D-I-Y RADIO

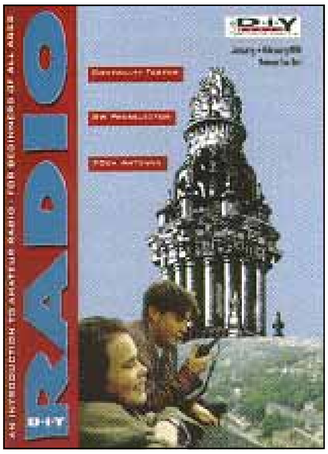
AN INTRODUCTION TO AMATEUR RADIO - FOR BEGINNERS OF ALL AGES

January • February 1996
Volume Six: No 1

CONTINUITY TESTER

SW PRESELECTOR

70CM ANTENNA



COVER PICTURE:
Emma, 2E1BVJ, and Matthew, 2E1BOO, admire the view - and the radio 'take-off' - from the top of the Wainhouse Tower. Feature: page 10. Photograph: G3UGF.

comment

TO CELEBRATE the start of a new year, we've re-designed the cover of *D-i-Y Radio* - we hope you like it. 1996 should see the launch of the Phase 3D amateur satellite, described in the last edition. It will also mark the lowest point of the sunspot cycle. There's even the possibility of a new amateur band being announced. It should be an interesting year on the air.

You can now subscribe to *D-i-Y Radio* 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 *Radio Communication*.
- If you are already an RSGB member, you can subscribe to *D-i-Y Radio* for an additional £7.65.

All of these subscriptions come with a joining pack, and further information can be found on pages 4 and 6 of this edition.

I hope you enjoy this *D-i-Y Radio*. Have a really good new year, and please keep writing to us and sending in your photographs.

Mike Dennison, G3XDV
Editor

CONTENTS

Radio components are the subject of our poster and Ham Facts.

CONSTRUCTION CODE

FOR THE COMPLETE BEGINNER . . . . (one symbol)

REQUIRES A LITTLE EXPERIENCE . . . . (two symbols)

FOR THE MORE EXPERIENCED (three symbols)

Japanese Girl Scouts: Front Row (l to r) - Misaki, 7K4GFJ; Marie, 7K2LQA. Back Row - Izumi, 7K1OUO; Jinbo, 7L2LQD; Sachiko, 7M1HDU. They are pictured with Yoko and Taizo Arakawa, JG3FAR and JA3AER/GW0RTA.

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
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SCHOOL SPACE LINK-UP

BELFAST ROYAL Academy's amateur radio club recently participated in a live radio link-up with German astronaut Thomas Reiter, DP0MIR, during his 135-day mission on board the Russian Mir space station. The school's 2m equipment was thoroughly checked out in preparation for the FM semi-duplex contact and a full turn-out of club members witnessed the event. Jonathan Chin, GI7NIL, asked about the preparations for the visit from the Atlantis shuttle crew and Thomas described the greetings they would receive on their arrival. Thomas and his Russian crewmates also sent greetings to the school and the city of Belfast.

RSGB DONATION TO SATELLITE PROJECT

THE 1995 President, Clive Trotman, GW4YKL, recently presented a cheque for £25,000 on behalf of the RSGB to Ron Broadbent, G3AAJ, for the AMSAT Phase 3D satellite project. Ron thanked the RSGB for its support and said that AMSAT-UK had already contributed over £110,000 towards the project. More details on Phase 3D were published in the November - December 1995 *D-i-Y Radio*. The satellite is now well on the way to completion, and is due to be launched by an Ariane rocket from French Guiana in South America towards the end of this year.

● AS FROM 1 January, the new address for the HQ of ISWL is: Mrs M H Carrington, G0WDM, Hon Secretary ISWL, 3 Bromyard Drive, Chellaston, Derby DE73 1PF.

Guides and Scouts get on the Air

MEMBERS OF the Girl Scout Gunma Troop 4 Amateur Radio Club in Tokyo, Japan, will be operating as JL1ZDL during *Thinking Day on the Air* (TDOTA), which this year is on 24 and 25 February. They hope to contact Girl Guide stations in the UK, so if you are involved with a special event station for TDOTA please look out for them. The girls are shown (opposite) with Taizo (GW0RTA / JA3AER) and Yoko (JG3FAR) Arakawa, who met them during a recent visit to Japan.

Back in October, Mrs Betty Clay, daughter of the Scouting movement's founder, Lord Baden Powell, visited a *Jamboree on the Air* station operated by members of the Taunton and District Amateur Radio Club. Mrs Clay sent a greetings message from GB2TWH, which was operated on behalf of the Taunton and District Scouts. She said that although Scouts and Guides abroad may be different to ourselves, through Scouting there are many similarities. All Scouts share the same aim - to improve their talents and skills so that they can help other people to lead a happier life.

● PLEASE NOTE that the RSGB HQ Annual Open Day will be on Saturday 4 May, and not as indicated in the 1996 calendar published in the November - December 1995 *D-i-Y Radio*.

OBSERVING AMATEUR RADIO

Patrick Moore meets F J Gregory, G3AQM, of the Norman Lockyer Observatory Amateur Radio Group in the new HF room at GB2NLO.

FAMOUS TV astronomer Patrick Moore recently opened new extensions to the Norman Lockyer Observatory at Sidmouth in Devon, thanks to a £125,000 grant from the East Devon District Council. The extensions include a planetarium seating 60 people and two new radio rooms equipped with HF and VHF demonstration stations. A permanent special event callsign, GB2NLO, has been issued to the station.

The observatory was set up in 1913, and radio has been used there ever since: Marconi himself was an early visitor. You can also visit the observatory on open days and certain nights throughout the year. Arrangements for group visits can be made by contacting the Secretary on 01395 568591.

THE FUTURE OF LICENSING

THE 1995 WORLD Radio Conference (WRC) discussed the proposal to delete RR2735, the international regulation requiring national administrations to test for proficiency in Morse code before allowing amateurs to operate on the HF bands (ie below 30MHz). It was agreed that the matter will be on the agenda at WRC 1999, which will give sufficient time to obtain a considered opinion on the matter from amateurs throughout the world.

As a result, the RSGB is to carry out a survey to find out amateurs' views on the qualifications and licensing structure necessary for the UK Amateur Service. RSGB Council recently approved a recommendation that the Society's Licensing Advisory Committee should supervise the survey which will cover all interested parties, whether members of the RSGB or not.

SW Receiver Pre-Selector

By Steve Ortmayer, G4RAW

A PRE-SELECTOR is a tuned radio frequency amplifier that is used between the antenna and the receiver's antenna socket.

WHY USE A PRE-SELECTOR?

THERE ARE SEVERAL reasons why a pre-selector may prove to be beneficial.

- To increase the signal level because the antenna in use is inefficient.
- To increase the sensitivity of an old receiver.
- To increase the signal-to-noise ratio of the received signal, because the receiver and antenna are located in an electrically noisy environment.

The pre-selector described here uses a tuned circuit with an FET amplifier in a 'grounded gate' mode. The reason for this arrangement, instead of the normal way of inputting the signal to the gate of the FET is for stability. An amplifier with a tuned circuit at both the input and the output has a tendency to oscillate because of the feedback from the one tuned circuit to the other.

The grounded gate FET does not give much gain but it is stable. The pre- selector tunes the 7, 10, 14, 18, 21, 24, and 28MHz amateur bands as well as the broadcast bands in between.

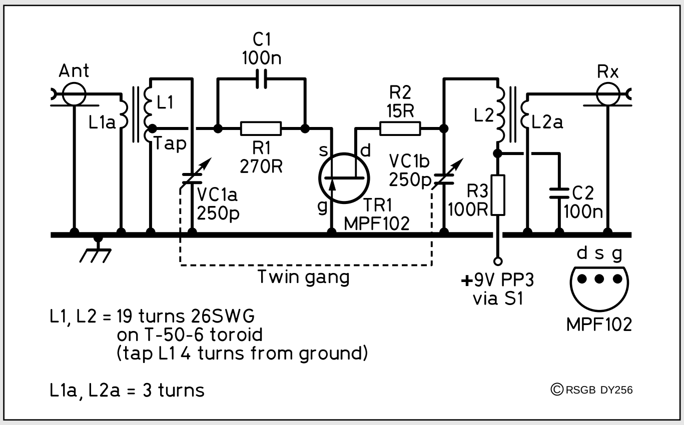


Fig 1: HF pre-selector, circuit diagram.

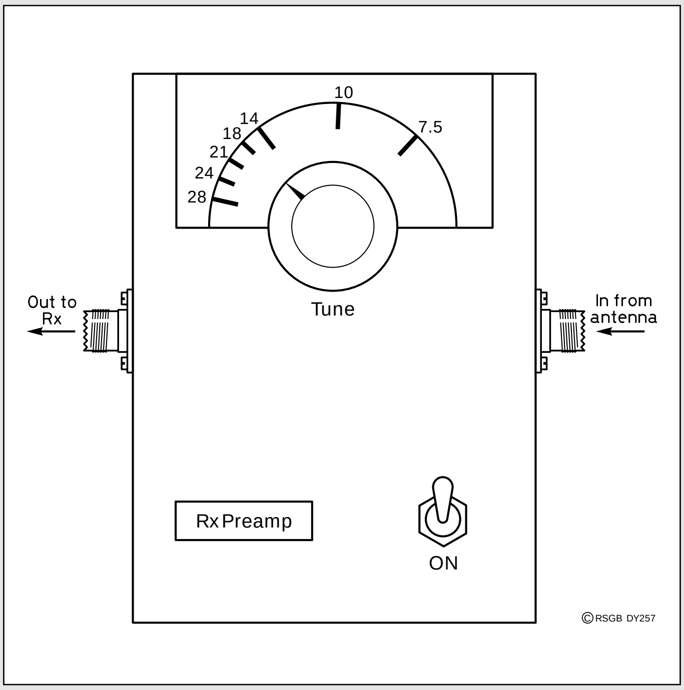


Fig 2: HF pre-selector, front panel layout.

CONSTRUCTION

THE CIRCUIT IS constructed on plain perforated board with the components pushed through the holes in the board and soldered together underneath to complete the circuit. Solder tags are used for an earth wire and when bolted to the case with stand-offs will earth the board.

COMPONENTS

Resistors - all 1/4 Watt carbon film resistors	
R1	270R
R2	15R
R3	100R
Capacitors	
C1, C2	100nF disc ceramic capacitors
VC1	250/250pF polyvaricon capacitor
Inductors	
L1, L2	19t 26swg on T.50.6 toroid tap L1 4 turns from ground end; L1A and L2A 3 turns over L1 and L2
Semiconductors	
TR1	MPF102 FET
Additional Items	
Aluminium box	12 x 9 x 3cm
Battery and snap	PP3 9V
SW1	ON/OFF Switch
Phono sockets or similar for input and output	

The board is mounted in a small aluminium box with a battery and an on/off switch. Sockets of your choice are used to connect the antenna and the receiver. The twin polyvaricon capacitor can be fitted with a pointer knob and a scale can be made to locate the bands covered.

When complete, check the wiring and connect to the low impedance (coax) socket of the receiver. Tune VC1 and a boost in the signal should be heard. Tune to the bands covered and mark the scale for reference.

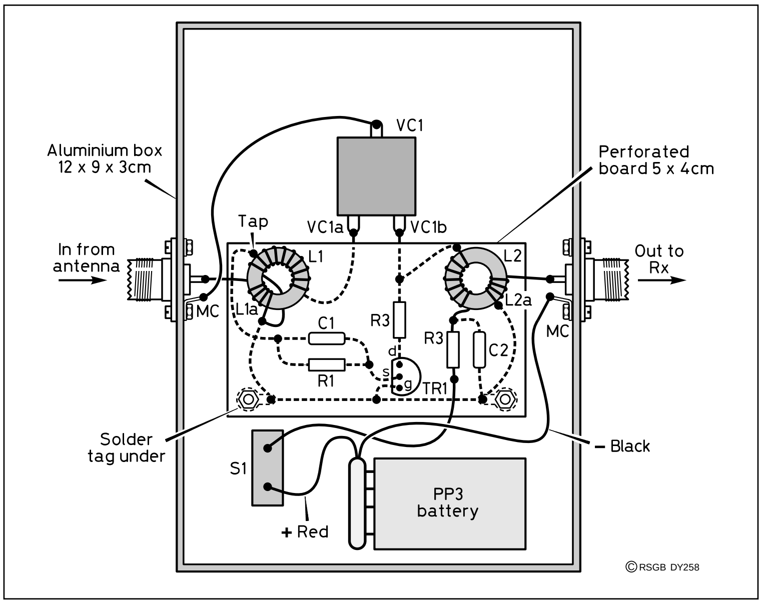


Fig 3: HF pre-selector, component layout.

Resistors and Capacitors

NO MATTER what the circuit is, the chances are it will contain resistors and capacitors. These two components are the most widely-used in electronics. Here we look at different types of resistors and capacitors in more detail.

FIXED RESISTORS

THESE ARE AMONG the most reliable components if correctly selected for the purpose. As the name implies, they resist the passage of current and in fact the unit 'ohm' is really the 'voltage per amp'. For many years resistors were made of a moulded mixture of **carbon** and binder, either painted or enclosed in an insulating tube.

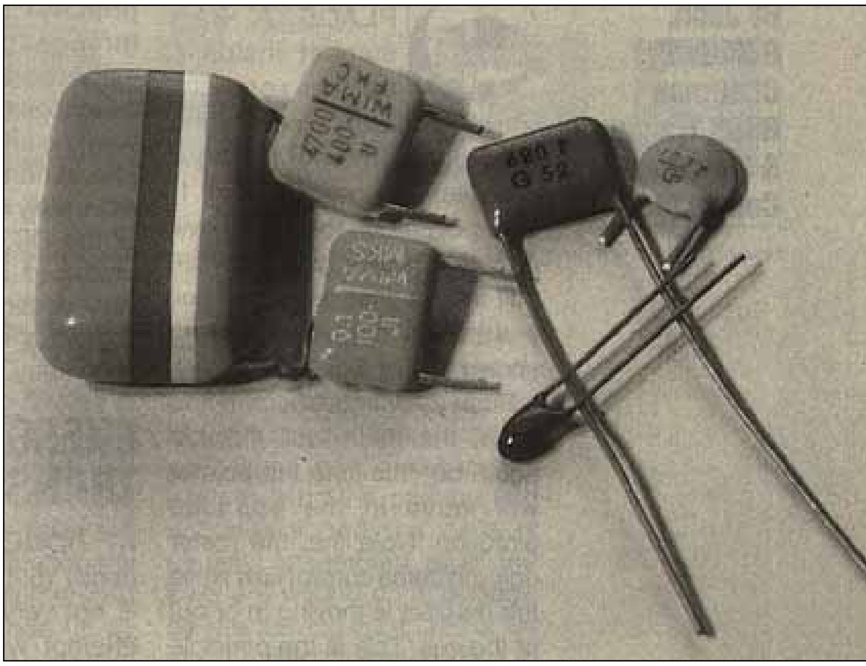
Tubes of carbon composition in various diameters with metallised ends are made for high-wattage dissipation. These may bear the trade name Morganite, and are suitable for RF loads. **Metal-film** resistors are more stable, less noisy and more reliable than carbon.

For higher powers, **wire-wound** resistors are used. More reliable ones are wound on a ceramic substrate protected by vitreous or silicone enamel, and for greater heat dissipation encased in an aluminium body which can be bolted onto the chassis or heatsink. Wire-wound resistors are of no use at radio frequencies owing to their inductance.

VARIABLE RESISTORS

OFTEN A RESISTOR has to be made variable, either for control or pre-set adjustment purposes, when it is usually called a **trimmer.** For versatility, variable resistors are made with a moveable tapping point, and this arrangement is called a **potentiometer**, or 'pot' for short.

Carbon composition, cermet, conductive plastic and wirewound construction are all used. Rotary tracks with both multi-turn and single turn are all available, both for pots and trimmers, in varying degrees of accuracy. Single-turn rotary pots for volume control and many other uses usually turn over 250°, with log and anti-log law as well a linear law being available.



Capacitors come in a variety of shapes and sizes.

FIXED CAPACITORS

CERAMIC CAPACITORS are the smallest and the loss factor is very low, comparable with silvered mica, and the value stays very nearly constant with temperature, applied voltage and life (stability).

Mica capacitors are larger than ceramic capacitors for a given value. Because they generally remain stable for long periods and have low loss they are used for tuned circuits and filters. The voltage rating and value are normally printed on the body.

Paper-dielectric capacitors were once much used, but are now only found as high-voltage smoothing capacitors and suppression capacitors for mains use. Paper capacitors are large and expensive for a given value, but are very reliable.

Common values of **plastic film** capacitors range from about 1nF (nanofarad) to several microfarads, and can be rated up to several kilovolts, components with the higher voltage ratings being able to replace paper capacitors in many applications. Tolerance is not usually important as these capacitors are unsuitable for tuned circuits but, as they may be used in resistor-capacitor timing circuits, 5% or better may be bought for increased cost. The value is marked either by colour code or printing, along with the tolerance and voltage rating.

Electrolytic Capacitors are much used for values larger than about 1µF (microfarad). The dielectric is a thin film of oxide on either aluminium or tantalum, and an electrolyte is used to contact the other plate.

Electrolytics are rated for a voltage at a specified maximum temperature. At full rating, some electrolytics have only 1000 hours of life. There is always an appreciable leakage current.

Now turn to our poster on pages 12/13 for more on components

Introducing Transformers

By John, GW4HWR, Chairman RSGB Training & Education Committee

PLACE A BAR magnet inside a coil then connect a sensitive milliammeter (a centre reading galvanometer if possible) as shown in **Fig 1**. The pointer of the meter will remain rock steady on zero, but pull the magnet out of the coil and the pointer will deflect as shown in **Fig 2**.

Push the magnet back in and again the meter will indicate again but this time the pointer will move in the opposite direction. Note that the meter only indicates current flow while the magnet is moving in or out of the coil. This is the principle on which the transformer operates.

DC AND AC

IN ITS SIMPLEST form the transformer consists of two coils wound either on top of one another or side by side. If a DC supply (such as a battery) is connected to one coil (the **primary**) the current flowing through it will generate a magnetic field but the field will be stationary and therefore will have no effect on the other coil (the **secondary**) but if a 50Hz AC supply is connected instead of the DC, the magnetic field produced by the primary will vary continuously and an AC voltage will be generated in the secondary. **Fig 3**.

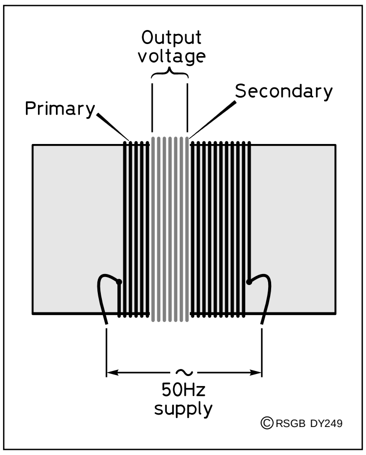


Fig 3: Layout of transformer windings.

ENERGY TRANSFER

AT DOMESTIC mains frequency (50Hz) this transformer is not very efficient and if an attempt were made to draw current from the secondary by connecting a resistor, the voltage across the secondary would fall to zero. This is because energy is transferred from primary to secondary by means of the **changing magnetic field** and the field produced by the primary is small unless the winding contains a great many turns. A considerable improve-ment would occur if an iron core was introduced into the coils as shown in **Fig 4** because with the same number of turns in the primary, the magnetic field created will be many times greater than before.

LINEAR RELATIONSHIP

FOR BEST RESULTS the core should be continuous, that is the magnetic field is contained

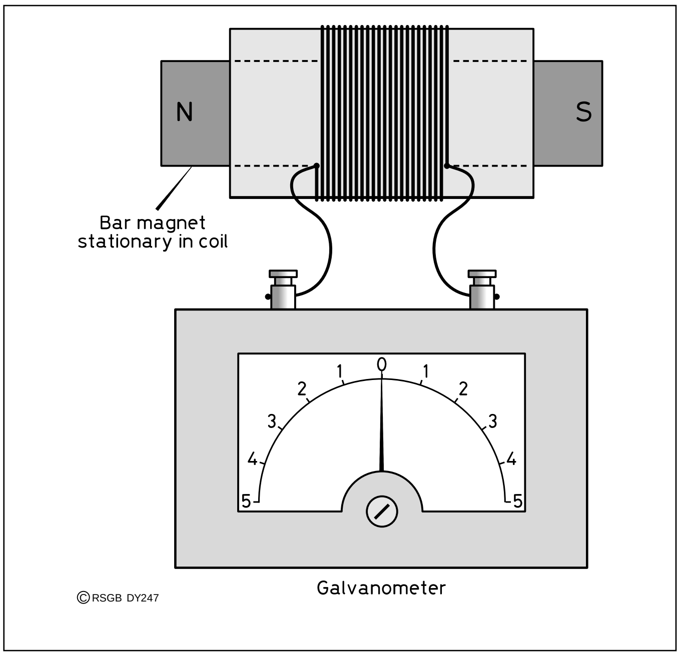


Fig 1: Galvanometer and coil with stationary magnet.

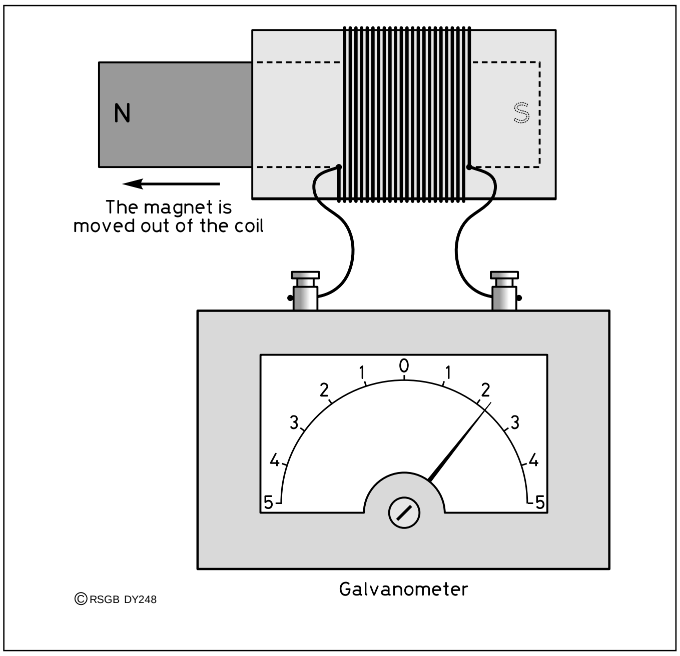


Fig 2: Galvanometer and coil with moving magnet.

wholly in iron and the cross section of the iron should be the same for all parts of the magnetic circuit. A core having a cross section of one square inch will enable just about 100 watts to be transferred from primary to secondary. The relationship is linear so that a core having a cross sectional area of 2 square inches will be capable of transferring 200 watts and so on.

However there is a serious snag - the magnetic field produced by the primary current treats the lump of iron as a very low resistance secondary winding which has its ends shorted together. A very high current flows in the iron causing considerable heat which would eventually result in the transformer burning up.

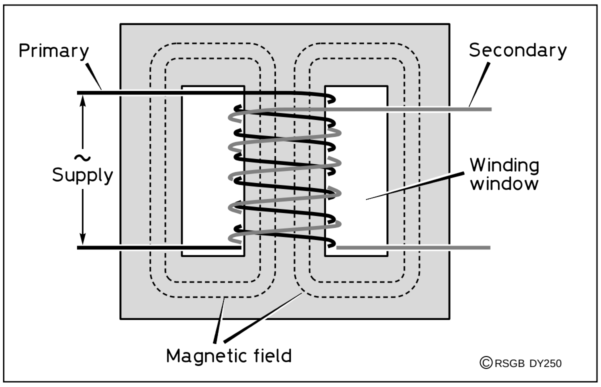


Fig 4: Layout of transformer windings on magnetic core.

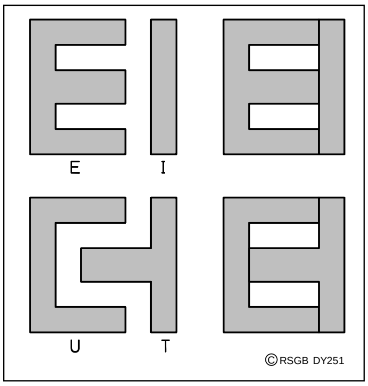


Fig 5: Arrangements of transformer laminations.

EDDY CURRENTS

THESE CURRENTS flowing in the core are known as **eddy currents** and are reduced to a very low level by making the iron non-conductive while still leaving its magnetic property intact. Instead of using a solid lump, the iron is made up by using a series of thin sheets or laminations each being coated on one side by an insulating material. The insulation is often in the form of paper, sprayed on in liquid form. This makes it easy to wind the primary and secondary and the core is usually assembled after the coils are wound on a **bobbin**, by interleaving Es and Is or Us and Ts. **Fig 5** should help to make this clear.

Another useful figure is the number of turns required on the windings. Again these figures only apply to transformers to be used on an input supply of 50Hz. First a figure for the 'turns per volt' is established, it is again linked to the cross sectional area of the core - 1 square inch of core requires 8 turns per volt but this time the relationship is in inverse proportion in other words a core of 2 square inches will require only 4 turns per volt. Once the 'turns per volt' is known the rest is easy. For a transformer with a core of 2 square inches (and therefore 4 turns per volt) a primary winding which is to be connected to 240V 50Hz supply, will need 240 x 4 = 916 turns. If the secondary is to supply 12 volts its winding will need 12 x 4 = 48 turns.

Finally the size of the wire required can be found from charts known as copper wire tables together with the winding space required which will in turn determine the size of the winding window as indicated in Fig 4.

A Towering Success

by Emma Constantine, 2E1BVJ

ONCE UPON a time, so the story goes, two men courted a beautiful young lady. The maiden married the rich man, to help her starving family, and although he was kind and he built her a beautiful garden, he was a very jealous man. So much so that he constructed a walled garden, so that no man could see her walking in the grounds. The poor man never stopped loving her, and longed to see her again. He eventually made his fortune in the cloth trade, owned a mill, and with his wealth constructed a huge stone tower, so high that he could see his love from his room, at the top.

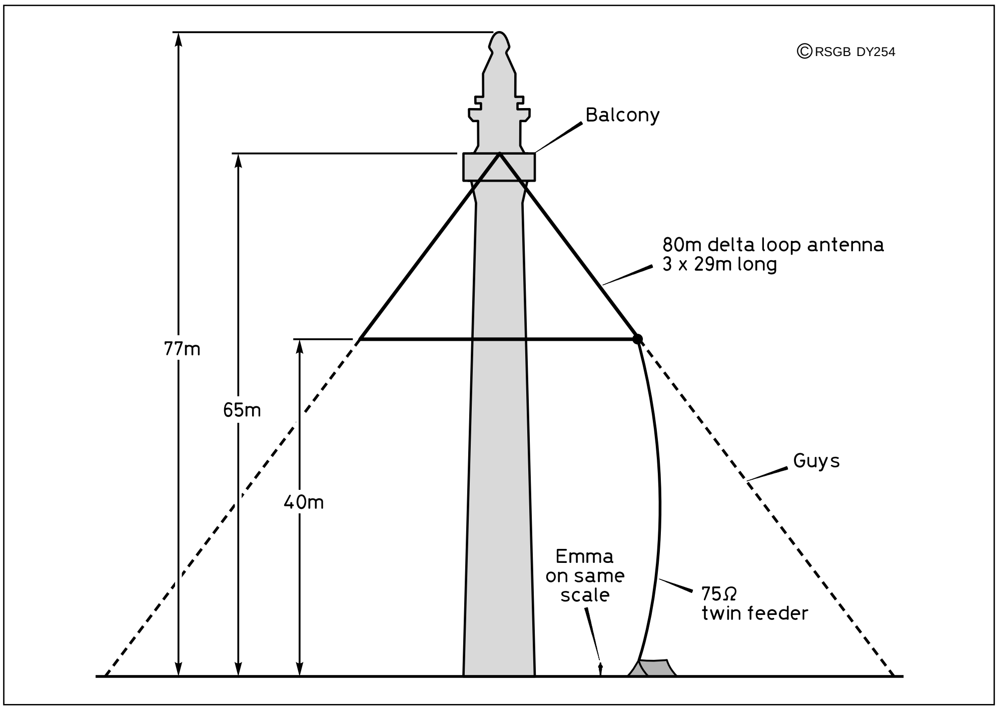
THE WAINHOUSE TOWER

IT'S A NICE STORY and there is some truth in it, but the reality is that the Wainhouse Tower, all 253 feet of it, is actually a Victorian dyeworks chimney, built in the 1890s, although never used for its original purpose. Every year, the Halifax radio club meets there to celebrate the exploits of the legendary local wireless pioneer, Percy Dennison, 2KD. His adventures would fill a book and include many radio firsts in the 1920s, using the Wainhouse Tower to support his antennas.

Imagine then our delight when they offered to let members of Rishworth School Radio Club take part in this annual event, and gave us the chance to use their 'monster' 80m delta loop antenna, almost 70m high, over the spring Bank Holiday weekend.

Many amateurs spend a lifetime getting by and work some excellent DX with make do and mend antennas which have to fit into a pocket size garden. However, if you hear any of those big DX signals booming in on any of the high frequency bands, and listen to their antenna set ups, it just makes you green with envy. My dad [Richard Constantine, G3UGF - *Ed*] says "There's no substitute for metal in the sky" when it comes to antennas, but I think that saying is even older than he is!

Even though we Novice operators enjoy meeting at school every Saturday morning in term time (yes, we do go there of our own free will!), there comes a time when you have to break out and do something different. This was our chance to experience full-size antennas with real gain, the kind that are beyond the dreams of most amateur operators.

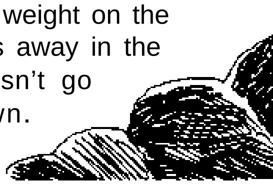


This drawing shows the sheer scale of the Wainhouse Tower and the 80m delta loop aerial used by Emma Constantine, 2E1BVJ.

THE CHALLENGE

HAVING RECENTLY managed - by the beg, borrow and otherwise obtain method - an HF station, the club was looking for a new challenge and a chance to use the 'big rig' for real. The club call is G0SQA, which we all say stands for "Silly Questions Answered" - not bad for a school radio club! Well, SQA number one coming up:

How do you raise an antenna up a tower, 65 metres above the ground? Answer: first, you run up a spiral staircase of more than 300 steps (I lost count half way up and ran out of breath), in the dark, then you lower some 200 metres of rope over the side with a weight on the end. This blows away in the wind, and doesn't go straight down. Then you chase the end of it



Four of the youngsters from Rishworth School Radio Club joining in the fun at G0SQA/P. From left to right: SWL Alex, SWL Toni (aged 9, who's taking her Novice exam soon), author Emma Constantine, 2E1BVJ, and Matthew Constantine, 2E1BOO, with the microphone.

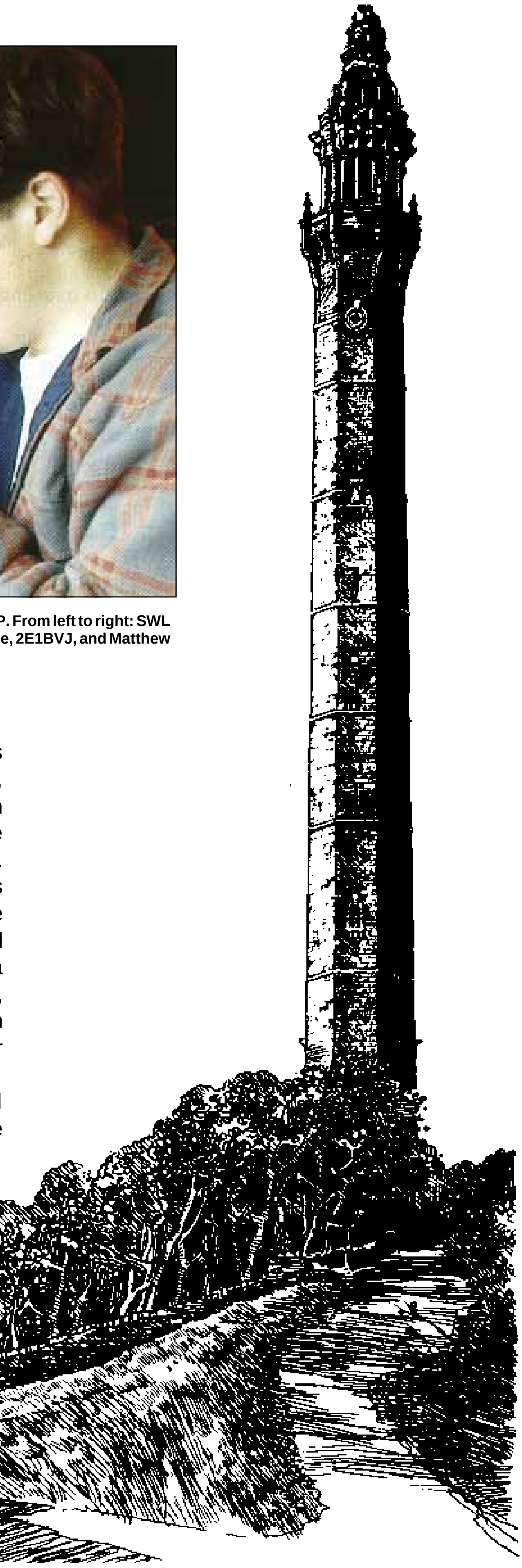
over three fields and a graveyard and drag it back. Once you have wrestled it to the ground, you smile sweetly at the strong men of the Halifax radio club, who sweat and strain whilst hauling it up into the air, trying not to tangle or kink the huge triangle of copper-coated steel wire, which may cause it to break before you have even called CQ.

Once up, you have to anchor down the men hanging on to each of the two bottom corners, before they too blow away or get hauled up the tower by the enthusiastic crew at the top. Communicating by means of 70cm handhelds whilst you do all this is an absolute must, as it is too far to shout and far less dangerous.

ON THE AIR

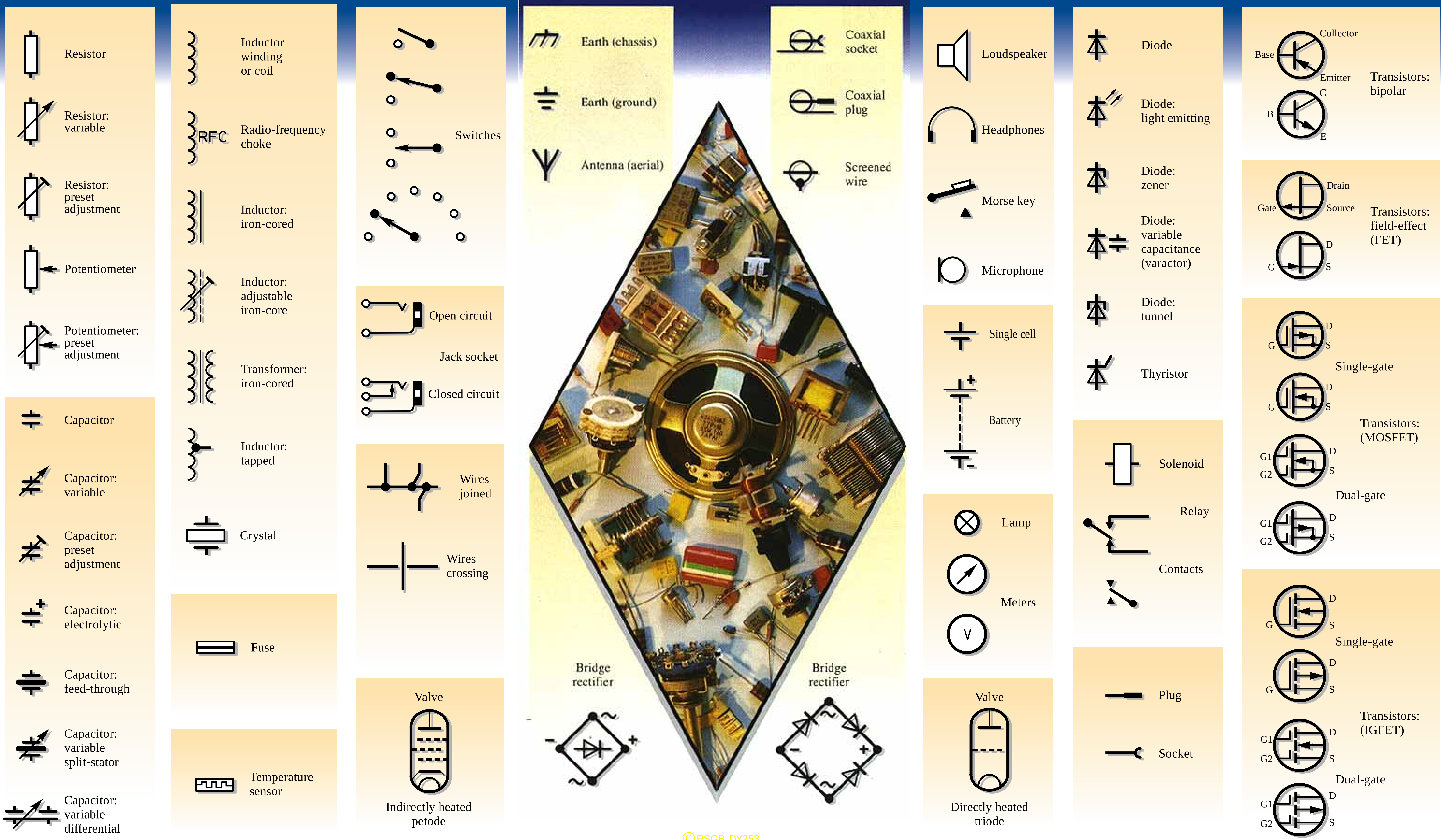
THE END RESULT of all this effort was a great two days, under canvas, using the 80m full-size delta loop, in what were really very poor radio conditions. In spite of the high noise levels and poor conditions, we Novice operators were able to work all Europe, and into Asia, Africa and Central America on 80m, as well as experience the gain of the antenna on the higher bands.

It was a great experience and we are looking forward to the next challenge - when the guys from the Halifax club get their breath back. Thanks fellas!



DRAWING COURTESY OF CALDERDALE COUNCIL

Amateur Radio & Circuit Symbols



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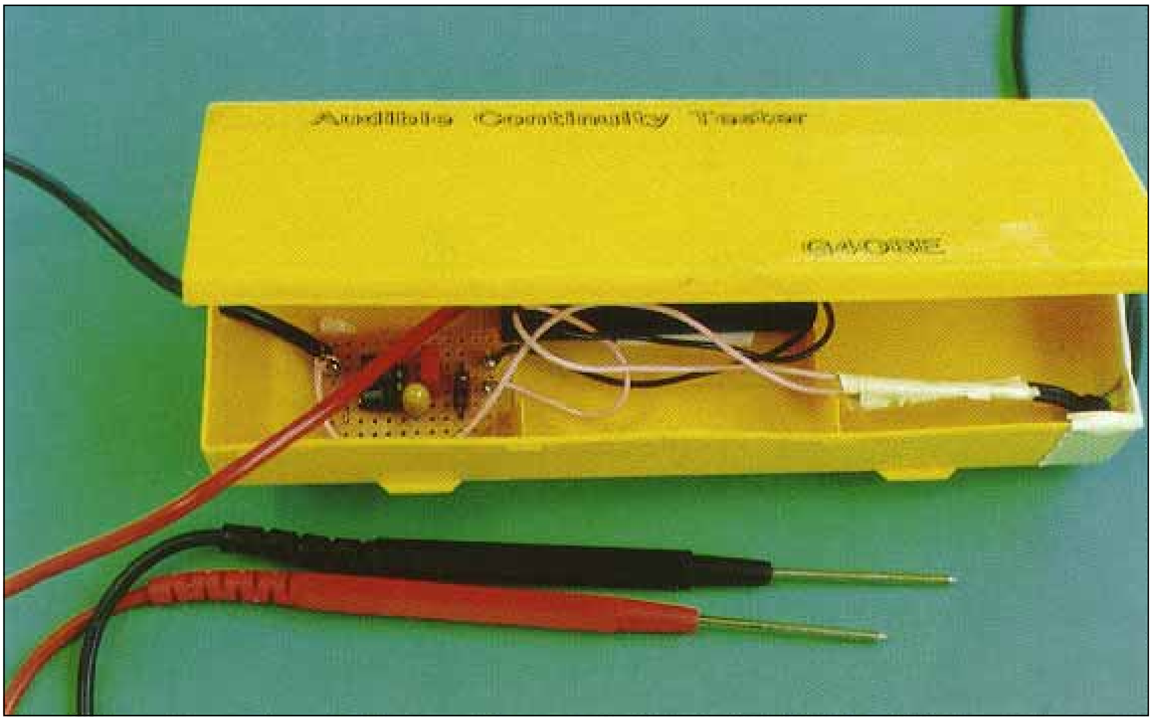
An Audio Continuity Tester

By Robert Snary, G4OBE



THE IDEA OF testing for continuity is very simple in that it proves if there is a good connection between two points in a circuit. The tester in its simplest form can consist of a battery and a bulb. Continuity can also be tested using an ohm meter. With this method of testing you have to look at the bulb or the meter at the same time that you are probing around in the circuit trying to check continuity.

The most convenient way of testing for continuity is to use a method that gives an audio indication that continuity exists. You could use a buzzer and a battery but this can lead to the current required for the buzzer being high enough to damage components, particularly as the current is intermittent with high current 'spikes'.

The tester described here uses an integrated circuit to act as the oscillator which drives a high impedance (64 Ohm) Loudspeaker.

CIRCUIT DESCRIPTION

THE INTEGRATED CIRCUIT IC1, see **Fig 1**, is usually used as an oscillator to flash an LED (Light Emitting Diode) from a 1.5 Volt source, with a low power consumption. However, in this case, the IC is used to act as an audio oscillator. Although the IC will provide enough drive for a low impedance speaker, the use of a higher impedance speaker ensures a low current drain. The oscillator frequency is determined by the resistor R1 and capacitors C1 and C2. It is also affected by the supply of voltage as well as any resistance between the test probes. Although any AA size battery can be used alkaline types are recommended as they have a lower internal resistance and are less likely to leak.

CIRCUIT CONSTRUCTION

The circuit could be built 'Dead Bug' style with components soldered directly between the component leads but for neatness it is better to follow the Veroboard layout shown in **Fig 2**. The unit is built on a piece of Veroboard measuring 7 strips by 15 holes, and four track cuts need to be made as shown in the diagram (these are underneath IC1). Once the track cuts have been made then the

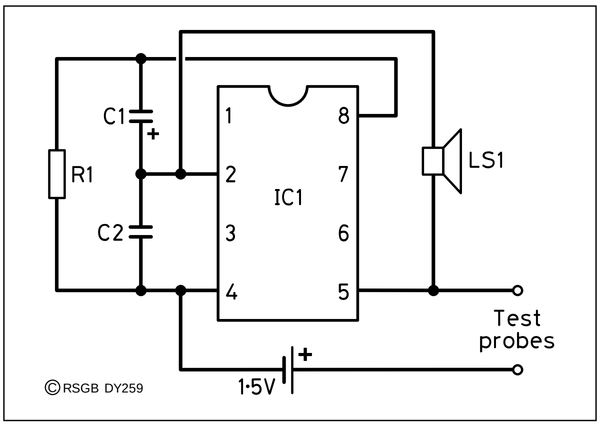


Fig 1: Continuity tester, circuit diagram.

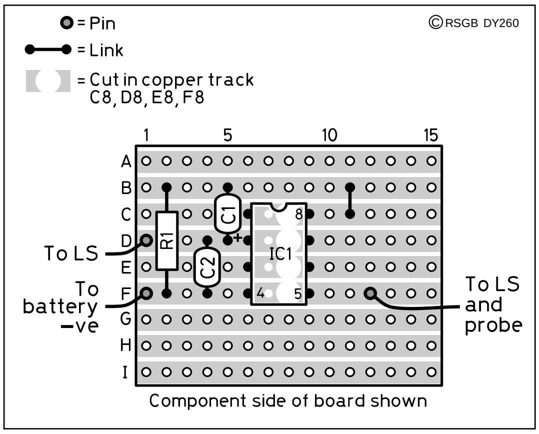


Fig 2: Continuity tester, component layout.

Veropins should be carefully soldered in place, followed by the wire link. Although no IC holder was used in the prototype I would recommend that you use one and this should next be soldered into place. Note the polarity of the capacitor and check that it is place the right way round.

After the components are all soldered in, a quick visual check of the board should be made before connecting the off board leads and inserting IC1 into the socket.

The two probes were made from a pair of meter leads purchased at a rally. An alternative method is to make the probes from thick (1.5 - 2mm) copper wire fixed into an old Biro pen case with the centre removed.

The circuit was originally tested with a high impedance loudspeaker from an old transistor radio found in my spares box. However high impedance loudspeakers are at times difficult to come across so an alternative is to use a pair of cheap 'Walkman' type headphones which are usually 32Ω Impedance per ear piece. These are then connected so that the loudspeaker connections are made to the 'Tip' and 'Ring' of the stereo jack on the headphones (**Fig 3**). This puts each ear piece in series and the total impedance is therefore 64Ω. Use a stereo socket so that the tip and ring can be connected to the circuit. Alternatively, remove the jack plug from the headphones, connect the braiding of the screened wires together and connect the centre wires directly to the circuit board.

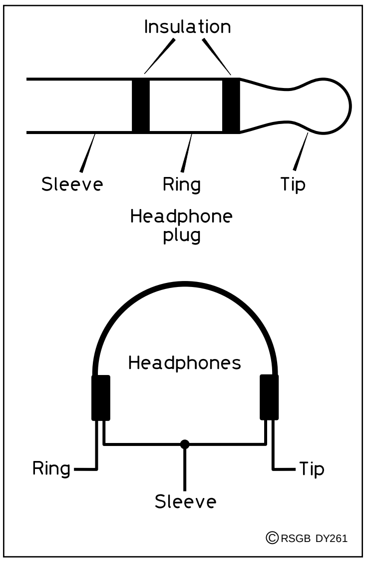


Fig 3: Headphone connections.

TESTING

BEFORE POWERING UP the circuit ensure the back of the Veroboard is clear of copper bits and that all the soldered joints are good. Make sure there are no solder bridges (solder shorting one track to another).

Make sure that the IC is correctly positioned and that all the track cuts and the link are in the correct place. Then the battery can be inserted into the holder. When the probes are connected together you should hear a tone from the loudspeaker or headphones.

BOXING THE PROJECT

THE CASE THAT WAS used for the prototype came from one of my other hobbies, photography, and is in fact the box some slides arrived in after being processed. Any plastic box is suitable and the board and battery holder can be fixed using double sided tape.

IN USE

THE CONTINUITY TESTER will give a different note between a short circuit and low value resistors and so will indicate continuity as well as possible poor soldered joints. The higher the resistance the higher the pitch of the buzz in the headphones or loudspeaker.

The tester will also indicate a coil or inductance by the sound of the note. It is worthwhile experimenting with checking different value resistors before using the circuit for serious fault finding.

IMPORTANT SAFETY NOTICE

THE CONTINUITY TESTER should only be used on equipment which is switched off and disconnected from any power source.

COMPONENTS

Resistors

R1	1kΩ 0.25 Watt 10% carbon resistor

Capacitors

C1	10µF Electrolytic
C2	0.1µF subminiature polyester capacitor. A ceramic capacitor can also be used.

Semiconductors

IC1	LM3909N

Additional Items

- 64Ω miniature loudspeaker, or pair of Walkman type headphones (see text). If the headphones are used a 3.5 mm stereo socket also is needed to allow connection of the headphones to the rest of the circuit.
- IC Holder
- Veropins
- Wire
- Two test leads. See text for details of how to make your own.
- Battery holder for a single AA battery
- Veroboard 7 strips by 15 holes

Components are available from JAB Electronics Components, 1180 Aldridge Road, Great Barr, Birmingham B44 8PB.

2's Company

News and Reports from Novice Licensees

NEWS THIS time of another Novice licensee who helps to run a radio club. Mrs Kath Wilson, 2E1CNY, is the membership Secretary of the UK FM Group (Western) which sponsors no less than 16 repeaters covering the North-West of England, and North Wales. If you use repeaters in that area, drop Kath a line to find out how to contribute to their upkeep.

CONTESTS

THE NOVICE section of the UK Six Metre Group's Summer Contest was won by E P Williams, 2E1AFN/P who scored 129,150 points from 88 contacts on the 50MHz band.

Poole Radio Society has published the results of their first National Novice Contest. This took place last September on the 50 and 432MHz bands. The 50MHz winner was James Mortimer, 2E1CXE, from Leicester, whilst on 432 the top place went to Joy Fowler, 2E1DXA/M, in Derbyshire.

The two winners received cups, as did the sender of the neatest hand-written log, B Cannon, 2E1DZQ, and all entrants were sent a certificate to commemorate the event. A full report on the National Novice Contest appears in the January 1996 edition of *Ham Radio Today*.

The diagrams in *D-i-Y Radio* are drawn on a computer by Technical Illustrator Bob Ryan, who is 2E1EKS.

VHF CONVENTION

IF YOU HAVE ANY interest at all in building for, or operating on, the VHF, UHF or microwave bands, you'll find something for you at the RSGB VHF Convention which is to be held on Sunday 18 February.

The venue is Sandown Exhibition Centre, Esher, Surrey, and the packed programme includes a trade show, talks, RSGB committees and trophy presentations. Further details can be obtained from Marcia at RSGB HQ (tel 01707 659015). See you there.

THE LOG BOOK

EVEN THOUGH we are probably several years away from the return of spectacular world-wide openings on 50MHz, it is still worth checking that band from time to time. Even under absolutely 'flat' conditions, distances of several hundred kilometres can be worked even with low power and simple antennas. By way of an example, 2E1CSD in Grantham, Lincolnshire, worked **GD**4XTT on the **Isle of Man** using 3W on 22 October**,** Sweden. During 1995, 2E1AIU in Essex worked 28 countries, and 2M0AEU (now GM0WDD) in Edinburgh worked over 33 countries on 50MHz. A new country for almost everybody was the appearance of **3V8**BB, a club station in **Tunisia**, on 50MHz during October.

Marios Nicolaou, 5B4WN, is a Cypriot medical student at Nottingham university. Here he is operating during the *CQ* World Wide SSB contest.

3V8BB was also much in evidence during the *CQ* World Wide DX contests, both in the SSB event in October and the CW leg a month later. Even if you do not compete in these major HF contests, they still provide an excellent opportunity to hear or work new DX countries. Propagation conditions were particularly good during the SSB event, with over 100 countries being worked from the UK on each of 10, 15, 20, 40 and 80 metres. What was unexpected was the good propagation on the 28MHz band, with a number of **VK** (**Australia**) and **ZL** (**New**

Band by Band

The Amateur Radio Spectrum: The 12 metre Band

TWELVE metres, the 24MHz band, is one of the three so-called 'WARC Bands'. It was allocated to amateurs during the World Administrative Radio Conference (WARC) in 1979 along with 30 and 17m. It is only available to amateurs with the full Class A licence.

It is a particularly useful band to those running low power (QRP) or using simple antennas, such as the dipole shown in **Fig 1**. This is because relatively fewer stations use the band (compared with, say, 20 or 15 metres) and therefore there is generally less interference, allowing weaker signals to be more easily heard.

Propagation is similar to that experienced on the 15 metre band (see *D-i-Y Radio,* September - October 1995) although, being higher in frequency, it is less reliable than 15m during **sunspot minimum** years. But good **DX** (long distance) signals can still be heard, particularly on north - south paths, such as from South Africa or South America.

It may prove difficult to find a cheap receiver kit which covers the 12m band, so an old second-hand receiver or transceiver may be the answer for those on a tight budget. Do check, though, that older equipment covers the band: all modern commercial HF transceivers cover 12m, but equipment from the 1970s may not!

A simple **half-wave dipole** (see Fig 1) will generally work quite well on 12m, because it can easily be erected at a half-wavelength above ground, which in this case is only about 6m or 20ft.

When rare DX stations show up on 12m, there can be plenty of competition to work them. However, no contests are permitted on this band, so 12m is often used by amateurs wanting more 'leisurely' contacts.

BAND FACTS

Allocation: 24.890 - 24.990MHz (Full A licence only)
Activity: 24.890 - 24.920MHz CW, 24.920 - 24.929MHz Digital modes and CW, 24.931 - 24.990MHz SSB phone.
Notes: 24.929 - 24.931MHz should be kept clear for international propagation beacons.

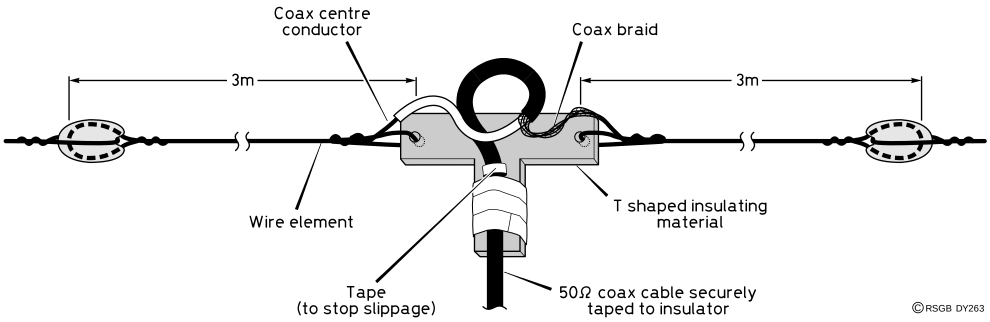
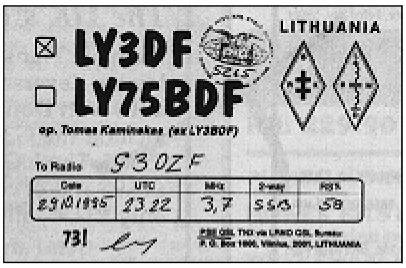


Fig 1: a simple half-wave dipole for the 12m (24MHz) band. If possible, it should be erected at least 20ft high, and as far away from other objects as possible.

THE LOG BOOK

Zealand) stations in people's logs, which is very unusual at this stage in the sunspot cycle. Another very rare DX country worked on 28MHz, as well as other bands, was **Myanmar** (formerly Burma), from where both **XY**1HT and **XZ**1A were active.

Other interesting stations logged during the *CQ* World Wide SSB contest included **ZC4**DX (**British Sovereign Bases on Cyprus**) - this was a British expedition specifically for the contest, **KH0**AM (**Northern Mariana Islands** in the Pacific), **6D**2X (a special prefix for **Mexico**), **KC6**MW (**Republic of Belau**), **VQ9**IO (**Chagos Archipelago**), and numerous stations in the Caribbean area, including **VP2E** (**Anguilla**), **VP2V**F (**British Virgin Islands**), **VP5**WW (**Turks and Caicos Islands**) and **V2**6B (**Antigua**).



QSL card from LY3DF, who was worked during the *CQ* World Wide SSB contest.

There are a number of contests during January and February, most of which concentrate on the lower-frequency bands - 40, 80 and 160 metres. The *CQ* World Wide 160m Contests are on 26 - 28 January (CW) and 23 - 25 February (SSB). Both events start at 2200UTC on the Friday and end at 1600UTC on the Sunday. There are also several RSGB contests: the Affiliated Societies (or 'AFS') Team Contests on 14 January (CW) and 20 January (SSB), the 1.8MHz CW Contest on 10 / 11 February, and the 7MHz CW DX Contest on 24 / 25 February.

Joining the 'Band' Wagon

by Peter Wood, G0HWQ

ARE YOU HANGING around on the edge of this glorious hobby of amateur radio wondering whether or not it's for you? Tony Hancock who did that skit on TV all those years ago has a lot to answer for. But the slightly eccentric image of the hobby is no more and you don't need to be a mad scientist to build some of your own gear either!

So could you do it? From my experience the answer has to be a resounding 'YES'. The most important incentive for me was to get listening cheaply on the short-wave bands. I had soldered the odd wire but never tackled such a project before. I have since made up several projects from kits and would like to tell you about a couple that might set you on the road to construction and perhaps to obtaining an amateur licence yourself.

I CAN DO THAT

MY INTEREST in amateur radio was kindled dramatically back in 1985 when my family and I were staying with friends in the Midlands for a short period. One, an old school friend was now a 'licensed amateur' and he offered to give us a demonstration. The experience had an amazing effect on me. I had listened to broadcast radios all my life but had never thought seriously of being able to talk back to the people I was hearing! It was a case of "I could do that", but I had no idea of what was involved. I was impressed by the possibility of being able to talk with my old school pal from my home in South East England.

THE BUG

WHAT I HAVE just described is commonly known as 'catching the bug'. The effect was an overwhelming urge to obtain a short-wave receiver so I could listen to radio amateurs doing what I hoped to do myself eventually - talking to others around the world.

I joined a radio club where I tried to get some idea of what it was I needed. Members quizzed me on my long-term intentions. Why wasn't I studying for the Radio Amateur's Exam (RAE)? Which bands was I interested in? How did I know? What bands were there? A scan of the many radio magazines I had bought didn't shed much light on the subject either. Most of the second-hand short-wave receivers for sale were identified by model numbers which meant nothing to me. The prices seemed ridiculously high for what might, for me, just be a passing phase and the local electronics shop didn't have a lot of suitable second-hand gear in stock.

What to do? During my avid reading of the radio magazines, I'd spotted some short-wave receiver kits and wondered if I might be able to put one together. In the end I took the bull by the horns and bought a kit. Since that time I have gone on to sit the RAE and take the Morse Test, and have held a licence now for several years. The first receiver I built myself holds a special place in my affections. It has been lent to others showing a gleam of interest in the hobby. I have no pretensions to special technical knowledge or a background in electronics, so read on.

BUILD A KIT

C M HOWES Communications at Daventry, Northants and Kanga Products of Folkestone, Kent both produce a range of kits which include what are called short-wave *direct conversion receivers*. Both of those I built (one from each company) run from a recommended 12 to 14V DC supply. They will, however, run from a 9V battery.

The one I put together at the beginning of my amateur radio career was the 80m version from C M Howes. More recently by way of a comparison I built the 'Sudden' 40m direct conversion receiver designed by George Dobbs, G3RJV, who is the vicar of Sudden in Rochdale.

The 80m kit was the first project I had tackled but this did not matter a bit. The instructions are exceptionally clear and include tips on soldering. Any potentially tricky bits are anticipated so that you are forewarned, making them quite easy. No special tools are needed, either, apart from a small-tipped soldering iron, some small side-cutters for stripping wire, a small trimming tool for adjusting the core of the coil during the simple 'alignment', or setting up, stage at the end and a pair of long-nosed pliers. (A set of tweezers will do for the latter if we are talking basics!)

PARTS SUPPLIED

BOTH PRODUCTS come with a full list of parts together with details of how to identify them, circuit diagrams and other useful information, including (in the case of the Howes kit), details about erecting a simple dipole aerial.

All the parts needed are supplied but you are advised to check them before you start. In the case of the Howes kit, the printed circuit board (or PCB) on which the parts are to be fitted, is marked with the shape of the components so it's very difficult to get it wrong. The essence of a successful project is to check you've got the right component wired into the right holes **before** you solder, and check your work at the end of each stage as you progress.

Soldering the components on the PCB of either kit can take less than an hour but why hurry? Both receivers worked first time, once I had discovered that I had wired up the socket for the loudspeaker on the Howes receiver back to front - an easy mistake to make as you near the exciting point of finding out if it's going to work or not.

It is hard to imagine the pleasure in putting together a project that actually works. I began with my first receiver to learn about amateur radio in a serious way. This proved to be very helpful basic work when I came to study for the RAE.

Several years later, I also enjoyed putting together the 'Sudden', which really did work first time. It, too, is out on loan now, encouraging someone else to join the ranks.

Experimental 430MHz Antenna

Make this easy-to-build high-gain antenna for the 70cm band.

MOST OF THE antennas that you will know are of the type known as **resonant** antennas. Antennas are broadly classified as either **standing wave** (resonant) or **travelling wave** (non-resonant). Standing wave antennas, such as a dipole, are narrowband (operate over a narrow range of frequencies), whilst travelling wave systems are broadband (able to work over a wide range of frequencies).

The **rhombic** is an example of a travelling wave (non-resonant) antenna. It is usually used for fixed commercial and military short-wave radio links. It is constructed with wire, in a diamond configuration, supported by four masts. It is very effective with lots of **gain** (the ability of an antenna to transmit or receive more effectively in one direction at the expense of other directions - see **Fig 1**) and its dimensions are not at all critical. However, it has not found its way into amateur radio use because of the amount of space it takes up. For example, an effective rhombic needs each side of the diamond shape to be at least two wavelengths long. A rhombic antenna for the 20 metre band would have to be supported on poles some 40 metres apart. Another dis-advantage is that, with such a structure, it cannot be rotated!

The rhombic will work over a wide range of frequencies. At HF it is possible to design a rhombic that will work on the 7, 10, 14, 18, 21 and 28MHz bands. A rhombic for the lower VHF frequencies could be made to work on the 50, 70 and 144MHz bands.

Its main disadvantage (large size) is less of a problem at UHF. You can make a portable rhombic for the 70cm band so that you can have fun working DX from high ground, even with your handheld transceiver.

The antenna described in this article has a gain of up to 9dB over a dipole. Connecting your transmitter to an antenna with 9dB gain is the equivalent of increasing the power of your transmitter eight times - and it increases received signals by the same amount. The horizontal polar diagrams of the small rhombic antenna and a dipole are compared in Fig 1 (The dipole has the figure of eight pattern).

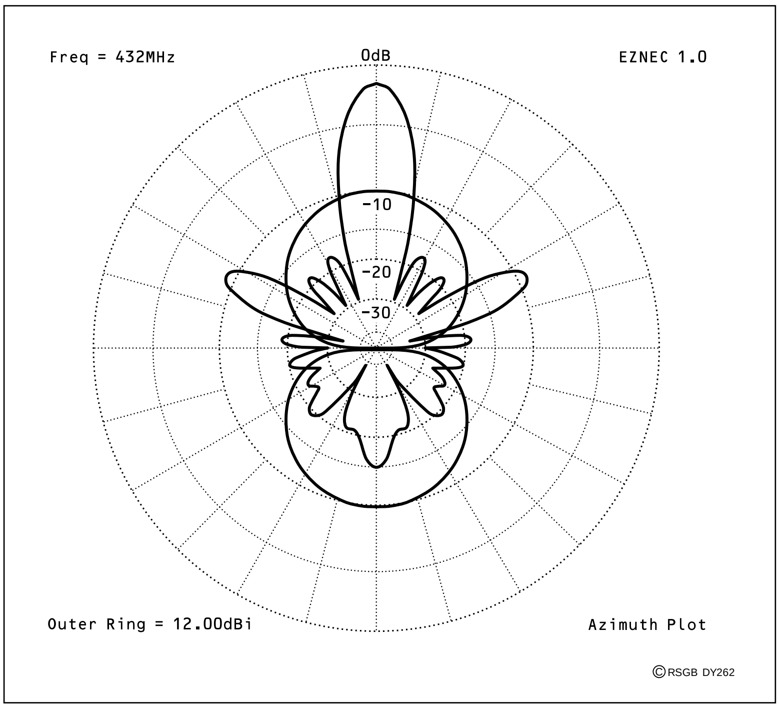


Fig 1: The horizontal polar diagrams of the small rhombic antenna and a dipole compared.

Unlike the Yagi this antenna has no critical dimensions, so you don't have to worry if the size is not within a couple of cms. Additionally it can be folded up to be transported in a car - or even on a bicycle!

A rhombic has a fairly high **feed impedance** and is usually fed with balanced twin feeder. If we are to use 50Ω coaxial cable to feed it we need a matching transformer. A half wave coaxial balun (**bal**ance to **un**balanced transformer), constructed from a halfwave length of coaxial cable, can be used. This device is a four-to-one stepdown transformer, which matches the balanced antenna to the unbalanced coax feeder.

ANTENNA CONSTRUCTION

THE ANTENNA FRAME is made of 1cm x 2cm wood strips fixed to a plywood centre, using 30mm long M4 bolts, as shown in **Fig 2a**. The outer bolts fixing the front and side wire supports can be removed so that the antenna can be folded up for transportation, as shown in **Fig 2b**.

The wires are fixed to the front and rear wire supports using screw connectors, see Fig 2a, details X and Y. The wire is fed through holes in the side wire supports.

The antenna is fixed to a mast using a small shelf bracket. One end of the bracket is fixed to the plywood centre using the same bolts that hold the wood rear wire support. The other end of the bracket can be fixed to the mast using either screws or a hose clamp (jubilee clip).

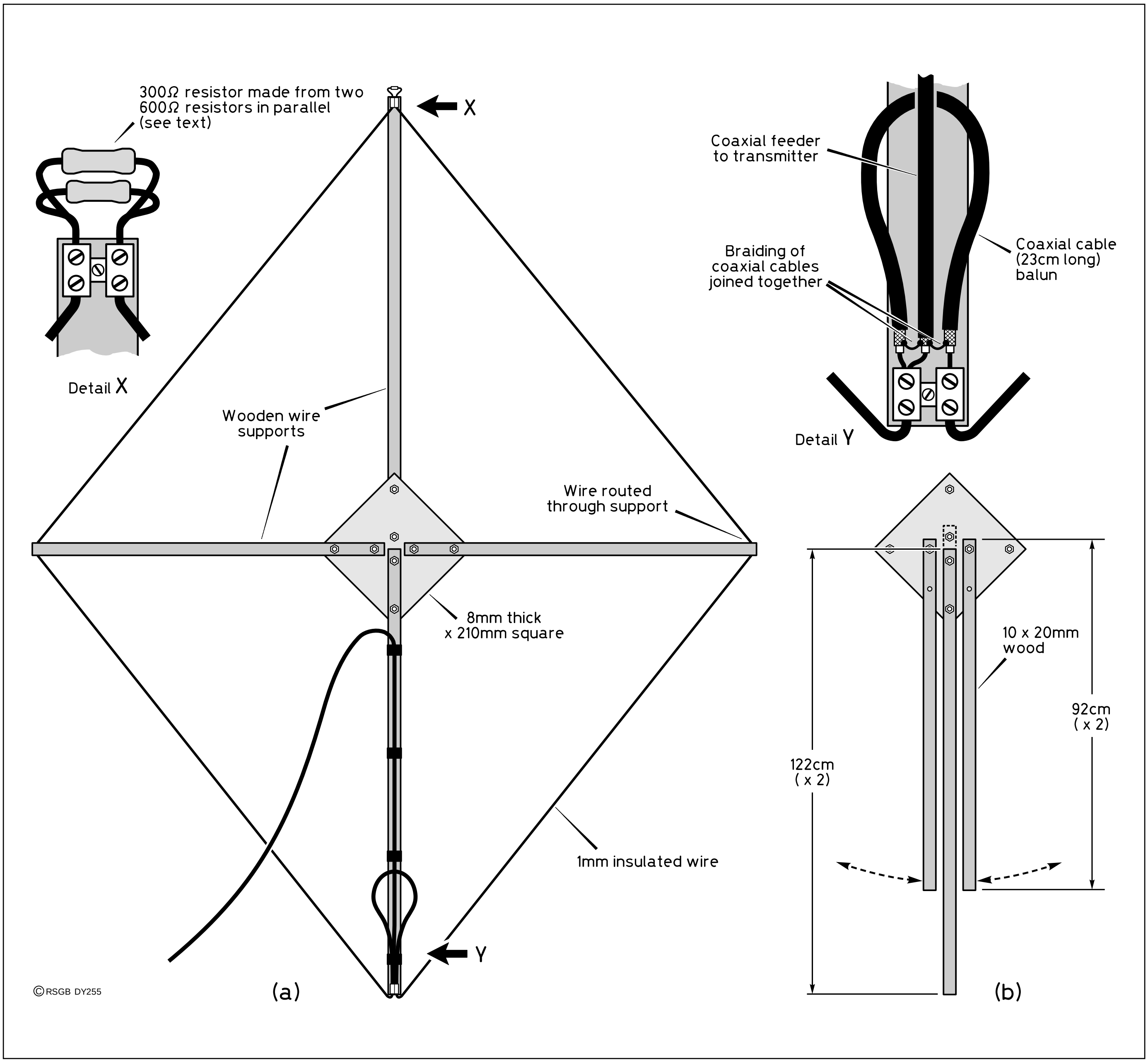


Fig 2: Construction of the UHF rhombic antenna.

BALUN TRANSFORMER CONSTRUCTION

THE MOST DIFFICULT part of the construction is making the coaxial balun. Cut a 27cm length of cable.

Cut back the outer insulation 2cm each end. Make a 'pigtail' at each end of the braid outer. Cut back the centre insulator material 1cm each side so that there is 1cm of centre conductor exposed. Detail Y of Fig 2 shows what is needed.

Prepare the coaxial cable which goes to the transceiver in the same way as described above. Solder the braiding together allowing soldering iron to melt the solder until it flows through the braid. Do not leave the soldering iron on the braid too long or the centre insulating material of the cable will be damaged.

Connect the cables together as shown in detail Y of Fig 2a. Tape the coaxial cable to the rear wood support and connect the other end to your radio.

USING THE ANTENNA

ASSEMBLE THE ANTENNA as shown in Fig 2 and fit it to a pole. It can be used horizontally (most SSB stations use horizontal polarisation) or vertically (for FM). Connect your transceiver to the antenna and tune for any repeaters in the vicinity. If your transceiver has an S-meter there should be large changes in S level as the antenna is rotated.

Readers' Letters

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

REMEMBERING COLOURS

I HAVE JOTTED down my way of remembering the 'new' mains plug colours:

Line = frizzles you to a crisp - Brown.

Neutral = blue-eyed boy, neutral and safe - Blue.

Earth = grows buttercups and daisies, harmless and lovely - Yellow / Green.

I wonder if you will publish this as an alternative way for the youngsters to remember. I'm surprised the Novice Radio Amateurs' Exam results on this were so poor, but even when you get a plug wired on to an electrical device in a shop the assistants get it wrong, as *Which* magazine found out.

Colin Sumner, G0POS

D-iar-Y JAN - FEB

JANUARY

14 Affiliated Societies Team Contest (CW). 1400 - 1800UTC, 3.510 - 3.590MHz.
16 LF Cumulative Contest (1.8MHz CW). 2000 - 2200UTC, 1.830 - 1.870 & 1.950 - 1.960MHz.
20 Affiliated Societies Team Contest (SSB). 1400 - 1800UTC, 3.600 - 3750MHz.
20 RSGB HQ Saturday Opening. 10am - 4pm, Visit the Book Shop, the GB3RS Shack and the National Amateur Radio Museum & Library. Morse tests available*.
21 Oldham Amateur Radio Club Mobile Rally, Queen Elizabeth Hall, Civic Centre, West Street, Oldham, Lancs. Details 01706 846143 or 0161 652 4164.
21 LF Cumulative Contest (3.5MHz CW). 1600 - 1800UTC, 3.530 - 3.580MHz.
24 LF Cumulative Contest (1.8MHz CW). 2000 - 2200UTC, 1.830 - 1.870 & 1.950 - 1.960MHz.
27 LF Cumulative Contest (3.5MHz CW). 1600 - 1800UTC, 3.530 - 3.580MHz.

FEBRUARY

1 LF Cumulative Contest (1.8MHz CW). 2000 - 2200UTC, 1.830 - 1.870 & 1.950 - 1.960MHz.
2 Lancastrian Rally, University of Lancaster, Just off jcn 33 M6. Details 01524 64239 or 0374 290088.
2 South Essex Amateur Radio Society Rally, The Paddocks, Long Road, Canvey Island, Essex. Details 01268 697978.
4 432MHz Fixed/AFS Contest. 0900 - 1500UTC.
4 LF Cumulative Contest (3.5MHz CW). 1600 - 1800UTC, 3.530 - 3.580MHz.
11 Cambridge and District Amateur Radio Club, Ambulance Station, Addenbrookes Hospital. Details 01954 200072.
11 Northern Cross Rally, Thornes Park Athletics Stadium, Wakefield. Details 0113 238 3622.
17 RSGB HQ Saturday Opening. 10am - 4pm, Visit the Book Shop, the GB3RS Shack and the National Amateur Radio Museum & Library. Morse tests available*.
18 RSGB VHF Convention, Sandown Exhibition Centre, Esher, Surrey. Trade Show, Lectures, Committees, RSGB Book Stand. Details 01707 659015.
24 11th Rainham Radio Rally, Rainham School for Girls, Derwent Way, Rainham, Gillingham, Kent ME8 0BX. RSGB books available. Details 01634 365980.
24 Tyneside Amateur Radio Society Rally, Temple Park Centre, South Shields. RSGB books available. Details 0191 265 1718.
24 /25 7MHz DX CW Contest. 1500 - 0900UTC, 7.000 - 7.030MHz.
25 Barry Mobile Rally, Barry Leisure Centre, off Holton Road, Barry. Details 01222 832253.

*** Candidates for Morse Tests must bring with them two passport-style photographs and the necessary fee. Tests are available on RSGB HQ Saturday Opening days from 11am to 12.30pm.**