the data.

CONCLUSION

FOR GETTING your feet wet on amateur radio data communications, the RSD 116, together with CommSLab's software disk, will provide you with a lot of fun. The HamComm software is excellent and well worth the extra cost of registering it. You can establish a useful RTTY station using a very cheap computer, and it will also allow you to dabble in other modes. At just under £20 the RSD 116 represents very good value for money.

Shortwave Broadcast Listening

MANY RADIO amateurs use HF transceivers with built-in general coverage (0.5 - 30MHz) receivers, yet they never tune away from the amateur bands. It is true that there are legal implications in listening to some types of transmission, but everyone is allowed to listen to shortwave broadcast stations, and for many people shortwave broadcast listening is a hobby as exciting as amateur radio itself.

RECEIVERS

OF COURSE, IT isn't necessary to have an expensive transceiver to listen to shortwave broadcast stations. Even the simplest radio which covers part of the shortwave spectrum will often give quite satisfactory results when used for broadcast listening. This is because broadcast stations almost all use AM (Amplitude Modulation), which is easier to tune in than the SSB (Single Side-Band) used by most amateurs. It is also because the power output used by broadcast stations is very many times that of amateurs, so signals are much stronger. Old radios covering shortwave can sometimes be picked up at car boot sales or amateur radio 'junk sales' for about £1. Alternatively, you may want to start with a simple home-made receiver such as the 'Nicky', described on page 27 of this magazine, or a kit such as the MFJ-8100W, which was described in the September - October 1993 issue of *D-i-Y Radio*.

Very many people use small portable transistor radios for shortwave broadcast listening, such as the Grundig Yacht Boy series, or Sony's ICF-7600 series (the current model is the ICF-SW7600G, while the ICF-7600DS was very popular a few years ago). This type of radio costs around £120 - £160. Many businessmen and holiday-makers (with otherwise no interest in radio) use this type of receiver to keep in touch with the UK by listening to BBC World Service when they are abroad.

For those who become really keen, a communications receiver is the answer: these start at just over £400 for the popular Lowe HF-150, up to several thousand pounds for professional receivers similar to those used by BBC Monitoring or GCHQ!

ANTENNAS

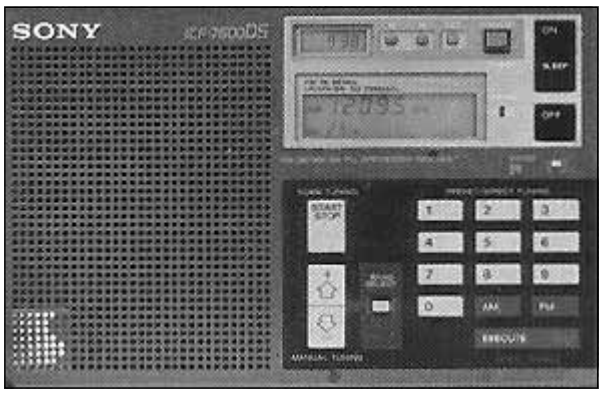
ALMOST ANY TYPE of antenna can be used for shortwave broadcast listening. Because broadcast stations have much stronger signals than all but the most local amateurs, even quite inefficient antennas can be used with success. Many shortwave portable receivers are also designed to be highly sensitive, as they are intended to be used with their built-in telescopic antennas, rarely more than about 1m long.

In most circumstances, though, adding a length of wire, perhaps 4 to 10m long, will improve reception considerably. The wire - which can be insulated or bare, thick or thin - can be plugged straight into the antenna socket of the radio (if it has one), or simply wound around the built-in telescopic antenna and then taped to stop it moving up and down, which causes 'crackles'.

A word of caution: attempting to improve reception by using a 'better' or longer antenna, can sometimes have the opposite effect. This is because, as noted above, some shortwave receivers are designed to be very sensitive, but using an antenna with too much signal 'pick-up' can cause the receiver to 'overload'. If this happens - and you will recognise it because you will start hearing all sorts of signals which should not be there, all at the same time - *decrease* the length of the antenna.

BROADCAST BANDS

LIKE AMATEURS, broadcast stations cluster together in bands of frequencies. **Table 1**



The Sony ICF-7600DS receiver provides digital frequency readout and is used by many for shortwave broadcast listening.

Tune-in to international radio broadcasts

Metre band	Frequency limits, kHz	Reception possible . . .
75	3900 - 4050	Mainly Europe, Darkness only
49	5850 - 6250	24 hours, mainly Europe
41	7100 - 7600	24 hours, mainly Europe
31	9350 - 9995	24 hours, Europe and worldwide
25	11500 - 12100	Mainly daytime, Europe and worldwide
22	13600 - 13900	Mainly daytime, worldwide
19	15005 - 15700	Mainly daytime, worldwide
16	17500 - 17950	Daytime only, worldwide
13	21450 - 21850	Daytime only, worldwide
11	25670 - 26100	Little used at present

Table 1. The international shortwave broadcast bands.

***Passport to World Band Radio** is available from RSGB Books. Call 01707 660888 for latest price.*

Collecting QSL cards from broadcast stations can be an enjoyable aspect of the hobby - and provides colourful wall coverings!

lists the shortwave international broadcast bands. Many broadcast stations use a number of frequencies simultaneously, to reach different parts of the world at the same time.

In addition to the official broadcast bands, some stations 'spill over' the edges of the bands into the adjoining Fixed and Mobile bands, or even occasionally into the amateur bands. Table 1 shows the actual limits of where most broadcast stations can be found, rather than the narrower internationally-agreed official limits.

SCHEDULES

BROADCAST STATIONS tend to stick to a published schedule: they broadcast at the same time and on the same frequency for months at a time. Programme schedule times *do* change - often twice a year at the same time as their target audience changes local clock times - whilst frequencies are changed to take into account the differing propagation conditions at different times of year, or the progress through the 11-year sunspot cycle. Many listeners enjoy 'trawling' the bands; keeping a log book with the date, time, frequency, station name and a few notes about the programme will enable you to find favourite stations again. Publications such as the *Passport to World Band Radio** and *World Radio TV Handbook* (obtainable from high street bookshops and some radio dealers) also give transmission schedules of a huge number of stations.

Many stations only have a half-hour daily programme in English, which is repeated several times a day, in order to reach the target audience at an appropriate time (usually mid-evening local time). Others, such as the Voice of America or Voice of Russia have many hours per day of English programmes.

PROGRAMMES

SHORTWAVE BROADCAST listening gives you the opportunity to hear news *direct* from the country concerned. There was a boom in the sales of portable shortwave receivers about five years ago, at the time of the Gulf War, when people wanted to hear news direct from the source of action.

The other type of programming common on shortwave which you will rarely, if ever, hear on British domestic radio is ethnic music. This could be French, German or Turkish pop music, Greek bazouki music, exotic Arabic, Iranian and Indian music, or the rhythms of Africa and Latin America.

Most shortwave stations have 'mailbag' or 'listener feedback' programmes in which listeners are invited to write in with questions about the country concerned. A few also have 'media' or 'technology' programmes, with news about developments in shortwave broadcasting, satellites, cellular phone technology and so on.

DXING

MANY BROADCAST listeners enjoy attempting to log the lowest-powered local broadcasters, whose signals are not intended for an international audience. This side of the hobby is called DXing, after an old telegraphy abbreviation 'DX', which means reception of distant signals. Reception of these stations is often difficult, as they often use frequencies which are shared with other services and so can be buried under layers of interference. Here, a good receiver becomes far more of a necessity than it is when listening to powerful international broadcasters.

Many international and domestic shortwave broadcasters ask for reception reports and send out QSL cards in reply. Collecting QSLs from different countries and stations can be just as challenging on the broadcast bands as it is with amateurs. These days, the ionosphere is sufficiently well understood for reception reports to be of little practical use to most stations, but many still welcome them as a means of gaining audience statistics.

FURTHER INFORMATION

THERE ARE A number of broadcast listening clubs which provide members with a forum for the exchange of news and listening tips and which publish monthly news magazines. The International Short Wave League (ISWL) covers both amateur radio and broadcast listening: their stand is a familiar sight at amateur radio rallies throughout the country. One of the best clubs devoted entirely to international broadcast listening and DXing is the British DX Club. *Short Wave Magazine,* obtainable from high street newsagents or on subscription, also contains regular columns and features on broadcast listening.

USEFUL ADDRESSES

Lowe Electronics, Chesterfield Rd, Matlock, Derbyshire DE4 5LE, tel: 01629 580800 (manufacturer of Lowe HF-150 and other communications receivers and radio retailer.)

Waters & Stanton Electronics, 22 Main Rd, Hockley, Essex SS5 4QS, tel: 01702 206835 (importers of MFJ equipment and radio retailer.)

International Short Wave League (ISWL), Mrs M H Carrington, G0WDM, 3 Bromyard Dr, Chellaston, Derby DE73 1PF.

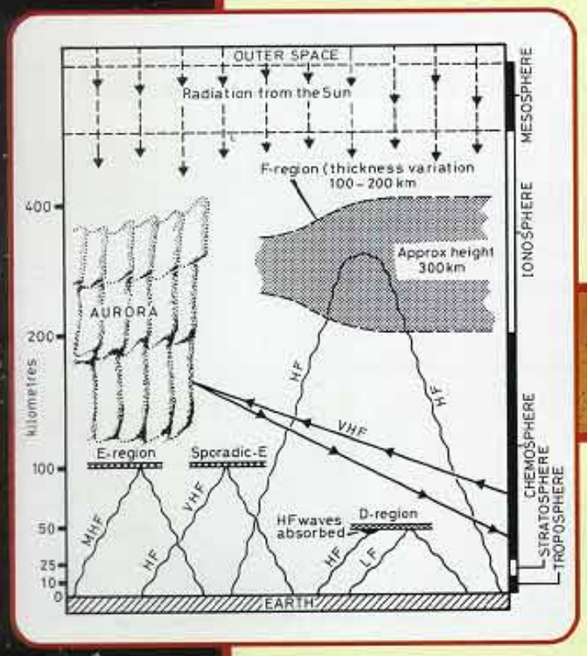
British DX Club, c/o Colin Wright, 126 Bargery Rd, Catford, London SE6 2LR (enclose a 29p SASE or 2 IRCs from overseas for a sample copy of their magazine *Communication.*)

***Short Wave Magazine*,** Arrowsmith Court, Station Approach, Broadstone, Dorset BH18 8PW, tel: 01202 659910.

Amateur Radio & the Sun

Propagation of HF Radio Signals

High Frequency (or short wave) radio signals can travel much further than line-of-sight by reflecting (actually refracting) from layers of gas hundreds of kilometres above the Earth's surface. The signals bounce off these layers, or *regions*, because the gases are *ionised* by the sun's rays. Because of this their effectiveness depends on the time of day and the time of year; day-time and the summer being better for the higher frequencies (say, above 10MHz) and night-time and winter being better for the lower frequencies.



Propagation of VHF Radio Signals

VHF signals above (30MHz) are less affected by solar activity although at 50MHz very long distant propagation can occur at sunspot maxima. Periodically, solar flares on the sun release streams of high energy particles. These particles create auroras (curtains of ionised gas) in polar regions of the earth. An aurora can propagate VHF signals over long distances for periods of a few hours at a time.

Sunspots

Sunspots are areas of the sun which are less hot (about 3000°C) than the rest of the sun's surface (about 6000°C) and therefore appear dark. They produce intense radiation which make the *ionosphere* reflect radio signals. The spots last from a few days to a month or two and the quantity of sunspots is directly related to the effectiveness of the ionosphere in reflecting short-wave signals as can be seen from this graph (top line - sunspot count; bottom line - effectiveness of ionosphere).

How to view Sunspots safely

IMPORTANT WARNING: Never look at the sun directly through a telescope or binoculars, even with a dark filter added. This causes permanent severe damage to your eyes!

The safe way to look at the sun is by projection as in the photograph. The binoculars are mounted on a tripod and the sun's rays are directed through a hole in a piece of thick cardboard. The image is then projected onto a piece of white card. Sunspots should be clearly visible using this method.

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

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AMATEUR RADIO AND THE HF SPECTRUM

HF BROADCASTING

THREE PARTS OF the HF spectrum are used for broadcasting: Long Wave (150 - 300kHz) and Medium Wave (540 - 1600kHz) for coverage of a single country or local area, and Short Wave (bands within 4.5MHz - 26MHz) for much greater coverage, including world-wide.

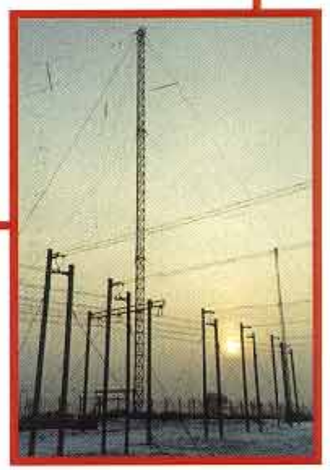
Almost all of the stations use amplitude modulation (AM), though single sideband (SSB) is gradually being introduced.

Some countries are so large and have such a wide-spread population that short-wave broadcasts are needed to reach everybody. In other cases the programmes are intended to reach people in countries far from the transmitter.

HF AMATEUR RADIO

NINE AMATEUR BANDS are available in the HF spectrum, at approximately 1.8, 3.5, 7, 10, 14, 18, 21, 24 and 28MHz. Most transmissions use single sideband (SSB) or Morse code (CW), but there's also plenty of data (computer to computer), teleprinter (RTTY) and Fax/SSTV (picture) signals.

Because propagation conditions change between day and night, winter and summer, and with the sunspot cycle, not all bands are useful all of the time. However, with nine bands to choose from there are always opportunities for amateurs to make worldwide contacts. All radio amateurs must pass a Morse test before they are permitted to use the HF bands: For the full licence 12 WPM and for the Novice licence 5 WPM.



KEY TO FREQUENCY CHART

- AMATEUR RADIO
- AM BROADCAST RADIO
- HF CITIZENS' BAND
- PRIVATE FIXED & MOBILE RADIO
- STANDARD FREQUENCY & TIME STATIONS

HF CITIZENS' BAND

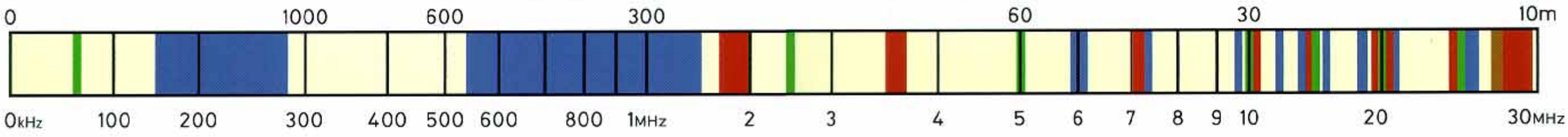
UK CB radio uses 40 channels (27.60125 & 27.99125MHz). All radios are frequency modulated (NBFM). Anyone can operate on CB channels without any qualifications but a licence must be obtained from the Post Office.

CB CITIZENS' BAND

FIXED & MOBILE RADIO

THIS INCLUDES military, police, emergency services, telephone etc.

Note that 'radio eavesdropping', or listening to messages that are not intended for *YOU* is an offence.



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

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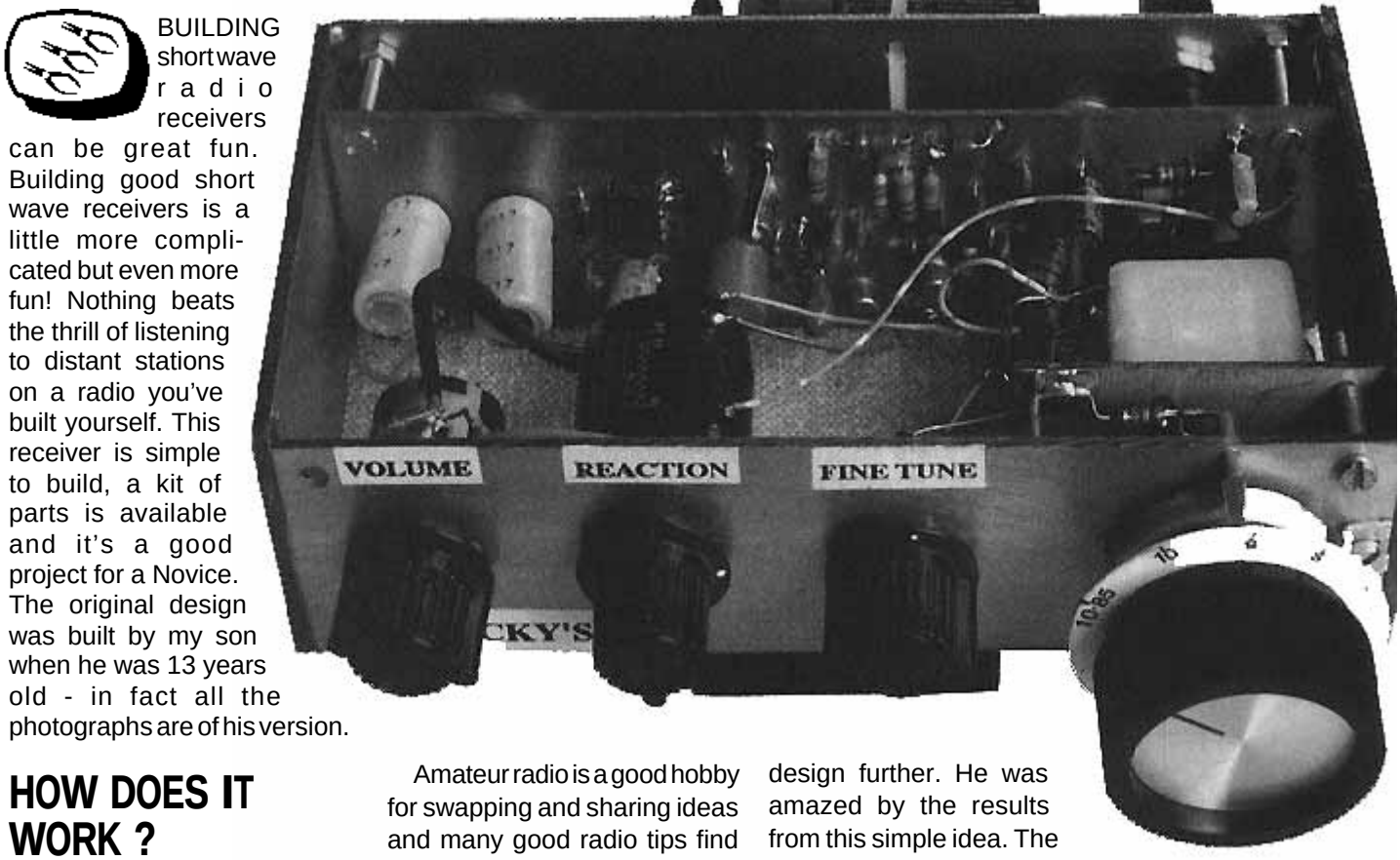
The Nicky Receiver



BUILDING shortwave radio receivers can be great fun. Building good short wave receivers is a little more complicated but even more fun! Nothing beats the thrill of listening to distant stations on a radio you've built yourself. This receiver is simple to build, a kit of parts is available and it's a good project for a Novice. The original design was built by my son when he was 13 years old - in fact all the photographs are of his version.

A Simple Short Wave Radio by Rev. George Dobbs, G3RJV

HOW DOES IT WORK ?

FIG 1 SHOWS A block diagram of the receiver which has a **Regenerative Detector**. The Nicky uses this principle and you may also hear this type of radio called a **TRF (or Tuned Radio Frequency)**. The idea was developed long ago by a man called Armstrong, who also invented both the superhet receiver and Frequency Modulation (better known as FM) which is now used for most high grade radio broadcasting.

Amateur radio is a good hobby for swapping and sharing ideas and many good radio tips find their way into the RSGB's magazine *RadCom* in the column called *Technical Topics* written by Pat Hawker, G3VA. In October 1987, a simple receiver circuit appeared from Des Vance, GI3XZM. As a result several other people were inspired to try similar simple receivers, including amateurs G3RJT and G3VMU.

Colin Davis, G3VMU, wanted a simple short wave radio for his son Nicky and developed the design further. He was amazed by the results from this simple idea. The Nicky TRF Receiver circuit first appeared in *SPRAT*, the Journal of the G QRP Club. I designed a printed circuit board for it, Doug Gibson, G4RGN, improved the circuit still further. Amateur radio is like that - from an idea, we now have a good radio available in kit form for a beginner.

The circuit diagram for Nicky's TRF Radio is shown in **Fig 2**. It may look a little complicated but complex radio circuits are really only a number of simple circuits 'stuck together'. Let me guide you through it step by step.

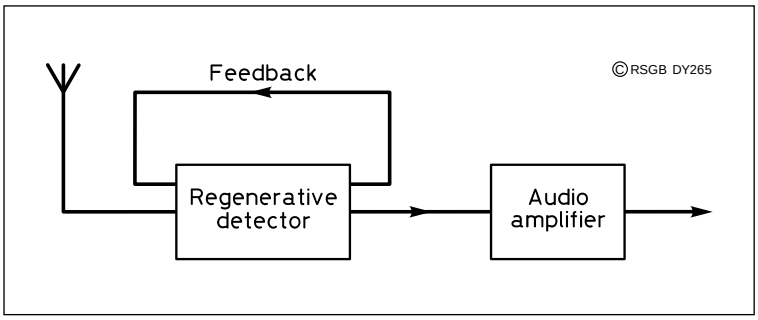


Fig 1: Just two simple stages make up the Nicky.

STAGE BY STAGE

TR1 IS AN FET (Field Effect Transistor) which acts as an untuned stage to match the antenna and detector stages. A regenerative detector will sometimes produce unwanted

signals and this stage stops them reaching the antenna. The small winding on T1 matches a low impedance antenna, the common type used in amateur radio work, and the capacitor input matches a high impedance antenna, such as a short length of wire.

Oddly enough, the next stage is detector TR3 which uses another FET. Ignore TR2, and the parts around it, for the moment.

The Nicky input tuned circuit is formed by T2, VC1 and VC2, the small winding taking the signal from TR1.

VC1 and VC2 are variable capacitors which provide the tuning control. Why two of them? Well, this is known as 'band spreading'. The larger value capacitor gives coarse tuning, and the smaller one fine tuning to pick out stations with greater ease. The tuned signals are then detected (converted to audio frequencies) by TR3.

TR2 is the **Q Multiplier** Stage. It is a Colpitts type oscillator which uses two 330pF capacitors, to give the circuit feedback.

A low value capacitor (C7) is used to couple TR2 to the tuned circuit and the input of TR3. The tuned circuit controls the frequency of the oscillation of TR2 and selects the signal passed on to TR3.

The value of this capacitor could be reduced to make the Q (selectivity) of the tuned circuit even better. The value here seems to work for any BC182 transistor used for TR2.

The secret of the Nicky receiver's ease of operation is in the special potentiometer RV1 (shown above the tuned circuit in Fig 2). Ten-turn potentiometers work like the usual volume-control type except that the track is in a spiral and the control turns ten times to cover the whole range. They're excellent for making fine adjustments. The setting of regeneration needed is dependent on the type of signal you wish to receive as in part 2.

TR4 provides audio amplification, and after the volume control, an LM386 audio amplifier chip will drive a small

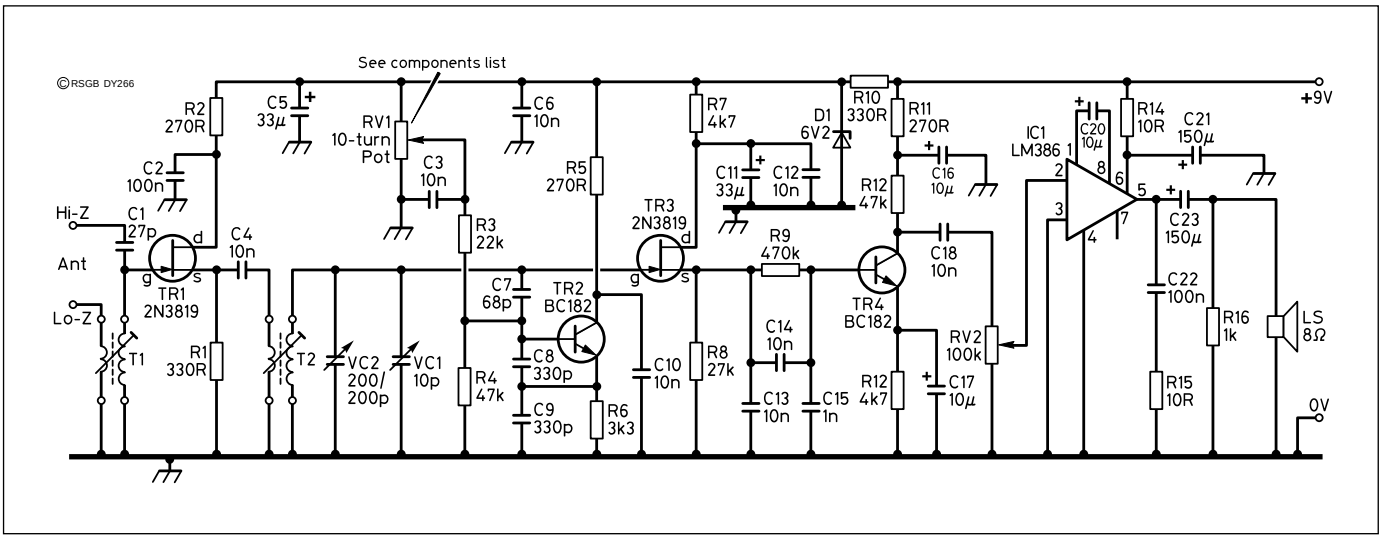


Fig 2: The circuit diagram showing the 10-turn potentiometer RV1. This is the regeneration control for the Nicky.

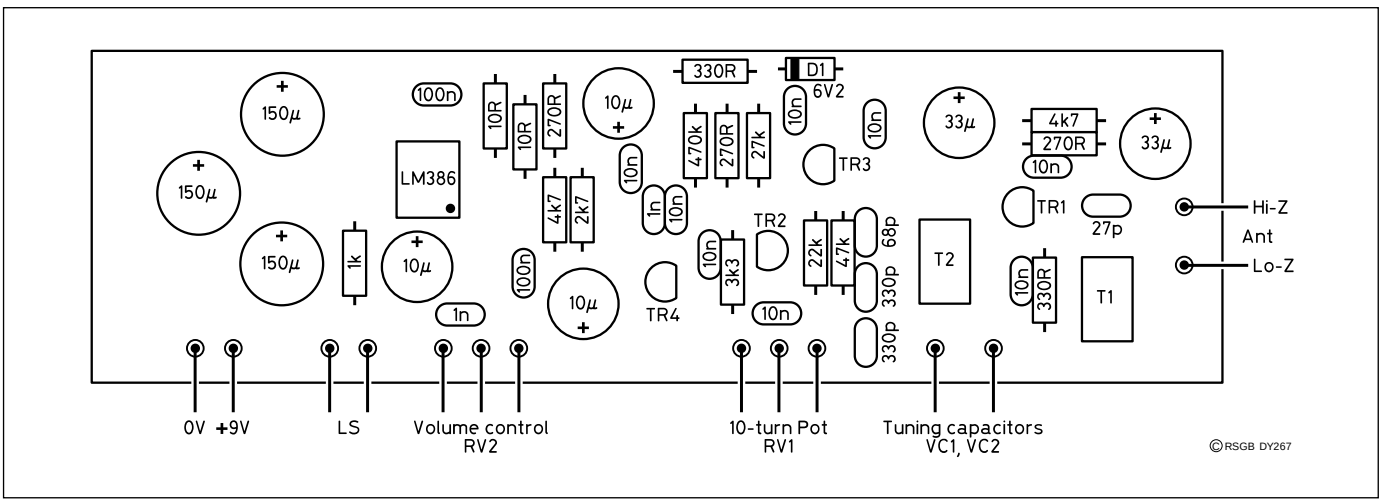


Fig 3: Layout of the Nicky receiver circuit board.

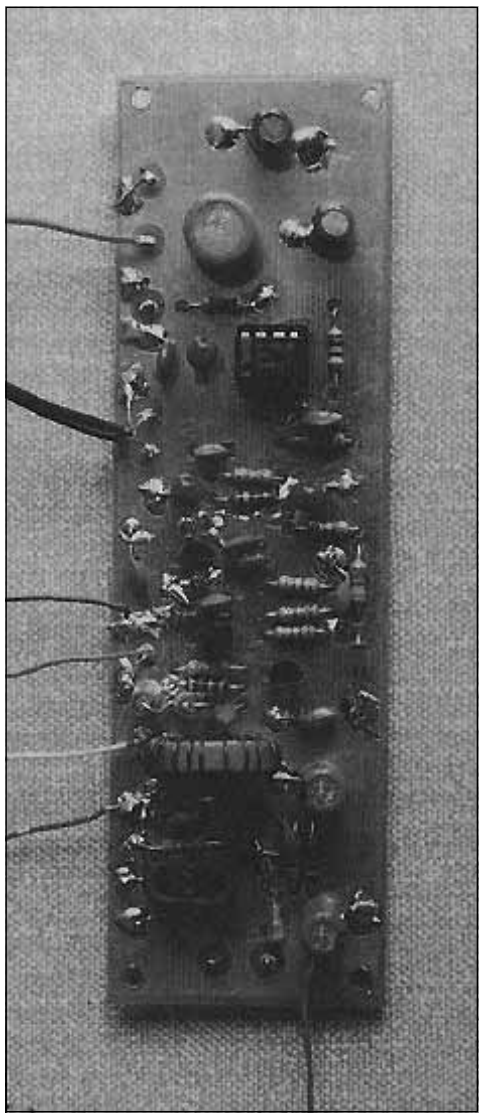
loudspeaker or headphones. Walkman type headphones work well with the Nicky.

The receiver is laid out on a printed circuit board (PCB) which can be obtained with the JAB component pack - see components list for details.

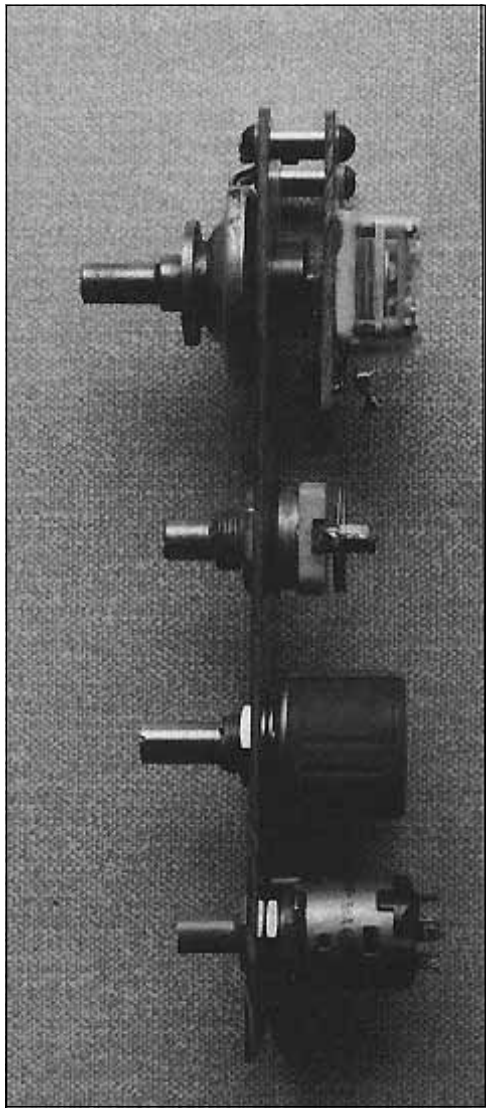
The layout of the board is shown in **Fig 3**. The parts are merely slotted into the board and soldered on the rear. Good soldering is essential as in all electronic projects. Take care to position all the components correctly - remember that some will not work if they are the wrong way round. T1 and T2 must be mounted the correct way round as must the transistors and LM386 chip.

Electrolytic capacitors are polarised, and marked with a + sign at one end and must also be mounted the right way round. The controls are connected to the terminals as shown. Follow Fig 3 carefully.

I decided not to buy a case for the Nicky but to make a front and back panel from un-etched PCB to form the structure. This can be seen in the photograph, but you can build the receiver in a metal case if you like. **Fig 4** gives the dimensions for cutting and drilling pieces of blank PCB for my method. These can often be bought cheaply at radio rallies or obtained from electronic parts mail order companies.



The Nicky is simple to assemble on a printed circuit board.



Tuning and gain controls are mounted on the front panel.

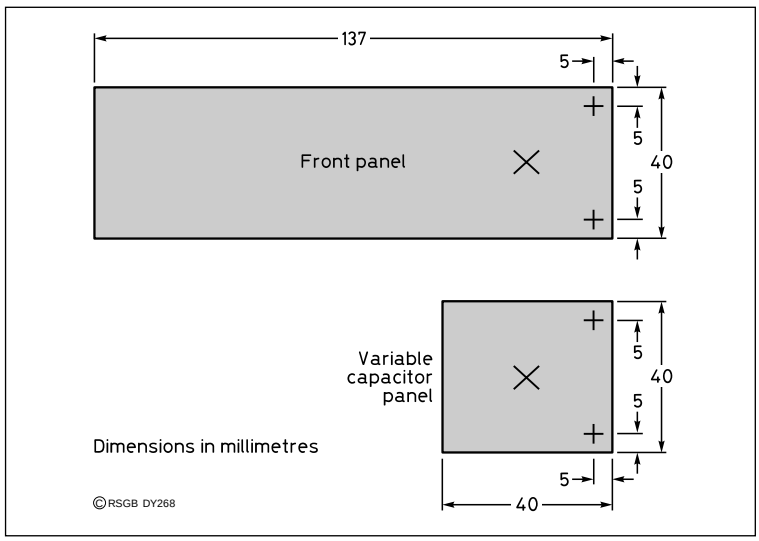


Fig 4: The case can be metal or made from PCB material.

I used a small slow motion drive for the main tuning - the band-spread control simply has a knob.

The main tuning capacitor is mounted onto a smaller panel held by two stand-off pillars behind the front panel for the slow motion drive. This variable capacitor is of the Polyvaricon type used in cheap AM radios. Sometimes these can be difficult to mount so I fixed mine to the small back panel with glue. I added a small tuning scale made from a disc of cardboard and an LED as a pointer.

Notice that the LED is pushed through the front panel and has

COMPONENTS LIST

Resistors

R1,R10	330R	R8	27k
R2,R5,R11	270R	R9	470k
R3	22k	R13	2k7
R4	47k	R14,R15	10R
R6	3k3	R16	1k0
R7,R12	4k7*		
RV1	10k 10-turn linear potentiometer (20k or 50k types are also suitable)		
RV2	100k log potentiometer		

Capacitors

C1	27pF	C8,C9	30pF
C2,C22	100nF	C15	1n0
C3,C4,C12,C13,C14,C18	10nF	C16,C17,C20	10mF
C5,C11	33mF	C21,C23	150mF
C6, C10	10nF	VC1	10pF
C7	68pF	VC	2200pF
C19	Not used		

Semiconductors

TR1,TR3	2N3819
TR2,TR4	BC182
IC1	LM386
D1	6V2 zener diode

Inductors

T1	3 turns primary, 15 turns secondary wound on a 2-hole ferrite bead. 36SWG wire.
T2	2 turns primary, 17 turns secondary wound on a T68-2 toroidal former. 28SWG wire.

Additional Items

6:1 slow motion reduction drive; Printed Circuit Board; Battery connector; PP3 battery; 8-pin IC socket; 8ohm speaker or headphones (eg Walkman type); Case made from PCB material or aluminium.

A component pack for the Nicky receiver is available from JAB Electronic Components, 1180 Aldridge Road, Great Barr, Birmingham B44 8PB. Price: £29.95

a series resistor of 1k8 soldered to a corner of the small panel. This corner has been isolated as a solder pad by drawing a saw blade across the printed circuit board to make an insulated pad. The LED is connected to the 9 volt supply via this resistor.

The volume control potentiometer has its own on-off switch for the PP3 battery mounted on the back panel. Antenna input sockets and the headphone/speaker socket are also mounted on this panel.

The way the Nicky PCB is used depends entirely upon how you want it to look. You may like to follow my ideas in the photograph or do it your own way. This is the joy of radio construction.

CHOOSE YOUR INPUT

CONNECT THE RECEIVER to an antenna. If a conventional amateur band antenna is being used, perhaps through an Antenna Tuning Unit, use the low impedance input. I had excellent results from the Nicky by connecting about three metres of wire to the high impedance input and using this as the antenna. Switch on the Nicky and set the volume control to a gentle hiss in the headphones or loudspeaker.

Turn up the reaction control until a definite hiss is heard. If a station is being tuned, this hiss will be more like a whistling (oscillating) sound on signals. Either way, you will notice a distinct change in the reception at this point. Back off the regeneration control just short of this point and the receiver is set for AM short wave broadcast stations.

On the amateur bands, the signals will be either SSB or CW and these need the reaction to be set just above the point of oscillation. The reaction will change as the Nicky is tuned, and the control will require re-setting from time to time. Juggling the tuning, reaction and volume controls to get the best reception is part of the fun of such receivers!

NICKY IN ACTION

A RECEIVER USING the regenerative method of reception needs practice to get the best results. The secret lies in the use of the regeneration control. For Morse code (CW) or single sideband (SSB) reception the control is set to the point of oscillation.

Tuned circuit T2 is arranged so the Nicky receives signals from roughly 6.5 to 11MHz. This includes two broadcast bands and the 7MHz and 10.1MHz amateur bands. Since there is only one tuned circuit coil T2 could be changed to cover other frequencies. Adding turns will let you receive lower frequencies, removing turns will cover higher frequencies.

I was amazed at what I heard on the Nicky. With my short piece of wire connected, it was a very useful receiver on the 7MHz (40 metre) amateur band. I also heard many stations from all over the world on the broadcast bands. The Nicky is certainly fun and works surprisingly well.

Get Involved with your Club!

How radio clubs are bringing more people into amateur radio

THE FEATURE about radio clubs which appeared in the November - December 1995 edition of *D-i-Y Radio, Let's All Club Together*, certainly created a lot of interest! We received several letters telling us of more clubs' activities, and even one or two mildly telling us off for not including *their* club amongst those "which particularly welcome youngsters and beginners"! Unfortunately, in the space available, it can never be possible to include details of *all* the clubs which are doing such a great job to introduce new people to amateur radio. However, most radio clubs *do* welcome newcomers, so if you want to find out more about your local radio club, either look in the RSGB *Call Book*, or give Lynnette Ranger, 2E1EKT, a call at RSGB HQ on 01707 659015.

GREAT YARMOUTH

THE GREAT YARMOUTH Radio Society has now trained over 20 Novices, including the very first Novice licensees in Norfolk. They were trained by David Buddery, G3OEP, the RSGB Senior Novice Instructor for Norfolk, and his 'right-hand man' Leo Balls, G3YYQ. Another four plan to take the Novice Radio Amateurs' Examination in May.

J B Barnard, G7RPJ, and N I Brown, G7RPY, are former Novices who have gone on to take out a full licence. G7RPJ is involved with Raynet, providing an emergency communications service, whilst G7RPY has become a valued instructor himself. Stan Wells, 2E0ABQ, had wanted to become an amateur all his life, but doubted his own ability. He only took out his Novice licence after retirement, but, according to David Buddery, Stan's Morse is now "excellent" and he is being encouraged to take out a full licence. Last year Stan was elected Chairman of the club.

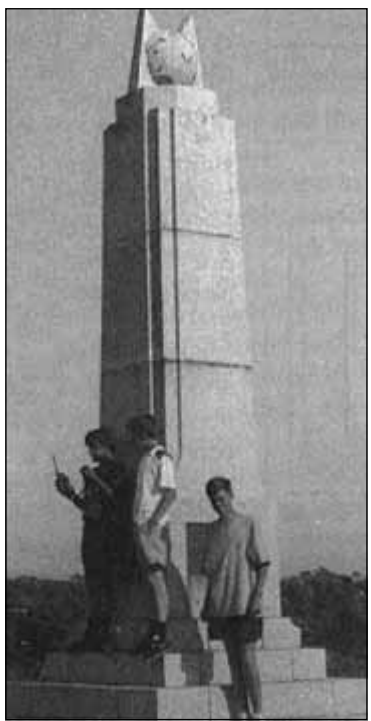
Lest it be thought that the club is only for older people, Aaron Lockton, G0VDC, received his full licence whilst in his early teens!

THANET

KEN SMITH, G3JIX, has spent "half a lifetime" in education and running youth groups. For the last 16 years he has been leader of the Thanet Electronics Club for Youth (TEC), which has introduced well over 150 boys and girls to amateur radio. Quite a few callsigns have originated through this work - including several mums who are now on the air! Nicholas Bray is one of five who recently passed the Novice Radio Amateurs' Examination, and was going on to take the full RAE course.

The club has its own callsign, G3SRE. Club members have put on exhibitions at local village fetes and helped Ken Smith during his lecture at the Kings College Radio Days by assisting with demonstrations. They have cycled for 250 miles, stopping at Youth Hostels and visiting interesting radio sites. They have developed and traded radio kits. They have carried out re-enactments of Michael Faraday's pioneering electromagnetic work. And much more.

The success of TEC and these other clubs doesn't happen by accident. It requires committed leaders like Ken Smith, David Buddery and the others. But we are delighted to see that there *are* radio clubs about who are encouraging youngsters - and the not-so-young! - to take up this fascinating hobby of amateur radio.



Three members of the Thanet Electronics Club for Youth communicating by radio from the Marconi monument at Poldhu in Cornwall - the very spot where Marconi carried out some of his early experiments.

Leo Balls, G3YYQ, instructing a Novice student at the Great Yarmouth Radio Society. Note the familiar RSGB *Novice Licence Student's Notebook* being used as a text book!

READING

SINCE OUR LAST clubs feature, the Reading and District Amateur Radio Club, held its AGM. The new committee includes a Novice, Eddie Milton, 2E1BDO, amongst its ranks, and the average age of the incoming committee is now less than 30! Exciting events organised by this club include providing communications for the Three Towers Hike on 16 March. This is a major radio exercise which the club has handled for many years.

CONTACT NUMBERS:

Reading and District Amateur Radio Club
Secretary: Peter Swynford, G0PUB, 219 Wykeham Rd, Earley, Reading RG6 1PL, tel: 01734 617388.

Great Yarmouth / Norfolk Novice Instructor:
David Buddery, G3OEP, 33 Addison Rd, Gorleston, Gt Yarmouth, Norfolk NR31 0PA, tel: 01493 662323.

Thanet Electronics Club for Youth
Leader: Ken Smith, G3JIX, Staple Farmhouse, Staple, Canterbury, Kent CT3 1JX (please enclose an SASE), tel: 01304 812723.

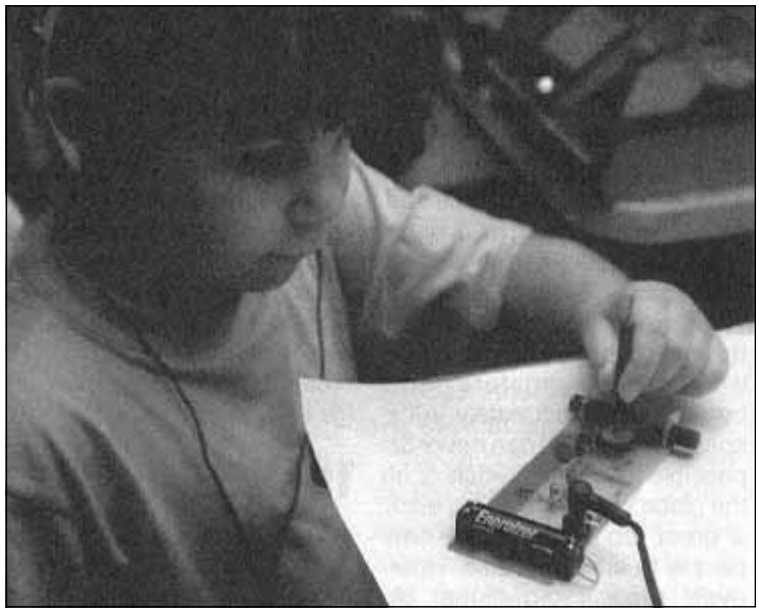
A Simple Medium Wave Receiver

A design for a simple medium-wave receiver based on the ZN414Z radio chip.

THE ZN414Z IC (integrated circuit) used in this design contains an RF (Radio Frequency) amplifier, detector and AGC circuit and requires only a few external components to make a complete AM (Amplitude Modulation) radio. The audio output from the ZN414Z chip is rather low under normal operating conditions so an audio amplifier is used to boost the audio to a level that will drive a pair of Walkman headphones.

In this design the audio is amplified using a BC109 transistor. The circuit diagram is shown in **Fig 1**.

Two different ways of constructing this receiver are described below, one using a PCB and the other using a tag strip.



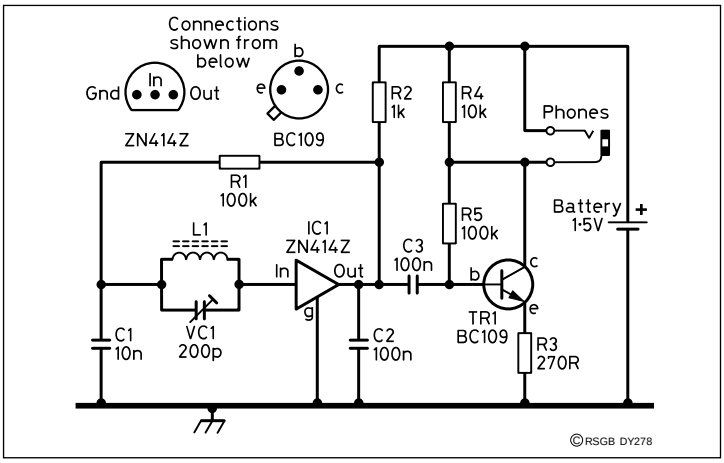


Fig 1: Simple medium -wave radio, circuit diagram. Note that the pin connections to IC1 and TR1 are shown from below.

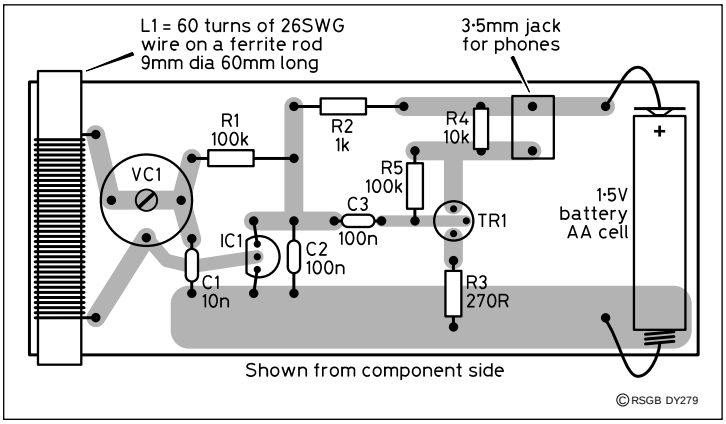


Fig 2: Component layout using PCB board.

USING A PCB

AN EXAMPLE OF construction using a PCB, designed by Steve Ortmayer, G4RAW, is shown in **Fig 2**. This type of construction is small and neat. Methods of making printed circuits is described in the *Radio Communication Handbook,* available from the RSGB bookshop, as advertised in this magazine.

The components are soldered into place as shown in Fig 2.

Note that the IC1 and TR2 are viewed from the top in Fig 2; connection pins are shown viewed from the bottom.

The arrangement shown in the photograph is preset; that is it is tuned to your favourite programme with a preset capacitor using a screwdriver. The preset capacitor could be replaced with a polyvaricon or air-spaced variable capacitor, with a dial, if you want the option of being able to tune to other stations.

The antenna is made by winding a coil of wire on a ferrite rod 9mm in diameter and 60mm long. This can be cut to size from a longer length if necessary. The ferrite rod is wound with 60 turns of 26 SWG enamelled copper wire; each turn is wound side-by-side and held fast with clear sticky tape. The completed rod is fixed to the board with plastic ties. The battery holder is fixed to the board using double-sided sticky tape.

The radio could also be provided with an on/off switch but it is convenient to switch the radio on and off by just connecting or disconnecting the battery. When complete the radio can be tested by inserting a battery andWalkman phones.

USING A TERMINAL STRIP

THE RADIO CAN be constructed using an electrical terminal strip, plus the capacitor, coil and battery holder fixed to a wooden base board. This arrangement is based on a design by Jaap den Herder, F6FYP/PA0YJ for Jamboree On The Air in 1986.

Using this method it is possible to construct most of the radio without using a soldering iron.

Mount the components on the terminal strip as shown in **Fig 3**.

Note the connections IC1 and TR1 and ensure that they are connected correctly at the terminal strip. Fix the terminal strip with two small screws. Double sided tape can be used if you have no suitable screws. The remainder of the parts can all be fixed with screws or double sided sticky tape.

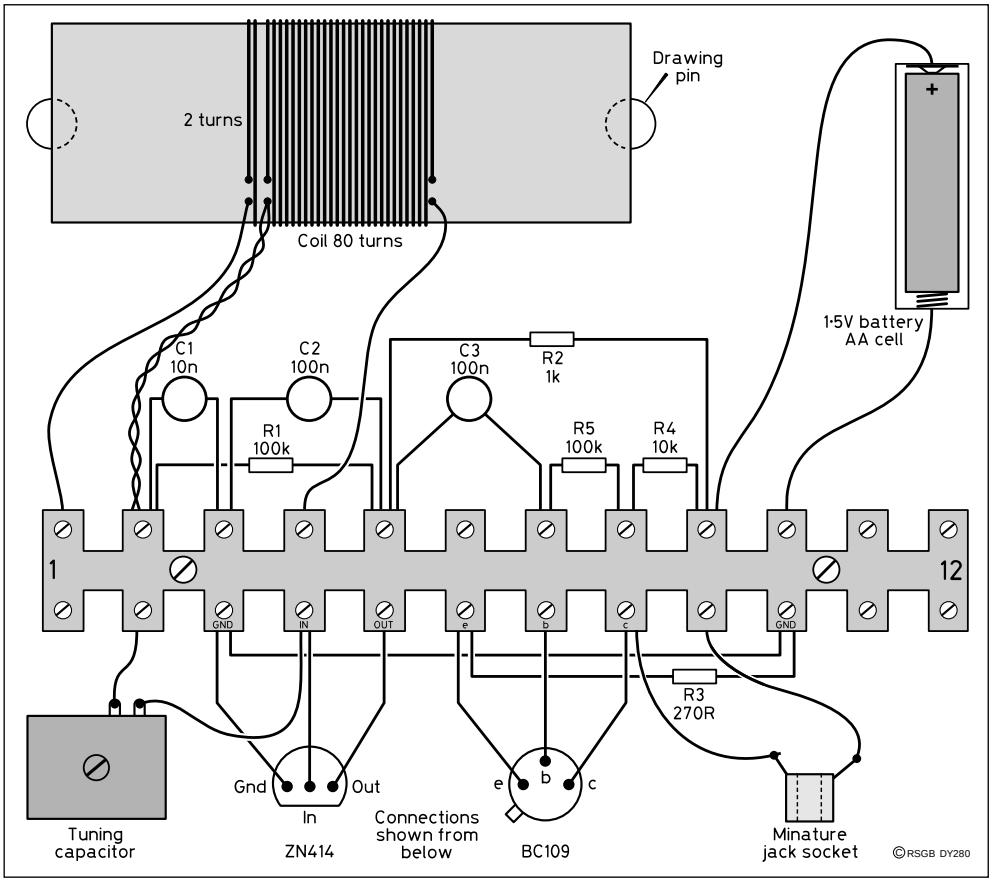


Fig 3: Component layout using connector strip. This layout is shown using the plastic or cardboard tube alternative coil former. An external wire antenna can be connected to tag strip connector 1 if required.

ALTERNATIVE COIL CONSTRUCTION

IF YOU ARE unable to get a suitable length of ferrite material you could wind inductor L1 on a cardboard or plastic tube. This tube should be around 30 to 40mm in diameter and around 120m long. You need 15 metres of enamelled covered wire - the wire diameter is not too important but it should be around 0.5mm (26 SWG is about right).

Make two holes near the edge of the coil former about 40mm from one end. Thread the enamel covered wire through these holes with enough wire to reach the tag strip. Wind on the 15 metres of wire; be patient with this operation and try to keep the winding tight with the turns close together but not on top of one another. Unwind three turns from the coil and make two holes where the windings now stop. Thread the end of the wire through the holes and cut off the excess wire, allowing enough wire to reach the tag strip. Remember to scrape the insulation from the wire before connecting the ends into the terminals.

Use the short length of wire to make two extra turns and connect as shown in Fig 3. You will need two additional holes at the end of the coil to secure the end of the wire.

The coil can be fastened to the board using double sided sticky tape or screws. Connect the ends of the coils to the terminal strip as shown in Fig 3.

The receiver should work without an extra antenna. However, if you live in a poor signal area a piece of wire, connected to tag connector number 1, and fixed up as high as possible will improve reception.

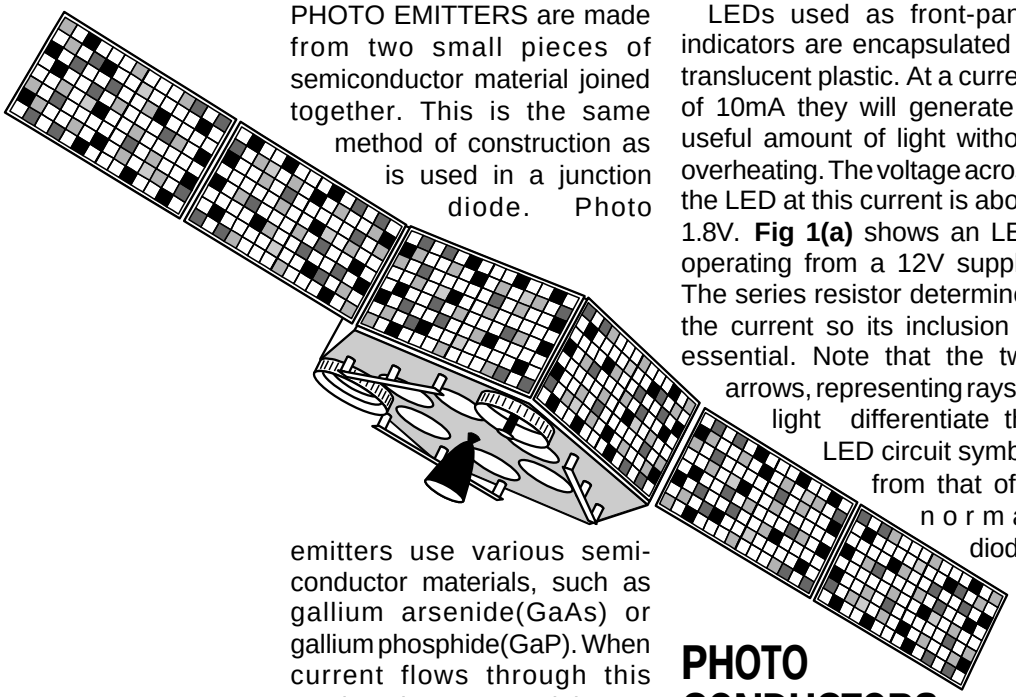
COMPONENTS

Resistors	
R1,R5	100k
R2	1k
R3	270R
R4	10k
Capacitors	
C1	10nF
C2, C3	100nF
Inductors	
L1	Ferrite rod 9mm in diameter and 60mm long, for coil winding see text
Semiconductors	
IC1	ZN414Z
TR1	BC109
Additional Items	
Variable capacitor	500pF
Terminal strip	12 way
Enamel covered wire	15 metres 0.5mm, 26 SWG (the wire diameter is not critical).
Battery and holder	1.5V
Miniature Jack Socket	
Pair of Walkman headphones	

A components pack is available from: JAB Electronic Components (see page 30 for address). The price is £9.95 inc. P&P and contains a connector strip and a PCB so that you can use either method of construction. Note that the PCB is not the same as Fig 2 but a layout is supplied with the component pack.

Optical Semiconductors

Light emitting diodes and light dependant resistors explained



A large communications satellite, showing the solar panels used to charge the batteries (above).

THESE AMAZING devices can covert eletrical current into light, or light into electrical current.

PHOTO EMITTERS

PHOTO EMITTERS are made from two small pieces of semiconductor material joined together. This is the same method of construction as is used in a junction diode. Photo emitters use various semiconductor materials, such as gallium arsenide(GaAs) or gallium phosphide(GaP). When current flows through this semiconductor material particles of wave energy, known as **photons**, are released.

Photo emitters constructed from pure gallium arsenide produce radiation in the infrared end of the spectrum. This radiation is invisible and is used for the transmitter/receiver described on page 11.

If aluminium is added to the gallium arsenide during the construction of the photo emitter, the wavelength of the photon radiation is shortened so that it produces visible light in the red portion of the spectrum. A semiconductor photo emitter device that produces visible light is known as an LED (**light emitting diode**).

The wavelength, and hence colour, of the light depends on the material used in the construction of the LED. Pure gallium phosphide produces radiation in the green region of the visible spectrum. LEDs that produce light in red, green, orange and yellow can be made by using suitable mixes of the substances described above.

LEDs used as front-panel indicators are encapsulated in translucent plastic. At a current of 10mA they will generate a useful amount of light without overheating. The voltage across the LED at this current is about 1.8V. **Fig 1(a)** shows an LED operating from a 12V supply. The series resistor determines the current so its inclusion is essential. Note that the two arrows, representing rays of light differentiate the LED circuit symbol from that of a normal diode.

PHOTO CONDUCTORS

LIGHT ENERGY (photons) can affect the resistance of certain semiconductor materials. In commercial photo conductors, also known as LDRs **(light dependant resistors**) the resistance can change considerably depending on the amount of light falling on the device. The most common material used in photo-conductors is cadmium sulphide (CdS), with a resistance range of more than 2MΩ in total darkness to less than 10Ω in bright light. A light sensitive resistor can be connected to a current meter and a battery to measure light intensity, as you can see on the light measuring photometer shown on page 9.

A similar effect is also used in some diodes and transistors so that their operation can be controlled by light instead of electrical current biasing. These devices are called photodiodes and phototransistors and they have more sensitivity to light than the light dependant resistors. A photo diode is shown in **Fig 1(b**).

PHOTOVOLTAIC CELLS

WITH CERTAIN semiconductor materials photons (light) will cause electrons to flow. Devices that use light from the sun to produce electricity in this way, using what is known as the photovoltaic effect, are called solar cells. Single cells are available that will produce 0.45 or 0.9 volts at currents of up to 700mA. To produce larger amounts of power numbers of cells are grouped and connected together to make up a Solar Panel. This is the most practical way charging batteries on space craft. The large solar panels, see drawing above, are a prominent feature of many space probes and satellites.

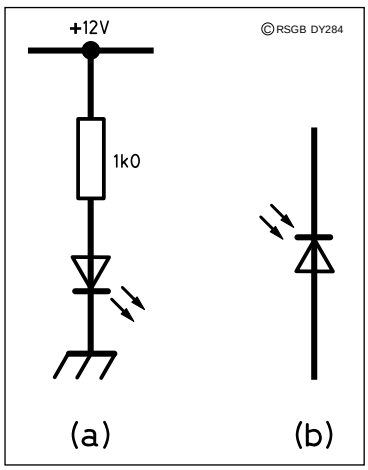


Fig 1(a) LED operating from a 12V supply with a current limiting resistor. Fig 1(b) shows the symbol for a photo diode. Note that the two arrows, representing rays of light, differentiate these special diodes from that of a normal diode.

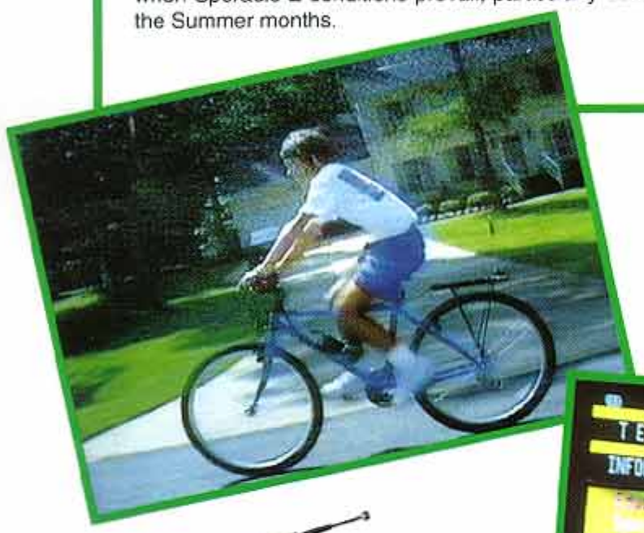
AMATEUR RADIO AND THE VHF/UHF SPECTRUM

VHF/UHF BROADCASTING

NEARLY EVERY TRANSISTOR radio sold today can receive high quality (often stereo) VHF FM radio in the 88-108MHz band.

UHF colour television, which requires larger bandwidths, is transmitted in the 460-820MHz band.

Many European black and white television transmissions in the 44-64MHz band can be received when Sporadic-E conditions prevail, particularly during the Summer months.



VHF AMATEUR RADIO

THERE ARE THREE bands allocated to amateur radio between 30 and 1000MHz (VHF/UHF).

6 Metres: 50-52MHz (50-54MHz in the USA). In poor conditions the communication range is up to 100 miles. In the summer months the band is frequently affected by Sporadic-E propagation and contacts of over a 1000 miles are possible. At peaks of the sunspot cycle intercontinental communications are quite common.

4 Metres: 70-70.5MHz. This band is available to stations in the UK, Eire, Gibraltar and Cyprus only. Most amateurs use home-made or modified private mobile radio units. The band is also used for packet radio links.

2 Metres: 144-146MHz. This is a popular band for both local and long distance contacts. This is mainly due to the easy availability of equipment and the small size of the antennas. There is a widespread network of repeaters for FM and mobile operation. Intercontinental communications are quite common via satellites

70 Centimetres: 430-440MHz. This band is also very popular, especially for mobile and hand-portable operation. There is a growing network of FM repeaters in most countries. Intercontinental communications are quite common via satellites.

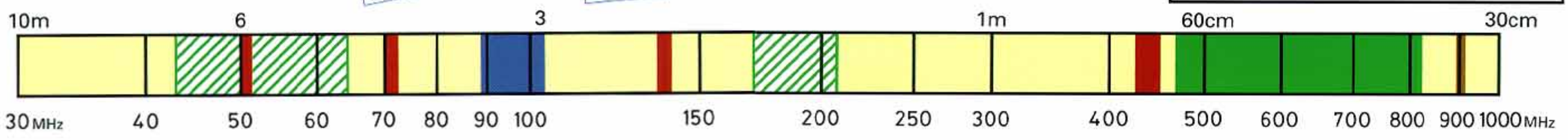
FIXED & MOBILE RADIO

THIS INCLUDES military, police, emergency services, telephones, pagers taxis etc.

Note that 'radio eavesdropping', or listening to messages that are not intended for *YOU* is an offence.

KEY TO FREQUENCY CHART

- AMATEUR RADIO
- UHF TELEVISION
- FM BROADCAST RADIO
- OVERSEAS (DX) TELEVISION
- UHF CITIZEN BAND
- PRIVATE FIXED & MOBILE RADIO



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

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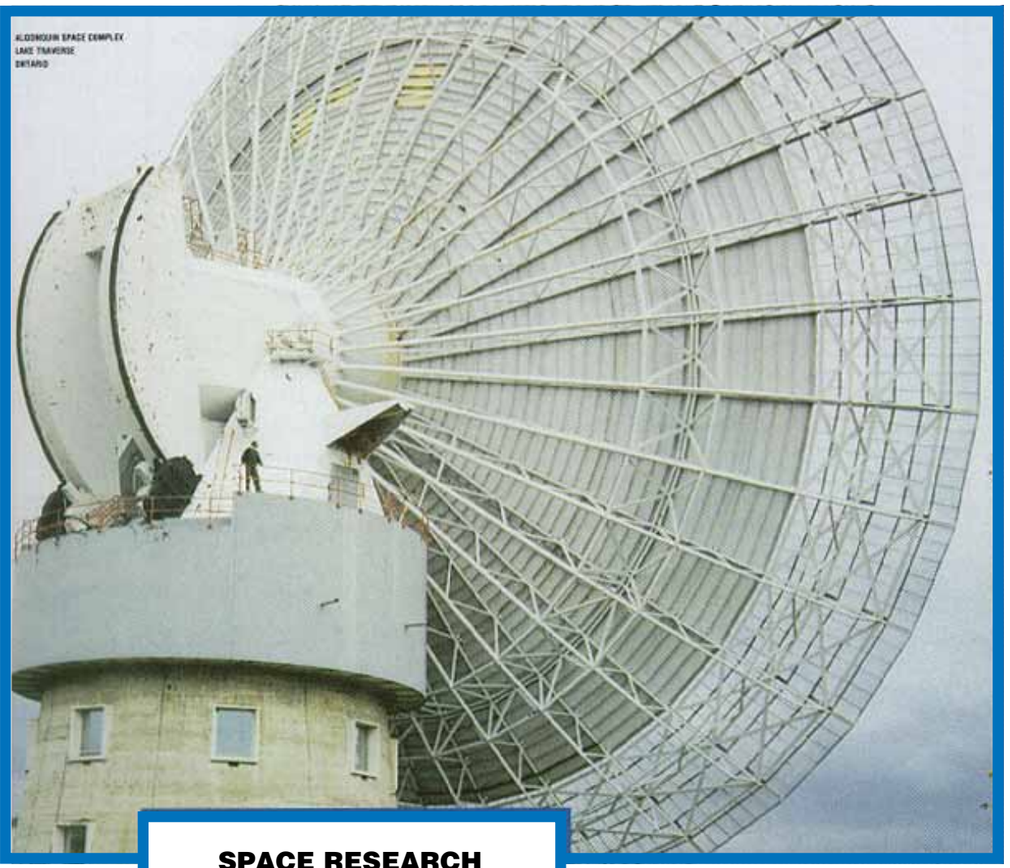
AMATEUR RADIO AND THE MICROWAVE SPECTRUM



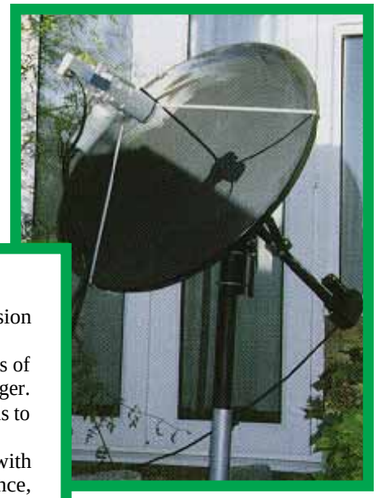
SPACE RESEARCH

MOST COMMUNICATIONS with research satellites and space probes is done at microwave frequencies. Parabolic reflector dishes are very efficient on these bands because the antenna polar diagram can be concentrated into a very narrow beamwidth, which is particularly important when communicating with a low power spaceprobe in orbit around Jupiter. All the spectacular colour planetary images that you see on TV, or in magazines, have been sent back as slow scan digital television on the microwave bands.

MICROWAVE AMATEUR RADIO

THERE ARE FIVE bands allocated to amateur radio between 1 and 30GHz; these are shown in the frequency scale at the bottom of the poster. These bands are used mainly to explore unusual propagation modes, fast-scan television, satellite communications and even moonbounce (communicating with countries in other continents by signals reflected from the moon). The amateur bands are shown below. The bands in bold are available to holders of the Novice Licence.

- **1.24 to 1.325GHz**
- 2.31 to 2.45GHz
- 3.4 to 3.475GHz
- 5.65 to 5.85GHz
- **10 to 10.5GHz**
- 24 to 24.25GHz



SATELLITE BROADCASTING

THERE ARE TWO main bands of frequencies used for relaying radio and television signals:

- 3.65 - 4.2GHz, is used for the relay of telecommunications signals across large areas of the globe. Most of the signals are weak, which require dishes of 3m in diameter or larger.
- 10.7 - 12.75MHz, called Ku-band, is used for the relay of telecommunications signals to defined areas.

Nearly 200 TV channels, broadcast from various satellites, can be received in the UK with appropriate equipment because many of the satellites have a beam centred on France, Germany or the Benelux countries.

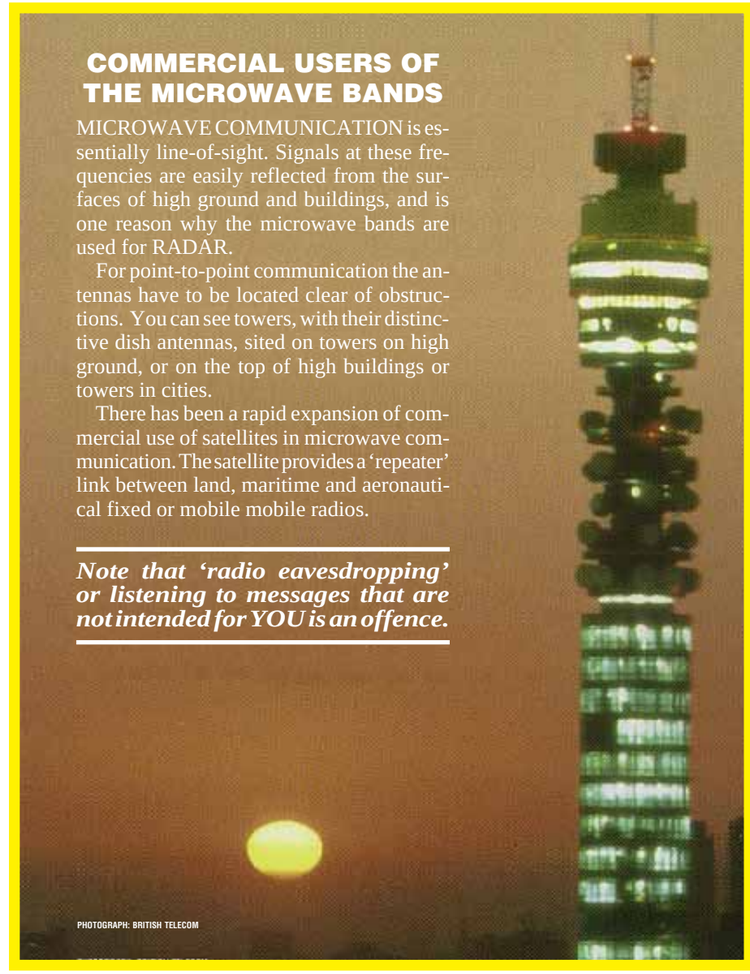
COMMERCIAL USERS OF THE MICROWAVE BANDS

MICROWAVE COMMUNICATION is essentially line-of-sight. Signals at these frequencies are easily reflected from the surfaces of high ground and buildings, and is one reason why the microwave bands are used for RADAR.

For point-to-point communication the antennas have to be located clear of obstructions. You can see towers, with their distinctive dish antennas, sited on towers on high ground, or on the top of high buildings or towers in cities.

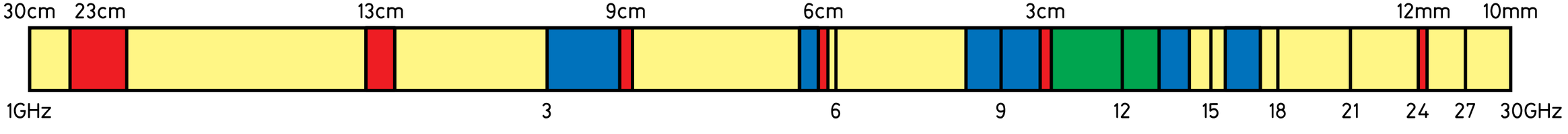
There has been a rapid expansion of commercial use of satellites in microwave communication. The satellite provides a 'repeater' link between land, maritime and aeronautical fixed or mobile mobile radios.

Note that 'radio eavesdropping' or listening to messages that are not intended for YOU is an offence.



KEY TO FREQUENCY CHART

- AMATEUR
- SPACE RESEARCH
- SATELLITE BROADCASTING
- FIXED & MOBILE SERVICES



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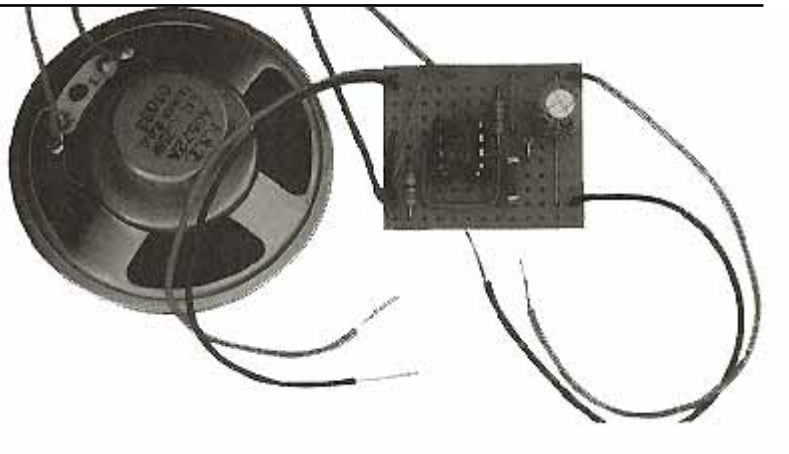
Advertisement

D-i-Y'er 555

by Steve Price, G4BWE



THE NE555 IS A very versatile integrated circuit (IC) which can be used to make a simple audio oscillator (bleeper).

Fig 1 shows the circuit diagram of a practical use for the '555. The timing voltages produced by resistors R1 and R2, and capacitor C2, are used to generate a series of pulses. These pulses, caused by tiny transistors inside the NE555 turning on and off, can be made to repeat so quickly that they become an audible vibration, or tone. The pitch (frequency) of the tone depends not just on the values of R1, R2 and C2 - it can also be varied by connecting a further resistance across the test leads.

All the components except IC1 are soldered onto a small piece of Veroboard (available from JAB Electronic Components). This has copper strips running along its underside which are used like the tracks on a printed circuit board (PCB) to provideconnections between different components. Four of the strips must be cut where shown - we have to do this otherwise the rows of pins on each side of the NE555 would be shorted together.

You can use a small twist drill bit (3mm is OK) in order to break the strips, but twist the bit by hand, not in a drill or you will probably finish up with holes going right through the Veroboard!

The four links are made with solid (single conductor) wire which should have an insulated covering. Remember to check that C1 (an electrolytic capacitor) is connected the right way round. It does not matter which way round you connect C2 or the resistors. After checking your work, insert the NE555 into its socket as shown in **Fig 2**.

EXPERIMENTS

CONNECT THE PROJECT TO a battery or power supply, checking that the positive and negative leads are the right way round - it helps to use a red flying lead for positive and a black lead for negative.

Now short the bared ends of the two test leads together and you should hear a tone from the loudspeaker. There are a number of uses for your NE555 oscillator and also quite a few experiments you can have fun with:-

- To make a Morse practice oscillator, simply connect your Morse key to the test leads. Each time the key is pressed the tone will sound.
- If a working torch bulb or fuse is connected across the test leads then you should hear the tone. However, if the fuse or bulb

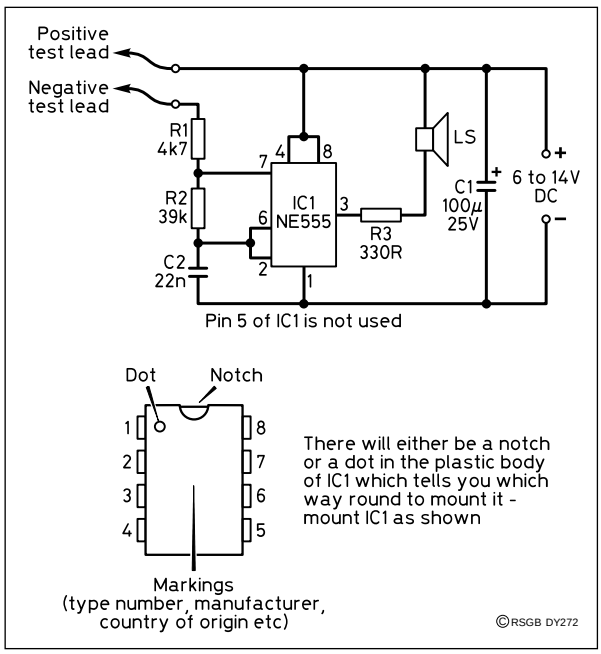


Fig 1: The circuit diagram.

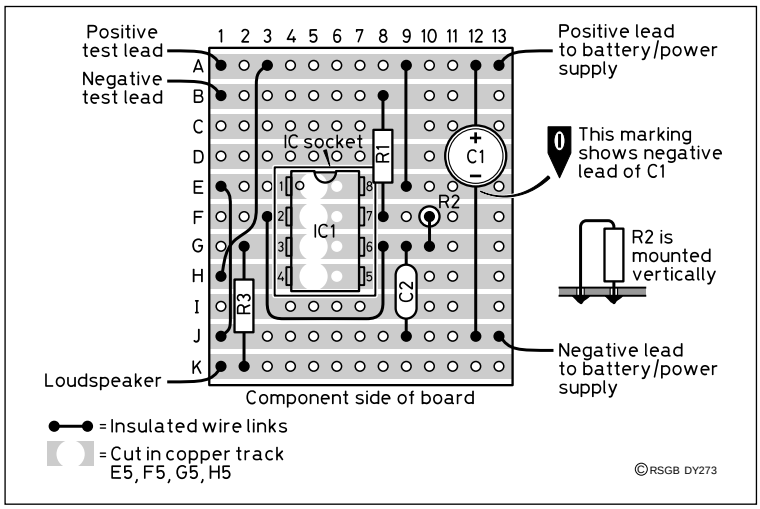


Fig 2: Veroboard Layout for the D-i-Y'er 555. If you can read a circuit diagram, the project can be built using other methods.

has 'blown' the oscillator will remain silent.

- The pitch of the tone is affected by the resistance connected between the test leads. Increasing the resistance will lower the tone. This effect can be used to estimate the value of resistance and also monitor any changes in it. For instance, if you hold the bare ends of the test leads in your hands a low pitched sound will be heard because of the high resistance in your body. However, if you squeeze the wires harder the pitch will increase as the contact improves (now try this with damp hands).
- Connect a potentiometer (variable resistor, like a volume control) to the test leads using the centre contact and one of the outer contacts - a linear type with a value of between 100 and 470kΩ will give the best effect.

  Rotating the potentiometer's spindle alters the pitch. The highest value of fixed resistor that will work is 10MΩ (ten million Ohms - colour code brown black blue). This resistance is so high that you can hear the individual pulses producing a repetitive clicking sound which is too low in frequency to be heard as a tone.
- Diodes can also be checked. Connect the cathode (that's the end marked with a ring) of a small silicon diode (such as a type 1N4148 or 1N914) to the negative test lead, and connect the anode to the positive test lead. The diode will be 'forward biased' and the oscillator should sound as the diode conducts.

  Now swap the test leads around - as the diode is now reverse biased the oscillator is silenced. The diode's one-way effect is used a lot in radio.
- A cadmium sulphide photoconductive cell type ORP12 (available from JAB) may be connected to the test leads. Shielding the cell from the light (try placing an upturned cup over it) will increase the cell's resistance and this lowers the pitch.

There are many more uses for the D-i-Y 555 project - can you discover any? Send us your ideas. They could be published in a future issue of *D-i-Y Radio.*

COMPONENTS LIST

Resistors - 0.25 Watt carbon film types

R1	4.7k (yellow, violet, red)
R2	39k (orange, white, orange)
R3	330Ω (orange, orange, brown)

Capacitors

C1	100µF 25V electrolytic (radial type)
C2	22nF Polyester (10mm lead spacing)
	The value of C2 may be marked as '22n' or '.022'

Integrated circuit (chip)

IC1	NE555

Other parts

- Miniature loudspeaker (preferably 35, 40 or 80 ohm but any type will work)
- 8 DIL IC socket
- 0.1 inch Veroboard ('stripboard') minimum size 11 strips by 13 holes
- PVC covered stranded conductor cable for test leads, battery/power supply and loudspeaker connections
- *This project requires a DC power source of between 6 and 14 Volts, such as a 9 Volt battery.*

COMPONENT SOURCE

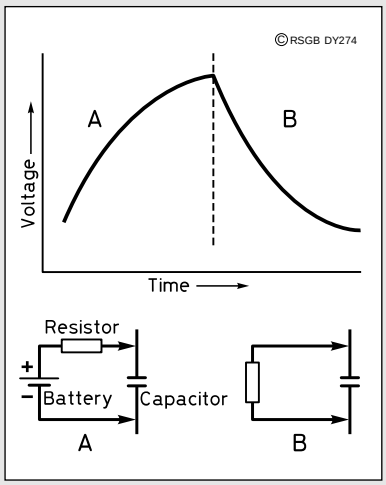
JAB Electronic Components, 1180 Aldridge Rd, Great Barr, Birmingham, B44 8PE. Tel: 0121 366 6928.

How the NE555 Works

D-i-Y RADIO often has projects using the NE555 integrated circuit (chip). It can be used for many different projects but all of them use the '555 as a timer. This is how it does it.

If we connect a battery across a capacitor via a resistor (see A) the capacitor will be charged - in fact a capacitor is just like a re-chargeable battery. The resistor limits the current flowing into the capacitor so that it takes time to charge - see curve A, which shows the voltage across the capacitor.

If the charged capacitor is now connected across a resistor (see B) current will flow through the resistor and discharge the capacitor. The capacitor's voltage now drops - see curve B. The higher the value of the resistor, the longer it takes to charge, or discharge, the capacitor.



In the project on, the NE555 works by controlling the regular charging and discharging of a capacitor [C2] connected to it using the two external resistors [R1 & R2]. Short charge/discharge times will produce a high-pitched note, and long times will produce a low note.

2's Company

News and Reports from Novice Licensees

WITH THE December 1995 Novice Radio Amateurs' Examination results out, there will now be a new influx of 2*1 and 2*0 callsigns on the air. We are pleased to see that Novices who have now been licensed for a while are featuring in RSGB operating awards and RSGB contest results.

AWARDS

FOR EXAMPLE, E P Williams, 2E1AFN, of Stroud, Gloucestershire, has recently provided evidence of having contacted 20 countries on the 6 metre band and has been presented with the RSGB 50MHz 20 Countries Award.

HF ACTIVITY

IN THE SERIES of 1995 LF Cumulative Contests, in which contacts are made over several short operating sessions on different days in the 160, 80 and 40 metre bands, P A Williams, 2E0AJE, was in overall 32nd place and T Cannon, 2E0ACY in 43rd place out of a total of 64 entries. There were also other Novices who appeared in the logs but who did not submit logs: please do so this year if you took part. Contacts with Novices count 20 points each, so are much sought after by those taking part in these contests.

2E0AJE also figured in the second 'RoPoCo' (Rotating Post Code) contest, which took place in August last year. In this CW (Morse) contest, you send your own post code as part of the contest exchange in your first contact, then the post code you have just received for the next contact (hence the name 'Rotating Post Code') and so on. This is a real test of both sending and receiving ability. 2E0AJE, who was the only Novice to submit a log for this contest, scored a highly creditable 500 points and ended up in 27th place out of the 51 entries.

VHF CONTEST

ALTHOUGH NOVICES are not permitted to use the 2 metre (144MHz) band, they may of course use this or any band under the supervision of (and using the callsign of) a suitably-qualified full licensee. Three young Novice operators, 2E1DWK (aged 15), 2E1CXE and 2E1EFS (both 13), took part in the fourth 144MHz 'Backpackers' contest as G6XRS/P, representing the Leicester Radio Society. The 'Backpackers' are a series of VHF contests in which participants set up a portable station by literally backpacking to their chosen location. The youngsters came out on top of their section, well ahead of their nearest rivals.

Essential reading for Novices and beginners of all licence classes! This book gives good, practical advice on many types of antenna, and is available from RSGB Sales.

THE LOG BOOK

THE THREE YOUNG Novice operators 2E1DWK, 2E1CXE and 2E1EFS (see *2's Company* above) contacted **ON6**RM/P, a portable station in **Belgium**, during the fourth RSGB 144MHz Backpackers contest. The Novices were operating under supervision as G6XRS/P. The contact was at a distance of over 400km, which is good 'DX' considering the Novices were using just 3W of SSB. They were using a 17-element Yagi antenna, which provides a lot of gain.

Large numbers of HF operators from all over the world are becoming interested in the RSGB's Islands on the Air (IOTA) awards. To qualify for an IOTA award, you must contact at least 100 islands or island groups which are listed and given a reference number in the *IOTA Directory* (available for £6.00 from RSGB Sales). Some amateurs go to island groups specifically to activate them for IOTA: two such are Phil Whitchurch, G3SWH, and Chris Burbanks, G3SJJ, who plan to operate as **F/G3SWH** from **Iles Chausey**, which are located between Jersey and the French coast. Phil and Chris will be on the air on 23/24 March CW only, from 80 to 17 metres.

QSL card from special event station GB50UN which operated from the Isle of Man during Jamboree on the Air to celebrate the 50th anniversary of the United Nations (see page 5).

Listen out from 1 April for the first **'M' callsigns**. Subscription Services Ltd (SSL), which issues amateur radio licences in the UK on behalf of the Radiocommunications

Band by Band

The Amateur Radio Spectrum: The 10 metre Band

TEN metres, the 28MHz band, is the highest of the HF (High Frequency) bands. The full band of 28.0 - 29.7MHz is available to amateurs with the full Class A licence. Class A Novices can operate CW (Morse), RTTY (Radio Teletype) and other digital modes from 28.060 - 28.190 and 28.225 - 28.300MHz; with telephony (speech modes or 'phone') and CW (Morse) between 28.300 and 28.500MHz. 10m is the only HF band where FM is regularly used, often around 29.500MHz.

The 10m band is arguably *the* most exciting band for the class A Novice, providing as it does the possibility of world-wide contacts with low power using speech, Morse and digital modes. 10 metres is on the border between HF and VHF, and it exhibits characteristics of both, depending on the **11-year sunspot cycle** (see our sun poster on pages 23/24). During **sunspot minimum** years (as at present), the band behaves like a VHF band with line-of-sight communication being the norm. **Sporadic-E** propagation also occurs, especially in the summer months, providing strong signals from central and southern Europe. During **sunspot maximum** years (such as last occured in about 1988 - 1991) strong signals can be expected from literally anywhere in the world. This sort of propagation is still a few years away, but it *will* return!

Due to the wavelength - 10 metres - antennas on this band can be relatively small. A half-wave dipole is only 5 metres long, whereas a **full-wave antenna**, such as a **delta loop**, can easily be fitted into most gardens. See January - February 1996 *D-i-Y Radio* for a description of an operation using a huge delta loop antenna for the 80 metre band.

It may be difficult to find a cheap receiver kit covering 10m. However, just about all commercial transceivers or receivers cover 28MHz and some can now be picked up for real bargain prices at 'junk sales' and bring and buy stalls at amateur radio rallies.

BAND FACTS

Allocation:

28.000 - 29.700MHz (Full A licence)
28.060 - 28.190MHz (Novice A licence)
28.225 - 28.500MHz (Novice A licence)

Activity:

28.000 - 28.050MHz CW (Morse) only
28.050 - 28.150MHz CW (Morse) & Digital modes
28.150 - 28.199MHz CW (Morse) only
28.201 - 29.200MHz Phone and CW (Morse)
29.200 - 29.300MHz Phone, digital modes and CW (Morse)
29.300 - 29.550MHz Satellite downlinks
29.550 - 29.700MHz Phone and CW (Morse)

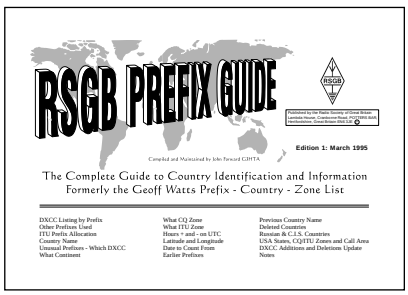
Notes:

28.199 - 28.201MHz should be kept clear for international propagation beacons. Beacons also operate between 28.190 and 28.255MHz.

THE LOG BOOK

Agency (RA), has announced that as from 1 April, all UK full licences issued will have callsigns starting with M0 (instead of G0) for the full class A licence, and M1 (instead of G7) for the full class B licences. Novice class A and B licences will be unaffected by this change. The RA *has* issued two 'M' callsigns before: M0RSE, which was used on Morse code only to celebrate Samuel Morse's birthday, and M1OOG, which was used last year to celebrate the 100th anniversary of the invention of radio by Guglielmo Marconi. But the new 'M' callsigns, starting with **M0AAA** and **M1AAA**, will be sufficiently unusual to attract a lot of attention when they first come on the bands.

Class A Novices who have equipment for the 10 metre band will be able to have a lot of fun during the ***CQ* 'WPX' SSB contest**, which takes place this year from 0000UTC on **30 March** to 2400UTC on **31 March**. *All* the UK class A Novice prefixes - 2E0, 2M0, 2W0 etc - will be much in demand by stations taking part in the contest, because the 'multiplier' for scoring is the number of different prefixes contacted. Listen for SSB stations taking part in the contest from about 28.200 - 28.600MHz, but especially between about 28.400 and 28.500MHz. UK Novice stations may use SSB between 28.300 and 28.500MHz only (see *Band by Band*, above).



The RSGB Prefix Guide is a way of finding out the location of stations heard using unusual prefixes. It will be particularly useful during the CQ WPX SSB contest at the end of March.

Advertisement

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.

ANYONE CAN DO IT

WHEN I PASSED the Novice exam in March 93 I was so excited about the prospect of communicating on air, I went off to a radio rally and bought a hand-held radio, and got on to 70cm. I began to learn all about being a radio amateur. I had nothing but friendly encouragement from other amateurs: they were wonderful to me. I had so much support and encouragement that I went on to study for the RAE and Morse. I had so much help that I gained the strength to take and pass the 12WPM Morse test July 94 and then take and pass the RAE - with credit - on 8 December 1994. When I tell you that I did all my study at home, chair-bound, you will appreciate the significance of their encouragement.

The Novice training scheme is a very good start to amateur radio. I learned strict rules which I respected, and from then on expanded on to a full class A licence. It was very hard work for me but I enjoyed it. Anyone can do it.

My husband passed the Novice exam in September 95 and I am really pleased with him. He too had lots of friendly encouragement from other amateurs. For me this is a dream come true, as my relationship with my husband started on the air, when we were radio operators in the auxiliary fire service in 1962.

Eve Scott, G0VSR, and Walter Scott, 2E1CIX

PRIZEWINNER

IT WAS WITH great pleasure that I opened the package from you to find I had won the Howes HF receiver from the September - October competition in *D-i-Y Radio*. I thoroughly enjoy *D-i-Y Radio* and also my grandfather's copy of *RadCom*, which makes its rounds between him, my father and myself - all 'hams'.

The receiver is already in use and I am sure will give me many hours of pleasure and the incentive to go for the RAE and Morse test in the not-too-distant future. I wish to thank the RSGB and Howes Communications for this prize.

Bryan Haswell, 2M1EAU

READING CIRCUITS

CONGRATULATIONS ON the new-look *D-i-Y Radio* magazine, and I thought the double-size issue recently on sale at the Leicester Show was outstanding. [We hope you like *this* double-size issue just as much! - *Ed*].

Would it be possible to include an article on reading circuit diagrams in future numbers please? This is a subject I know very little about, particularly how the diagram 'translates' into something solid and three dimensional, and what connects to what. The Novice course seems a long while ago now!

Eric Smeaton, 2E1DXT

[Thanks for the suggestion, Eric. We will certainly try to put together an article on reading circuit diagrams in the near future - *Ed*]

INDIAN *D-i-Y-ER*

GREETINGS FROM India!

I read your magazine regularly at the National Institute of Amateur Radio and find it of interest.

Jose Jacob, VU2JOS

D-iar-Y MAR-APR

MARCH

2	West Wales Amateur Radio & Computer Rally, Aberystwyth. Details 01545 580675.
2 / 3	RSGB March 144 / 432MHz Contest, 1400 - 1400UTC.
2 / 3	ARRL International DX SSB Contest 0000 - 2400UTC, 160 - 10m.
9 / 10	**RSGB London Amateur Radio & Computer Show, Lee Valley Leisure Centre, Edmonton, London N9. Details 01923 893929.**
9 / 10	RSGB Commonwealth Contest 1200 - 1200UTC, CW only.
10	RSGB 70MHz Cumulative Contest, 1000 - 1200UTC.
10	Wythall RC Radio Rally, Silver Street, Wythall, near Birmingham. Details 021 430 7267.
16	RSGB HQ Saturday Opening, Lambda House, Cranborne Road, Potters Bar, Herts. 10.00am to 4.00pm. Details 01707 659015.
16 / 17	Russian DX Contest, 1200 - 1200UTC, both CW and SSB.
16 / 17	Bermuda Contest, 0000 - 2400UTC, both CW and SSB.
16 - 18	BARTG Spring RTTY Contest, 0200 - 0200UTC.
17	Nobreck Amateur Radio, Electronics and Computing Exhibition. Details 0151 630 5790.
17	Tiverton South Radio Rally. Details 01884 252259.
24	RSGB 70MHz Fixed Station Contest, 0900 - 1300UTC.
24	Pontefract and District Amateur Radio Society Rally. Details 01977 677006.
24	Bournemouth Radio Society Annual sale. Details 01252 845900.
30 / 31	*CQ* WPX SSB Contest, 0000 - 2400UTC, 160 - 10m.
31	Magnum Radio & Computer Rally, Irvine. Details 01294 215457.
31	Thames Valley Electronics Rally, Kempton Park Racecourse. Details 0494 450504.

APRIL

1	RSGB 80m Slow Speed CW Cumulative Contest, 1900 - 2030UTC.
2	RSGB 144MHz SSB Fixed Station Cumulative Contest, 1900 - 2100UTC.
7	RSGB first RoPoCo Contest, 0700 - 0900UTC, CW only, 80m.
7	RSGB 1.3 / 2.3GHz Fixed Station Contests, 1700 - 2100UTC.
9	RSGB 80m Slow Speed CW Cumulative Contest, 1900 - 2030UTC.
10	RSGB 144MHz SSB Fixed Station Cumulative Contest, 1900 - 2100UTC.
14	Bury Radio Society Rally. Details 0161 762 9308.
14	Cambridgeshire Repeater Group Annual Rally. Details 01223 811477.
14	Launceston Amateur Radio Rally. Details 01409 221624.
14	Swansea Amateur Radio Society Rally. Details 01792 404422.
17	RSGB 80m Slow Speed CW Cumulative Contest, 1900 - 2030UTC.
18	RSGB 144MHz SSB Fixed Station Cumulative Contest, 1900 - 2100UTC.
20	RSGB HQ Saturday Opening, Lambda House, Cranborne Road, Potters Bar, Herts. Details 01707 659 015.
21	RSGB Low Power Fixed Contest, 0700 - 1100UTC, CW only, 80 / 40m.
21	Microwave Round Table, nr Didcot, Oxon. Details 01488 638792 (evenings).
21	Dunkerque Rally, France. Details 00 33139 312800.
21	White Rose Rally. Details 0973 189276.
25	RSGB 80m Slow Speed CW Cumulative Contest, 1900 - 2030UTC.
27	Isle of Wight Exhibition, Wireless Museum, Puckpool Park, Seaview. GB3WM celebrating Marconi's birthday. Features a special display of very early Marconi equipment. Details 01983 567665.
28	British Amateur Radio Club Rally. Details 01788 890365.
28	Marske-by-the-Sea Radio Rally. Details 01642 475671.

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