



# The PROPAGATOR

Illawarra Amateur Radio Society Inc.



The monthly newsletter of the Illawarra Amateur Radio Society Inc.  
Registered by Australia Post publication number :- NBH - 1491.

Meetings are held on the second Tuesday each month (except January) at 7.30 pm in the  
State Emergency Services building in Montague St, Nth Wollongong.

Visitors are most welcome.

VOLUME 90 No8

AUGUST 1990

## EDITORIAL COMMENT

WELCOME TO THE FIRST PROPAGATOR STARRING THE NEW COMMITTEE. WE THE EDITOR OF NO FIXED ABODE WISH TO WELCOME YOU TO THE INCREDIBLE WORDS OF WISDOM THAT ARE CONTAINED IN THESE PAGES.

YOU WILL NOTICE THAT THIS ISSUE HAS A FAIRLY NEW FORMAT. HOWEVER THE ASTUTE READERS OUT THERE WILL NOTICE THAT IT HAS A STRIKING RESEMBLANCE TO THE PREVIOUS TOME, MOSTLY BECAUSE WE DON'T KNOW WHAT WE ARE DOING. HAVING SAID THAT, WE WILL ENDEAVOUR TO KEEP UP THE EXCELLENT STANDARD SET BY THE PREVIOUS EDITOR. TO THAT END, WE WILL NEED YOUR ASSISTANCE IN THE SHAPE OF NEWS, ARTICLES, INTERESTING BITS AND GENERAL STUFF. SO DON'T BE BACKWARD IN COMING FORWARD. OTHERWISE ALL YOU WILL GET TO READ IS THE RUBBISH WE WRITE.

THIS ISSUE TAKES THE UNUSUAL STEP BEING EDITED BY NOT ONE BUT THREE PEOPLE. THIS IS MAINLY DUE TO THE FACT THAT NO ONE PERSON WAS CRAZY ENOUGH TO VOLUNTEER FOR THE JOB. IT ALSO MEANS THAT TERRORIST ATTACKS ON THE EDITORIAL RESIDENCE WILL BE THREE TIMES AS HARD TO CARRY OUT.

## PROGRAMME

AFTER THE AGM, THERE IS A COMPLETELY NEW CALENDAR. SOME EVENTS COMING UP INCLUDE...

AUGUST: TALK BY LYLE VK2ALU ON MICROWAVES. THERE IS SOME DETAILS ON THIS SOMEWHERE IN THIS ISSUE (WE HOPE).

SEPTEMBER: TALK BY JOHN VK2XGJ AND CRONIES ON PACKET AND DIGI-STUFF. (RAY VK2XCC IS IN THE PROCESS OF ORGANISING SOME RIVAL ACTIVITY WE HEAR.....SURELY WE DON'T WANT MORE PEOPLE ON PACKET).

SOMETIME IN NOVEMBER WILL BE A DX-PEDITION ORGANISED BY THE SOCIETY. DUE TO LACK OF BRAVADO, THIS WILL BE TO THE TOP OF ONE OF THE LOCAL MOUNTAINS. THE IDEA HERE WILL BE TO TALK TO KIWIS ON 2M, SOME SERIOUS MICROWAVE WORK, AND OF COURSE THE REGULATION HF WORK. MORE DETAILS ON THIS AS THEY COME TO KEYBOARD.

DECEMBER: NO DOUBT THERE WILL BE ANOTHER CHRISTMAS PARTY ON IN DECEMBER. WE HAVE NO INFORMATION OF THIS YET, BUT IT FILLS UP THE PAGE NICELY.

\*\*\*\*\*

\*\*\*\* PAGE 1 \*\*\*\*

## DENNIS'S ANTENNER COLUMN

EDITOR'S NOTE: THE FOLLOWING MATERIAL HAS BEEN SUBMITTED TO THE EDITORS BY DENNIS. DENNIS IS A REAL PERSON, BUT IS NOT A MEMBER OF THIS SOCIETY AND IS NOT YET AN AMATEUR OPERATOR. HE IS, HOWEVER, AN EXPERT ON ANTENNA SYSTEMS (SO HE SAYS). IT WILL ALSO BECOME RAPIDLY OBVIOUS THAT HE IS NOT LIKELY TO NEED THE SERVICES OF THE SOCIETY FOR SOME TIME TO COME.....

\*\*\*\*

### DENNIS'S TIPS FOR GOOD ANTENNER OPERATION:

IF YOU HAVE TROUBLES WITH HIGH VSWR ON AN ANTENNER SYSTEM, THE SIMPLEST AND BEST SOLUTION IS TO LOOSEN OFF THE CLAMPS AND MOVE THE OFFENDING ANTENNER IN A DOWNWARD DIRECTION ON THE MAST. THIS SHOULD HELP TO LOWER THE VSWR AS REQUIRED.

A CO-LINEAR ANTENNA AT UHF IS SUPERIOR ON RECEIVING COMPARED TO MOST COMMON TYPES OF YAGI BEAM. THIS IS PRETTY OBVIOUS, REALLY. YOU CAN HEAR MORE NOISE AND PEOPLE AND STUFF, SO IT MUST BE WORKING BETTER. UNFORTUNATELY, A YAGI WILL WORK BETTER FOR TRANSMITTING, SO A CO-AXIAL RELAY MUST BE USED. EITHER THAT OR YOU NEED TO BE QUICK AT SWAPPING CONNECTORS.

\*\*\*\*

THAT'S ALL WE HAVE FROM DENNIS FOR THIS MONTH. WE GET THESE TIPS FROM DENNIS FROM TIME TO TIME, AND WILL PASS THEM ON AS WE GET THEM. WE HOPE THAT YOU FIND THEM USEFUL.

\*\*\*\*\*

### DOTC EXAM

KEITH VK2OB ADVISES THAT THE NEXT SET OF EXAMS WILL BE HELD ON THE THIRD TUESDAY IN AUGUST (WHICH IS THE 21ST), AT THE TAFE COLLEGE. APPLICATIONS WOULD BEST BE MADE BY CONTACTING KEITH VERY SOON.

\*\*\*\* PAGE 2 \*\*\*\*



\* "NOW don't let things worry you, Mr Smith. We all have our funny little ways."

### ZAPHOD'S HINT No 75

NORM VK2ZXC HAS ADVISED US THAT HE HAS HAD A PROBLEM ON SUNDAY'S BROADCAST. WHEN HE WENT TO CALL BACK, NO-ONE HEARD HIM. THIS WAS MOSTLY BECAUSE HE WAS USING THE WRONG MICROPHONE. APPARENTLY THERE IS LOTS OF BIRDLIFE AT HIS LOCATION WHICH WAS DISTRACTING HIM.

ZAPHOD (THE EDITORIAL NOM DE PLUME) SUGGESTS THAT THE BEST METHOD TO AVOID THIS PROBLEM IS TO FOLLOW THE CABLE FROM THE RIG TO FIND THE CORRECT MICROPHONE. UNFORTUNATELY THIS HAS THE SIDE EFFECT OF MAKING THE OPERATOR EXTREMELY DIZZY, BUT YOU CAN'T WIN THEM ALL.....

Microwaves - KISS.

So you have read Dale's article in the Propagator about our recent mini DXpedition? No - well take a look at it, as it forms the introduction to the little talk on "simple microwaves" that I have been conned into giving at a Club meeting soon.

Read it now? Good!

If my transmitted signal frequency was 10350MHz, on what frequency should he be transmitting? Two guesses - maybe they are both correct! Why?

We were using wideband FM. So, what approx. signal level above noise will be needed for us to just hear each other? --- Come on, look in your books if you can't answer. "off the top of your head." After all, you probably use FM on 2 metres - its just the same for that- and knowing the answer will help to explain why those with "all mode" 2 metre rigs should be "down the bottom end" on SSB.

Final question. Why do I use an ironing board as the "table" for my WBFM gear at home? ( Two points for the correct answer to this one!)

On the night of my talk on Microwaves (KISS), bring along any of the bits and pieces from your junk box that you think may be ~~microwave~~ items (not more than 10lbs. weight per person!) and also a ruler-calibrated in mm. and we will see if we can identify them, and also decide on what approx. frequency they may have been used. No fancy filters or other more complex devices please! (I never was involved with microwaves while at work!)

OK - on this night it will be - KISS - !!! (So, if you want to bring your wife/girlfriend with you. Well!)

Lyle VK2ALU.

FOR SALE:

HITACHI CL212 OSCILLOSCOPE. THIS DEVICE IS ALSO IN AS NEW CONDITION, AND HAS ONLY BEEN USED FOR HALF AN HOUR. FREQUENCY IS GOOD TO 20MHZ. PRICE IS \$650, CONTACT VK2JTB, PHONE 562213.

YAESU FT-747GX HF TRANSCEIVER. THIS RADIO IS IN AS NEW CONDITION, AND HAS NEVER BEEN TRANSMITTED ON. IT HAS HAD THE FM OPTION FITTED AND HAS A SCANNING MIC. CONTACT GRAHAM VK2JGI. PRICE IS \$850.00

## REPEATER REPORT

THIS IS MY FIRST REPORT FOR THE PROPAGATOR SINCE MY "LANDSLIDE UNOPOSED ELECTORAL VICTORY" SWEEPED ME TO POWER AS REPEATER CHAIRMAN. WHY DIDN'T ANYONE ELSE PUT THEIR HAND UP? (THE BEST MAN FOR THE JOB GOT IT, ROB...ED). WHAT HAVE I LET MYSELF IN FOR?

FIRST OF ALL I MUST THANK JOHN VK2XGJ FOR ALL HIS WORK DURING THE PAST YEAR AS CHAIRMAN, I HOPE I CAN MAINTAIN HIS EXCELLENT STANDARD. SHOULDN'T BE TOO HARD. (SORRY, JOHNNIE BOY, ONLY JOSHIN').

WE HAVE AN EXCELLENT GROUP FOR THE REPEATER COMMITTEE THIS YEAR...  
KHE PETER TOMLIN  
XLA GRAHAM EAST  
TKE KEN GOODHEW  
XGJ JOHN SIMONS  
KLD LES DAVID  
BIT PETER WOODS  
THEO JEPSON

### CURRENT STATUS FOR OUR CLUB'S REPEATERS---

\*VK2RAW 6850 - SITE BATTERY VOLTAGE IS A "TAD" LOW AT THE MOMENT. PERHAPS CONTRIBUTABLE TO THE SHORTENED DAYS/LOW ANGLE OF THE SUN ON THE SOLAR PANELS. NO IMMEDIATE ACTION IS PLANNED, JUST KEEP AN EAR ON THE TONE OF THE IDENT. ALSO, THERE IS OCCASIONALLY SOME "SCRATCHING" ON THE RPTS TX - THE GUY WIRES NEED ATTENTION. ONCE AGAIN, NOTHING IMMEDIATE, NEXT TIME ONE OF US HAPPENS TO FIND THEMSELVES AT MT MURRAY.

\*VK2RAW 7575 PACKET RACKET DIGI - ALL O.K.

\*VK2RIL 7275 - ALL O.K.

\*VK2RUW 8225 - OCCASIONALLY SUFFERING FROM SOME KIND OF SIGNAL ON THE RX FREQ OF UNKNOWN SOURCE. GENERALLY O.K. BUT IMPROVEMENTS POSSIBLE? WITH SUCH A SALTY LOCATION AS HILL 60, THE ANTENNA

\*\*\*\* PAGE 4 \*\*\*\*

## VIMCOM

YOU KNOW THE PLACE  
AND YOU KNOW THE NAME  
AND YOU KNOW WHAT WE  
DO SO WHY DO WE NEED  
TO ADVERTISE TO TELL  
YOU THAT BESIDES  
ELECTRONIC  
COMPONENTS AND BITS  
AND PIECES, WE HAVE A  
VERY LARGE RANGE OF  
MICROCHIPS TO HELP  
YOU BUILD THOSE  
PROJECTS.

WE ADVERTISE TO ENABLE US TO  
PROVIDE AN EVEN BETTER SERVICE  
AND HELP YOUR CLUB.

Call in and see us at:-

131 Kenny St  
Wollongong

(right down the southern end)

Ph. 284400

HARDWARE NEEDS MORE THAN THE OCCASIONAL CHECK-OVER.

\*VK2RIL 8725 - STILL OFF AIR. POSSIBLY WON'T BE ON THE AIR AGAIN WITH THE CURRENT EQUIPMENT (WHICH IS TECHNICALLY NOT UP TO SCRATCH). AT THIS POINT IN TIME, RE-INSTALLATION AT SUBLIME POINT IS PERHAPS TOO EXPENSIVE. THIS REPEATER IS IN LIMBO BUT DEFINITELY NOT FORGOTTEN.

\*\*\*\*\*

\*VK2RAH 29.620 - STILL SUFFERING FROM THE "MACHINE-GUN" NOISE ON THE LINK FREQUENCY. THE SOURCE OF THE PULSE HAS BEEN LOCATED & DEFINED WITH THE GENEROUS ASSISTANCE OF BARRY SULLIVAN FROM THE LOCAL DOTC. (BARRY HAS SPENT MANY, MANY HOURS HELPING US TO FIND THE PROBLEM). UNFORTUNATELY, THE OWNERS OF THE PULSE ARE THE PRIMARY USERS OF THIS BAND (420 - 450 MHZ) AND WE ARE SECONDARY USERS - HENCE WE HAVE TO SHIFT OUR LINK FREQ. ONCE AGAIN BARRY HELPED US BY PUSHING THROUGH A RE-ASSIGNMENT OF FREQUENCY IN DOUBLE-QUICK TIME, SAVING MONTHS OF WAITING. THANKS, BARRY.

TO ACCOMODATE THIS CHANGE OF FREQUENCY, WE'VE HAD TO CHANGE LINK RXERS DUE TO OUR PRESENT EQUIPMENT REQUIRING TOO MUCH MODIFICATION TO MOVE DOWN THE 20 MHZ. FORTUNATELY, GRAHAM CAG HAS GENEROUSLY DONATED A RXER THAT WILL DO THE JOB. NEW CRYSTALS FOR THE TXER AND RXER WILL HAVE ARRIVED BY THE TIME YOU READ THIS. ALSO, THE NEW RXER HAS TO BE CONNECTED IN WITH THE EXISTING EQUIPMENT.

FUTURE PLANS AND IDEAS FOR THE CLUB'S REPEATERS.....

\*VK2RAW - GET OUR OCCASIONAL POWER LICKED FOR GOOD. THERE ARE A FEW IDEAS ON THE TABLE FOR THIS. HAVE YOU GOT ANY? A GENERAL CLEAN-UP & MAINTENANCE OF SITE SO AS TO KEEP OUR MAIN RPTR SITE AS RELIABLE AS POSSIBLE.

\*VK2RIL (VHF) - WELL... "WHEN YOU ARE ON A GOOD THING, STICK TO IT"! AS LONG AS THE SITE DOESN'T GET ANY MORE PAGER NEIGHBOURS, NOTHING IS PLANNED. OUR PRESENT PAGER NEIGHBOUR AND OUR REPEATER ARE HAPPILY WORKING TOGETHER SIDE BY SIDE.

\*VK2RUW - I'M KEEN TO IMPROVE THIS REPEATER. WE'VE ALL HEARD THE SAYING - "USE IT OR LOSE IT", WELL OUR SLAB OF 420 - 450 MHZ IS AN

\*\*\*\*\*

EXTREMELY VALUABLE PIECE OF THE FREQUENCY SPECTRUM. (THE PROBLEMS WE HAVE EXPERIENCED ON VK2RAH ON THE LINK FREQUENCY SHOULD GIVE SOME IDEA OF HOW WEAK OUR GRASP IS ON THIS BAND). I URGE THOSE WHO CAN USE UHF TO DO SO AND THAT'S NOT JUST FM AND REPEATERS. ANYWAY, GETTING OFF MY SOAPBOX (WHEW..ED), IN AN EFFORT TO HELP POPULATE UHF THE IMPROVING OF COVERAGE ON OUR UHF REPEATERS WOULD BE HELPFUL, EVEN IN A SMALL WAY. POSSIBLE IMPROVEMENTS TO RUW WOULD INCLUDE A BETTER ANTENNA SYSTEM, INCLUDING FULL DUPLEXING (IE, A BIG HILL), LINKED TO OTHER UHF REPEATERS? IDEAS?

\*VK2RIL (UHF) - AS SAID BEFORE, THE REPEATER HAS NOT BEEN FORGOTTEN, THERE ARE IDEAS IN THE PIPEWORKS BUT ULTIMATELY MONEY IS THE RESTRICTING FACTOR. (HOW ABOUT SLINGING IT OFF THE IARS SPACE SHUTTLE?..ED) NOT WISHING TO CONTRADICT MYSELF REGARDING RUW AND UHF WORRIES, DO WE REALLY NEED 2 UHF REPEATERS IN WOLLONGONG??? WOULD ONE VERY WELL-SITED GOOD COVERAGE REPEATER BE PREFERABLE? OUR CLUB'S LIMITED FINANCE COULD BE CHANNLED INTO MAKING ONE EXCELLENT UHF REPEATER OF TWO GOOD ONES? THESE ARE MY THOUGHTS, TELL ME YOURS.

\*VK2RAH - OBVIOUSLY GET RID OF OUR RESIDENT MACHINE-GUN ONCE AND FOR ALL (ANYONE GOT A SPARE BAZOOKA).. IMPROVE OUR RX PERFORMANCE, A BETTER SQUELCH AND MORE TX POWER (BACK UP TO FULL POWER - WE ARE CURRENTLY ONLY RUNNING 3W OUTPUT, BUT STILL GETTING GREAT SIGNAL REPORTS FROM VK6, VK8, JA, ZL, KH6, 3D2). AT OUR FULL POWER, ANOTHER 100B PLUS...

WELL THAT'S ABOUT IT. I PROMISE MY NEXT REPORT WON'T BE SO LONG. LUCKY MY TYPEWRITER DOESN'T TIME OUT LIKE A REPEATER... I'D BE IN BIG TROUBLE IF IT DID. IF YOU OR OTHER USERS HAVE IDEAS, CONTACT ME PSE.

\*\*\*\* PAGE 5 \*\*\*\*

For People Who Want Quality and Support a Realistic Price!

## Thinking about PC's??

We sell quality IBM COMPATIBLES with Superior specifications to the original AND at much LOWER PRICES

XT, AT and 386 compatible Computers

All are TURBO machines and have 12 months warranty.

All we ask is that you PHONE US before buying  
COMPUTERS, SOFTWARE or PERIPHERALS.

### SOFTWARE

Available - Educational,  
Real Estate, Milko, Doctor,  
Hire, Register, Accounting,  
Sales Monitoring and  
Programming Languages for  
IBM and compatibles.

### HARDWARE

Available - All peripherals  
for IBM and compatibles  
including Printers, Monitors,  
Hard Disks and Expansion  
Cards.

### OTHER

Consulting, Contract  
Programming and Training  
Available. We have been in  
the industry since 1979.

For your Computer needs, phone...

## Janson Computer Services

Ph (042) 61-5451

PRINCESS HIWAY DAPTO

### ZAPHOD'S HINT No MJ2955

IF YOU EVER FIND THAT YOUR  
KENWOOD OR YAESU RIG IS NOT PUTTING  
OUT POWER WHEN TUNING UP ON CW, THE  
FIRST STEP IS TO PANIC SEVERELY.  
FOLLOWING THIS, CHECK THE FINALS,  
POWER SUPPLY, IF AMPLIFIER, ZENERS,  
CHECK THAT THE DISPLAY IS WORKING,  
AND PANIC ONCE MORE. ONCE THIS IS  
DONE, CHECK THAT THE KEY IS NOT  
PLUGGED INTO THE SOCKET ON THE  
BACK. A PERSON WHO SHALL REMAIN  
NAMELESS (IS THAT OK SIMON?)  
ADVISES THAT THIS PROCEDURE WORKED  
FINE FOR HIM WHEN TUNING A RIG.

\*\*\*\*\*

ALSO, MAX XMD HAS SOME HINTS ON  
REPAIRING DISHWASHERS THAT MIGHT BE  
USEFUL TO SOMEONE OUT THERE (BUT  
YOU WILL PROBABLY NEED A BOX OF  
BAND-AIDS FOR YOUR FINGERS).

\*\*\*\* PAGE 6 \*\*\*\*

### DOTC QUESTION

LAST MONTH, KEITH ASKED: WHY DO  
FREQUENCY MULTIPLIERS USUALLY  
OPERATE IN CLASS C FOR BOTH AM AND  
FM TRANSMITTERS???

THE ANSWER WAS C) IT IS THE MOST  
EFFICIENT AND WILL NOT AFFECT FM,  
WHILST IN AM THE AUDIO IS ADDED  
AFTER MULTIPLICATION.

THIS MONTH KEITH VK2OB ASKS US:

IF AN ELECTROMAGNETIC WAVE HAS A  
SINGLE CYCLE DURATION OF 2.25NS,  
ITS FREQUENCY IS APPROXIMATELY:

- A) 28 MHZ
- B) 54 MHZ
- C) 144 MHZ
- D) 444 MHZ

\*\*\*\*\*

# WIDEBAND ANTENNA BALUNS

Few antennas are co-operative when it comes to feedpoint impedance. Matching them up or down to the required 50 ohms (occasionally 75 ohms) often proves awkward. Roger Harrison shows the easy way round.

IN ANY COMMUNICATIONS system the weakest link in the chain is always the antenna system. Even if the best antenna to suit the particular circumstances is chosen, it is necessary to provide efficient transfer of power to or from the antenna feedpoint. However, the antenna feedpoint impedance is not always conveniently the same as that of the feedline, the transmitter output impedance or the receiver input impedance. The latter are usually either 50 or 75 ohms to match the coaxial transmission lines normally employed. Coaxial transmission lines are, by nature unbalanced electrically, whereas many types of antennas have balanced feedpoints and thus require a balanced transmission line. To correct this a 'balun' is necessary — the word being derived from 'balanced — to — unbalanced'. Originally, the term applied to a device which only involved changing from the balanced to unbalanced condition without a change in impedance. Where a change in impedance is necessary the term transformer is, strictly speaking, the correct term.

There are a wide variety of methods of making antenna baluns and impedance matching devices. However, most techniques are suitable for use on a single, narrow frequency band. The most versatile technique, which results in baluns that may be used over a wide frequency range, employs sections of made-up transmission line wound on a ferrite core, usually in the form of a toroid or some other convenient shape. Sections of transmission line are wound together and connected in a series or parallel combination to effect the desired balanced-to-unbalanced transformation and/or an impedance transformation. Winding the transmission line sections on a ferrite core increases the inductance of the length of transmission line used. This article shows how to make the most useful types using locally available components.

## High Power Transmitting Baluns

The following baluns to be described all employ toroids and are for use

in transmitting applications at power levels up to 200 W, and up to 1 kW, CW or PEP output. Only two toroids are specified, both from the Neosid range. For applications up to 200 W, the toroid type 4328R/2/F14A/EC is employed, while that for powers up to 1 kW employ the type 4324R/3/F14A. The first has an outside diameter of 25.4mm, an internal diameter of 19.05 mm and a thickness of 9.52 mm. It is coated in an enamel paint. The second, and larger toroid has an outside diameter of 38.1 mm., an inside diameter of 25.4 mm, is 19.05 mm thick and is uncoated. Both have bevelled edges and will not nick or cut the insulation of wire wound around them.

The smaller toroid may be used for purely receiving applications if desired, particularly for the higher transformation ratios of 9:1 and 16:1.

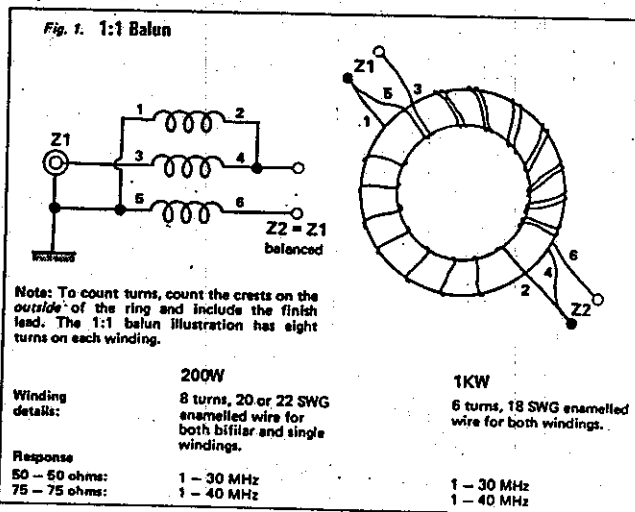
The baluns described are suitable for use from 2 MHz to 30 MHz and in some cases a wider range.

## 1:1 Balun

The circuit and connections for a 1:1 balun are given in Figure 1. This uses a bifilar winding wound around half the core and a single winding around the other half as illustrated. One wire in the bifilar winding is connected in series with the single winding. This balun is some times described with a trifilar winding but balance and bandwidth are not as good as with the method described.

This type of construction exhibits excellent balance at the Z2 termination and operates over a bandwidth of 1 MHz to 30 MHz in 50 ohm systems for assemblies on either toroid. The bandwidth is considerably better for 75 ohm systems constructed on either toroid, extending to 60 MHz for the 1 kW assembly but only 40 MHz for the 200 W assembly.

The exact gauge of the wire used is not very critical, a latitude of plus or minus one gauge being tolerated. When winding on the heavy gauge wires, a



neat winding can be obtained by carefully forming each bend, holding the already wound part firmly against the core.

Some confusion arises when counting turns of a winding on a toroid. To count turns, count the 'crests' on the outside of the ring and include the finish lead. The assembly illustrated in Figure 1 has eight turns on each winding.

#### 4:1 Baluns

An unisolated balun has a dc connection between input and output, the isolated type is a true transformer.

Figures 2 and 3 illustrate unisolated types. A 4:1 isolating balun is in Fig. 4.

A single bifilar winding is used. The wires may be twisted together lightly or wound together around the core as illustrated. The latter method is preferable. Identify the ends and connect in series as shown. The bifilar winding is spread around most of the circumference. For the larger toroid, it is difficult to spread six turns around the circumference so the winding is distributed around about two-thirds of the circumference of the toroid.

Balance of the high impedance is excellent. Bandwidth for both toroids is best for Z1 of 50 ohms. The 1 kW assembly in this case has the best bandwidth for either 50 or 75 ohm systems.

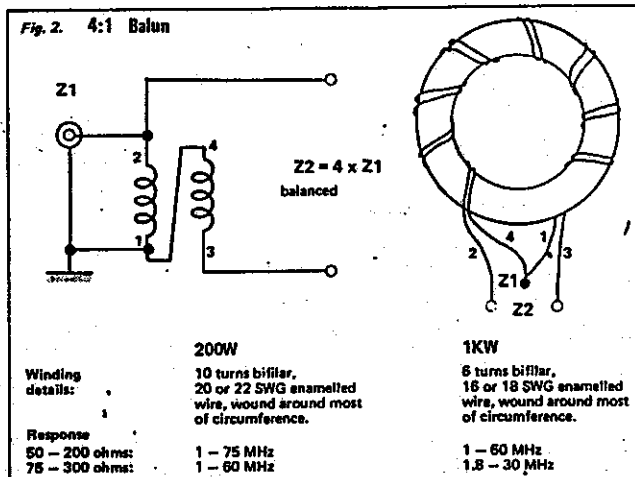
The same assembly can be connected as an unbalanced transformer. The arrangement is shown in Fig. 3. Bandwidth is limited in this application but most vertical or loaded vertical antenna systems are used on the lower bands, below 15 MHz in any case. Best bandwidth is obtained for transformation from about 19 ohms to 75 ohm systems.

The isolated type is illustrated in Figure 4. This consists of a trifilar winding having two of the wires connected in series for the high impedance winding, the third wire being the low impedance, unbalanced winding.

The 1 kW assembly has the best bandwidth, when matching to 50 ohm systems. However, the full HF range is covered by both assemblies.

#### 9:1 Balun

Baluns providing high impedance ratios are rarely described. Recently, wide-band transformers for use in HF transistor linear power amplifiers, having impedance ratios as high as 36:1, have been described, but the techniques used

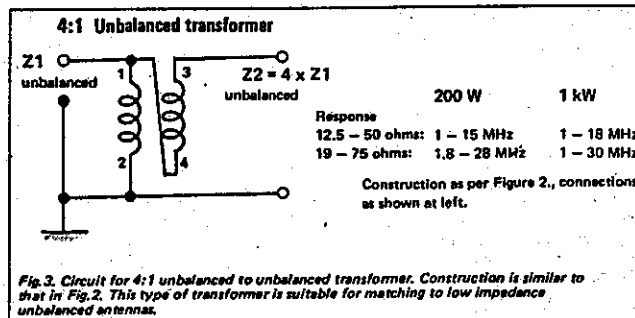


are not generally adaptable to the applications considered here.

Many types of HF beam antennae have high impedance feedpoints, such as the Lazy-H, Sterba curtain, V-beams and Rhombics, therefore presenting a matching problem that is usually solved by using resonant matching devices or 'match-boxes' involving tuned transformers. The wide bandwidth advantage of the V-beam and the Rhombic is compromised by such devices and a wide-band balun provides a much better solution to the problem of matching the balanced, high impedance feedpoint to the unbalanced, low impedance transceiver antenna terminal. You don't have to tune up each time you change bands.

Conversely, you lose the harmonic and spurious suppression advantages of the tuned matching system. However, it is always good practice to insert a low-pass filter in the transmission line immediately following the transceiver, regardless of the matching system used.

For antennas having a feedpoint impedance close to 600 ohms the balun illustrated in Figure 5 is applicable. It consists of three separate bifilar windings wound on the ferrite toroid as shown. One wire from each winding is connected so that each is in series, this forming the balanced high impedance winding. The remaining wires from each winding are all connected in





## WIDEBAND ANTENNA BALUNS

parallel for the unbalanced low impedance winding.

A single pair stripped from a length of suitable ribbon cable, or rainbow cable as it is also called, may be used for the windings on the small toroid specified for the 200 W assembly. For the 1 kW assembly on the larger toroid, a type of 'figure - 8' flex that is sold as speaker cable is conveniently used. It has one lead marked with a dark-coloured stripe which helps to identify the separate wires in each bifilar winding. The different coloured insulation of the ribbon cable wires serves the same purpose. The figure-8 flex sold as 240 V lamp and appliance cord is too large to be used here.

The assembly illustrated will cover the range 3 MHz to 25 MHz with eight turns per winding on the small toroid and six turns per winding on the larger toroid. More turns per winding are required if the balun is to be used at frequencies lower than 3 MHz. However, as the assembly only has a bandwidth of about 8:1 the upper frequency is then limited to about 15 MHz. The number of turns required barely fits on each core in this case.

Although the balun described is specified for matching 600 ohms to 75 ohms it can also be used to match antennas having impedances close to 450 or 500 ohms, to 50 ohms. The upper frequency limit is then reduced to about 20 MHz in this case. A slight impedance mismatch is readily tolerated by most equipment and there is little to be gained in trying to get an exact match.

### 16:1

For antennas having feedpoint impedances in the vicinity of 800 ohms the balun illustrated in Figure 6 is applicable for matching to 50 ohms. It is constructed in a similar manner to the previous one. Four bifilar windings are wound on the core. Four wires, one from each winding are connected in series to form the high impedance balanced winding. The other four wires are connected in parallel for the low impedance unbalanced winding.

A single pair stripped from ribbon cable is also conveniently used for this balun on the small toroid, while figure-8 flex is convenient for the larger toroid, as discussed for the 9:1 balun.

This balun covers 3 to 25 MHz for assemblies wound on either toroid. Sufficient turns will not fit on the smaller toroid if you wish to go below 3 MHz. For purely receiving appli-

cations, use light gauge enamelled copper wire - such as 28 or 30 swg, and wind eight or nine turns per winding of bifilar pairs on the small toroid. As receivers are usually fairly tolerant of some degree of mismatch, a balun constructed in this manner may be used over the range 1 MHz to about 25 MHz.

The larger toroid will fit sufficient turns to cover the range down to 1.8 MHz but, as for the 9:1 balun, the upper frequency limit is about 15 MHz.

## TOROIDS

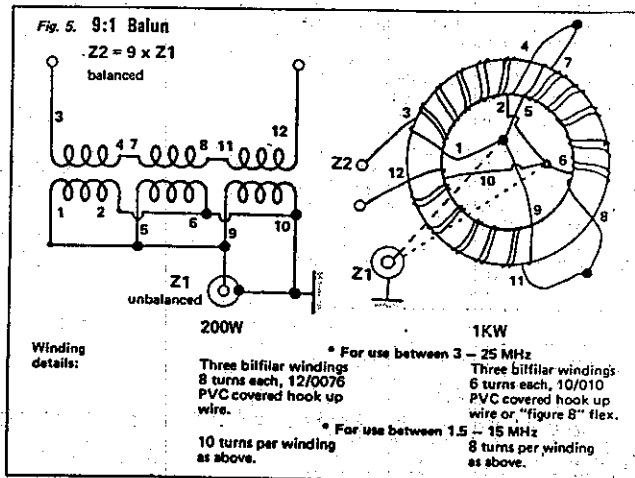
200W: 4328R/2/F14A/EC

Size: 25.4 mm x 19.05 mm x 9.52 mm (od, id, depth). Suitable up to 200 W and for receiving applications. Also available from DAVID REID Electronics, 104-106 King Street, Newtown (PO Box 317) 2042.

1 kW: 4324R/3/F14A

Size: 38.1 mm x 25.4 mm x 19.05 mm (od, id, depth)

The toroids specified are manufactured by Neosid (Aust.) Pty Ltd, 23-25 Percival St, Lilyfield NSW 2040; phone (02) 660-4566.



For all Mechanical Repairs  
go to

No 1 JARDINE ST  
FAIRY MEADOW  
844259

**MAZCARE**

(042) 84-4359



Spares and Repairs -  
Servicing - Alarms -  
Wheel Balancing - Air  
Conditioning - Tow Bars -  
Towing

### Encapsulating Balun Assemblies

Where necessary, to protect them from the weather, the balun assemblies may need to be encapsulated. A suitable mould may be fashioned from stiff paper or cardboard and the balun assembly potted in a suitable epoxy compound. The input and output terminations may be potted along with them, ensuring that no short circuits are possible in the process. Alternatively, they may be sealed in a suitable plastic moulding such as those produced for 240 V electric cable conduit. These are available as T-junctions etc. and are generally obtainable from hardware stores in sizes suitable to contain the toroids specified. A complete balun and dipole feedpoint termination can be encapsulated in an appropriate fitting. A suitable coax socket and eye-bolts to take the antenna strain are readily included also. The exact construction is left up to the individual to suit the circumstances. A little imagination goes a long way. ●

See Jack at

**NEWTEC  
ELECTRONICS**

We stock

Alarms, antennas, kits,  
tools, cable, data  
books, Goldstar test  
equipment, Electronic  
components for the  
professional, Amateur  
and hobbyist.

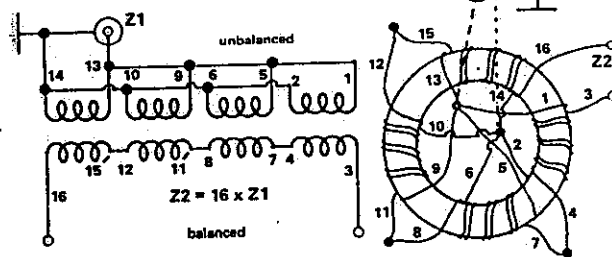
102 Kembla St.  
Wollongong

(opp. Wgong Bowling Club)

Ph. 27-1620

\*\*\*\*PAGE 10\*\*\*\*

Fig. 6. 16:1 Balun



$$Z2 = 16 \times Z1$$

Winding details:

200W

Four bifilar windings  
6 turns each, 12/0076  
PVC covered hook up  
wire.

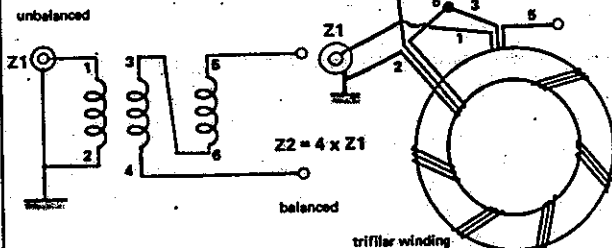
Sufficient turns will  
not fit on the toroid.  
See text.

1KW

\* For use between 3 - 25 MHz  
Four bifilar windings  
4 turns each, 10/010  
PVC covered hook-up  
wire or "figure 8" flex.

\* For use between 1.8 - 15 MHz  
6 turns per winding  
as above.

Fig. 4. 4:1 Isolating balun



$$Z2 = 4 \times Z1$$

Winding details:

200W

8 turns trifilar,  
20 or 22 SWG enamelled  
wound around most of  
circumference.

Response  
50 - 200 ohms:  
75 - 300 ohms:

1.8 to 28 MHz  
3.0 to 35 MHz

1KW

6 turns trifilar,  
16 or 18 SWG enamelled  
wound around most of  
circumference.

1.8 to 75 MHz  
2.5 to 30 MHz



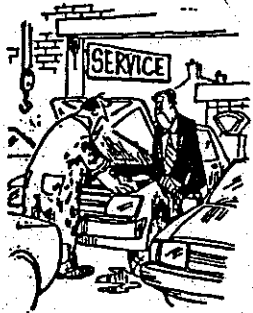
WHAT DO YOU MEAN,  
THANKS FOR THE GREAT  
EYEBALL?  
I JUST GOT OFF THE  
RADIO !!

### A GOOD CHEAP 2M ANTENNA

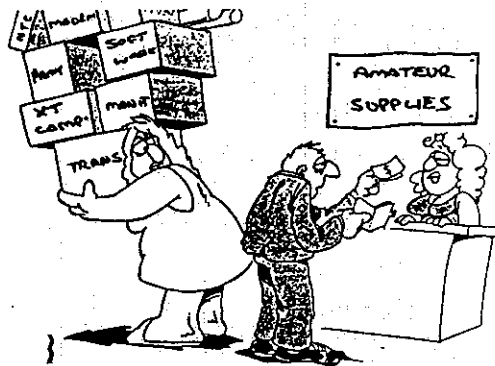
GRAHAM VK2JGI TELLS US ABOUT A 2M ANTENNA HE HAS MADE... RATHER THAN MAKING A DIPOLE OF GROUND PLANE ANTENNA, I MADE A ONE WAVELENGTH SQUARE LOOP ANTENNA, IN THE VERTICAL ORIENTATION AND POLARIZED VERTICALLY. THIS GIVES PERFORMANCE WHICH IS BETTER THAN A DIPOLE OR GROUND PLANE.

THE ONLY MATERIALS USED WERE 2M OF 2MM ENAMELLED WINDING WIRE I HAD LYING AROUND, A LENGTH OF 20MM CONDUIT WHICH WAS PRETTY CHEAP, AND SOME CO-AX TO FEED IT WITH. FOR A MAST, I NEEDED SOMETHING WHICH WAS NON-CONDUCTIVE, BUT REASONABLY STRONG. I HAD 5 FT OF CONDUIT LEFT OVER, SO I JUST USED IT. IT'S A BIT FLEXIBLE, BUT IT WORKS OK AND HASN'T BLOWN DOWN YET.

I USE THIS ANTENNA ON THE ROOF OF MY HOUSE, AND IT SEEMS TO PERFORM QUITE WELL. NOT BAD FOR \$5.



THE TEMPERATURE GUAGE WAS NOT SHOWING STRENGTH 9.



ARE YOU SURE THIS IS THE MINIMUM I NEED TO GET ON WITH / PACKET

### SCOUT CAMP ANNIVERSARY

ON THE 10TH OF NOVEMBER, OUR LOCAL SCOUT CAMP TURNS FIFTY. THERE IS PLANNED TO BE A BIG CELEBRATION DAY AT THE MOUNT KEIRA SCOUT CAMP ON THE SATURDAY. ONE OF THE THINGS BEING DONE IS AN AMATEUR STATION DEMONSTRATION, WHICH IS BEING ORGANISED BY GRAHAM VK2JGI. GRAHAM ADVISES US THAT SOME HELP FOR THE WEEKEND IN THE FORM OF SOMEONE TO HELP WITH OPERATION, AND MAYBE ALSO BRING UP SOME GEAR (HE HAS 2M AND HF, BUT MAYBE SOME UHF OR 6M WOULD BE NICE TO SHOW OFF) WOULD BE APPRECIATED.

ALSO WITH THIS DEMONSTRATION WILL BE A DISPLAY OF A HISTORICAL NATURE. NO DOUBT SOMEONE OUT THERE HAS SOME HISTORICAL-LOOKING RADIO GEAR WHICH WOULD LOOK GOOD IN OUR DISPLAY THAT THEY MIGHT LEND HIM FOR THE WEEKEND (IT DOESN'T HAVE TO WORK, AND PROBABLY WON'T BE OPERATED). ANYTHING CIRCA 1940 WOULD BE IDEAL, BUT ANY SORT OF OLD GEAR TO MAKE THE DISPLAY LOOK GOOD WOULD BE VERY WELCOME.

ILLAWARRA AMATEUR RADIO SOCIETY  
INCORPORATED.

MINUTES OF COMMITTEE MEETING -  
TUESDAY 17 JULY, 1990  
HELD AT SES HQ, MONTAGUE STREET,  
NORTH WOLLONGONG  
START: 19:30

PRESENT: VK2'S KWG (CHAIR), KLH,  
XLA, XSV, KEY, KCV, TKE,  
XGJ, MT.  
APOLOGIES: VK2KHE. VK2XCC

**BUSINESS:**

1. CLUB RECORDS INDICATE THAT  
THE CLUB'S MEMBERSHIP OF WIA  
MAY HAVE LAPSED. THE COMMITTEE  
RESOLVED THAT THE CLUB SHOULD  
APPLY (REAPPLY) FOR MEMBERSHIP.  
VK2KCV TO CLARIFY THE MATTER  
AND, IF NECESSARY, REQUEST AND  
COMPLETE RELEVANT FORMS.

2. THE CLUB IS TO FORMALLY  
REQUEST THE RETURN OF THE UHF  
REPEATER (VK2RIL) AND THE 9  
CAVITIES LOANED TO VK2XNH FOR  
TESTING IN THE NOWRA AREA.

3. A LOCK IS REQUIRED FOR THE  
CLUB'S RADIO ROOM. VK2TKE TO  
LIAISE WITH VK2KHE RE INSURANCE  
ASPECTS, TYPE OF LOCK  
REQUIRED ETC.

4. TO ENCOURAGE USE OF SOME  
LESSER UTILISED BANDS, VK2KWG  
SUGGESTED THE CLUB UNDERTAKE A  
"6 METRE OPERATIONS DAY".  
THE COMMITTEE FURTHER DISCUSSED  
THE MATTER AND PROPOSED AN  
ALL BANDS OPERATIONS DAY  
INVOLVING THE CLUB STATION,  
SUBJECT TO D.O.T.C. APPROVAL  
AND THE LAWRENCE HARGRAVE AWARD  
POSSIBLE DATE PROPOSED 17/18  
NOVEMBER, 1990.

5. THE COMMITTEE ALSO CONSIDERED  
HOLDING A FOX HUNT/CAR  
RALLY EVENT. VK2MT TO CONTACT  
VK2JBS RE AN ARTICLE IN THE  
"PROPAGATOR" FOR THE OPERATIONS  
DAY (WEEKEND) AND FOX HUNT.

6. ROB, VK2MT, ADVISED THAT  
BOTH "CB ACTION" & "AMATEUR  
RADIO" HAVE EXPRESSED INTEREST  
AND REQUESTED INFORMATION  
ABOUT THE CLUB'S 10 METRE  
REPEATER, VK2RAH. ROB ADVISED  
THAT AN ARTICLE WOULD BE  
PROVIDED ONCE THE CURRENT  
PROBLEMS  
AT THE SITE HAVE BEEN RESOLVED.

7. CRYSTALS FOR THE NEW LINK  
FOR VK2RAH HAVE BEEN ORDERED.  
ROB ADVISED THAT GRAEME, VK2CAG,  
HAS DONATED A RECEIVER AND  
CRYSTAL TO THE PROJECT.  
WE WOULD LIKE TO THANK GRAEME FOR  
HIS INTEREST AND SUPPORT.

8. KEN, VK2TKE VISITED THE  
VK2RAW SITE AND REMOVED SOME  
LOOSE WIRE FROM A TURNBUCKLE.  
THIS APPEARED TO SOLVE THE  
NOISE PROBLEM. IT WAS NOTED  
THAT THE BATTERIES WERE EITHER  
PARTIALLY DISCHARGED OR NOT  
ACCEPTING THE CHARGE. THIS  
MATTER TO BE EXAMINED AT THE  
NEXT VISIT.

9. THE COMMITTEE APPROVED  
THAT KEITH, VK2OB, PURCHASE  
SUFFICIENT ALUMINIUM FOR A  
20 METRE MONOBANDER FOR THE CLUB  
STATION.

10. TOWER PROJECT. A WORKING  
BEE TO BE HELD SATURDAY, 21  
JULY TO CLEAN ANOTHER SECTION.  
THE HOLE FOR THE BASE TO BE  
DUG WHEN THE GROUND HAS DRIED  
OUT. VK2KHE TO PROVIDE DETAILS  
REGARDING COUNCIL APPROVALS.  
THE INCOMING COMMITTEE  
REQUESTED THAT DETAILS OF TOWER  
AND BASE DESIGN BE PROVIDED  
BY THE TOWER COMMITTEE FOR  
CLUB RECORDS.

11. THE COMMITTEE WAS ADVISED BY KEN, VK2TKE, THAT CURRENT MEMBERSHIP IS APPROX 80 MEMBERS. IDEAS SUGGESTED FOR SPECIAL EVENTS AND JOTA OPERATIONS, SHOPPING CENTRE AND SCHOOL DISPLAYS, OPERATING DAYS ETC. IT WAS NOTED THAT THE NEED TO BE WELL ORGANISED FOR EVENTS OF THIS TYPE IS OF PARAMOUNT IMPORTANCE.

12. THE COMMITTEE DISCUSSED POSSIBLE TOPICS AND THEMES FOR FORTHCOMING GENERAL MEETINGS. THESE INCLUDE: MICROWAVE BANDS, SATELLITE OPERATING PROCEDURES, PACKET, BROADCAST OFFICER DUTIES, OPERATING DAY REHEARSAL, CLUB AUCTION, HOME BREW NIGHT, DISCUSSIONS ON TOPICAL MATTERS BY DISTRICT RADIO INSPECTOR, WIA, DAVID VK2YKQ ETC. FURTHER SUGGESTIONS WOULD BE WELCOMED.

COMMITTEE MEETING CLOSED 21:30.

#### Presidents Report

I would like to thank the last committee for their fine effort during their term in office. As you can see from the back of the propagator we have a few new members in the committee with a few faithfuls from the old one.

The club station tower is progressing. A working bee was held on Saturday 21st with Vic VK2XSV (Extra Super Victor), Pat VK2KEY, and myself. It was a fine day for painting and the general consensus was that a Bar Bee Que was the go for the next session on the tower.

## Calling All Amateurs

It's time to visit your local  
Market at BULLI if you need :-

METERS

ANTENNA MATERIAL

RADIO PARTS

KIT BITS AND PIECES

ELECTRONIC THINGAMYS

TRUE VALUE 4 MONEY

# CAVIONS

11 Molloy St. Bulli

Ph (042) 84-6838

Our committee has got off to a good start with an enthusiastic inaugural meeting on the 17th. We have come up with plenty of good topics for the club meetings, these will be published as they are firmed up. I am looking forward to this months general meeting where Lyle VK2ALU (our resident microwave, eme etc expert) will talk on Microwave communications.

Ken Grimm VK2KWS

10 GHz Mountain top Dxpedition - Dale VK2DSH & Lyle VK2ALU

by VK2DSH

Over a period of some months I have been building some equipment for the 10 GHz band. The equipment is a simple wide band F.M system, built so that it is light weight and portable. With the kind assistance and guidance of Lyle VK2ALU, I have been able to get the equipment working.

The system consists of a Gunn diode oscillator in a simple wave guide cavity. The oscillator is the transmitter as well as the local oscillator for the receiver. Frequency modulation is achieved by modulating the supply voltage ( about 7 volts ) of the Gunn diode. A deviation of about 100 KHz is used and a power output of up to 10 mW. The receiver consists of a diode mixer followed by a 30 MHz IF amplifier followed by another conversion to 10.7 MHz where demodulation takes place. The whole lot being simple, easy to get going and light weight.

Our first QSO was on the 10th March of this year over about 30 m in Lyles (large) backyard! Following this succesfull test, we decided to go futher afield.

Time went by until On the 11th July, I set out for the summit of Mt Kembla carrying a back pack of radio gear. 2 M equipment for a liason link, 10 GHz equipment, tripod, horn antenna, batteries and assorted bits and pieces were taken along. After tramping through the bush for about an hour the summit was reached - just in time for a shower of rain. A nice flat rock facing the correct direction was found and when the rain stopped the gear was set up.

Lyle was at his home with his wide band gear set up on his front lawn, communications was established on 2 M and Lyle starting transmitting on 10 Ghz and I picked up his signal with no difficulty but Lyle could not hear me. A noise free voice signal was heard by me, but Lyle could not hear me at all on 10 Ghz. A few adjustments were made but after about an hour we decided that we could only work one way. So after some lunch I started making my way back to Lyles place.

The problem turned out to be that my transmit power was too low, about 0.5 mW instead of 5 mW - some futher adjustments will be required before we try again. Despite the problem with one transmitter, lots of fun was had and a lot was learnt. The path distance in this experiment was about 6 Km, however even using this simple type of equipment links upto several 100 Km are possible, depending on the site of the equipment and atmospheric conditions.

Anyone else for 10 GHz? Its lots of fun and fairly easy to get going on!

### TECHNICAL INFO

YOU WILL PROBABLY NOTICE THAT THE TECHNICAL INFORMATION IS FAIRLY SIMPLE IN THIS ISSUE. THIS IS MOSTLY BECAUSE THE EDITORS FEEL THAT THERE SHOULD BE SOME TECHNICAL CONTENT IN THIS BOOK, BUT WE ARE NOT OVERLY INFORMED ABOUT THINGS. BEARING IN MIND WHAT AMATEUR RADIO IS ABOUT, AND WHAT ROB MCKNIGHT HAD TO SAY IN HIS REPEATER COLUMN (UH, OH, THERE SEEMS TO BE SOME SOAP BUBBLES COMING FROM THAT BOX HE'S STANDING ON...ED), MAYBE (JUST MAYBE) SOME OF YOU ARE CONDUCTING THE ODD EXPERIMENT OF A TECHNICAL NATURE, AND MAYBE YOU ARE DOING IT ON UHF. 'NUFF SAID, BUT NO DOUBT OTHERS WOULD LIKE TO HEAR OF YOUR ENDEAVOURS. (WE HAD BETTER KICK THE BOX OUT FROM UNDER THIS GUY PRETTY SOON).

WHILE I HAVE YOUR ATTENTION, AND I HOPE THAT YOU AREN'T EXPECTING ANYTHING TECHNICAL IN A COLUMN NAMED LIKE THIS ONE, IF YOU DO NOTICE THAT A LOT OF THE STUFF IN THIS ISSUE SEEMS TO BE NOT INTERESTING TO YOU, OR NOT RELATED TO WHAT YOU THINK AMATEUR RADIO IS ABOUT, THEN YOU ARE THE SORT OF CHARACTER WE NEED. IF ANYONE HAS ANYTHING THEY WOULD LIKE TO SEE IN HERE, FEEL FREE TO SUGGEST OR CONTRIBUTE. ALSO....

AT THE REQUEST OF THE EDITORIAL COMMITTEE, WE JUST DECIDED THAT WE HAD BETTER KNOCK THIS GUY ON THE HEAD BEFORE HE STARTS SOMETHING WE DON'T WANT TO HEAR. WE WOULDN'T WANT ANOTHER FORD PREFECT (PERFECT???) OR ANYTHING, WOULD WE. HE DISAPPEARED WITH THE GOING OF THE OLD EDITOR, DIDN'T HE???

BUT LIKE THE MAN SAYS, IF YOU WANT TO SEE SOMETHING, TELL ONE OF US (BILL, SIMON, GRAHAM), AND WE WILL SEE IF WE CAN ACCOMMODATE YOU. (THINKS...ANOTHER PAGE OUT OF THE WAY.....)



YOU'RE LUCKY.  
I CAN'T EVEN  
GET A QSL CARD

WANTED

INFORMATION OR SCHEMATIC DIAGRAMS ON  
PHILLIPS FM1680C/25N, FM1680A/25N  
OR SIMILAR VHF FM TRANSCEIVERS.

KEN VK2KWG. PHONE 28-8218

## WOLLONGONG ALUMINIUM CENTRE

Available ex stock, we have a large range of

### Aluminium

- \* Rectangular Hollows
- \* Round Hollows
- \* Square Hollows
- \* Flat Bars
- \* Channels

All at competitive wholesale prices

Ideal for building your own antennas

Situated close to the railway crossing

79 Gipps St Wollongong

PH 28-5188 FAX 299-382

\*\*\*\*\*

- POST BOX - ALL MAIL CAN BE SENT TO "THE ILLAWARRA AMATEUR RADIO SOCIETY AT P.O. BOX 1838 WOLLONGONG 2500.
- REPEATERS -VK2RAW - 146.850 VOICE VHF MT MURRAY  
 -VK2RAW - 147.575 PACKET VHF MT MURRAY  
 -VK2RIL - 147.275 VOICE/RTTY VHF SUBLIME PT  
 -VK2RUW - 438.225 VOICE UHF HILL 60  
 (OFF AIR) -VK2RIL - 438.725 VOICE/RTTY UHF SUBLIME PT  
 -VK2RAH - 29.520/.620 VOICE HF
- BROADCAST -IS ON SUNDAY EVENING AT 6.45PM. RTTY MODE TRANSMITTED ON 147.275 AND RELAY ON 3.618 MHZ +/- QRM. CALL BACKS TAKEN IMMEDIATELY AFTER. VOICE BROADCAST HELD AFTER WIA BROADCAST ON 146.850 MHZ (VK2RAW) AND 3.618 MHZ +/- QRM.
- WIA RELAY -IS ON 146.850 MHZ AT 10.45 AM AND 7.15 PM EACH SUNDAY.
- NEWS LETTER -IS PUBLISHED EACH MONTHLY TO REACH ALL FINANCIAL MEMBERS IN THE WEEK PRECEDING THE CLUB MEETINGS. ARTICLES AND LETTERS ARE VERY WELCOME.
- MEMBERSHIP -\$15.00 P.A. CONCESSIONS \$12.00 P.A.
- LAWRENCE HARGREAVE AWARD -VK STATIONS REQUIRE 10 CONTACTS WITH IARS MEMBERS. OVERSEAS STATIONS REQUIRE 5 CONTACTS. ONE CONTACT WITH THE CLUB STATION VK2AMW IS SUITABLE. DETAILS OF CONTACTS ARE TO BE SENT TO THE SECRETARY.
- STORE -THE CLUB STORE IS OPEN AT EACH MEETING.

\*\*\*\*\*COMMITTEE\*\*\*\*\*

- |                |                                |                        |
|----------------|--------------------------------|------------------------|
| PRESIDENT      | -VK2KWG - KEN GRIMM            |                        |
| VICE PRES      | -VK2KEY - PAT JORDAN           |                        |
| SECRETARY      | -VK2KCV - PAT KENNEDY          |                        |
| ASSIS SEC      | -VK2XSV - VIC HEE              |                        |
| TREASURER      | -VK2TKE - KEN GOODHEW          |                        |
| ASST TRES      | -VK2KHE - PETER TOMLIN         |                        |
| COMMITTEE      | -VK2MT - ROB MCKNIGHT          | -VK2XSV - VIC HEE      |
|                | -VK2FPN - PETER READ           | -VK2XGJ - JOHN SIMONS  |
|                | -VK2KCH - BRIAN CLARKE         | -VK2KHE - PETER TOMLIN |
| REPEATER PRES  | -VK2MT - ROB MCKNIGHT          |                        |
| REPEATER COMM  | -VK2KHE - PETER TOMLIN         | -VK2XLA - GRAHAM EAST  |
|                | -VK2TKE - KEN GOODHEW          | -VK2XGJ - JOHN SIMONS  |
|                | - TOM JEPSON                   | -VK2KLD - LES DAVID    |
| OSL. CARDS OUT | -VK2JGI - GRAHAM DENNEY        |                        |
| OSL. CARDS IN  | -VK2JBS - BILL STONE           |                        |
| PUBLICITY      | ???                            |                        |
| BROADCAST      | ???                            |                        |
| CARTOONIST     | -VK2AXI - BRIAN WADE           |                        |
| PROPAGATOR ED  | -ZAPHOD (VK2XQX VK2JGI VK2JBS) |                        |
| PRINTERS       | -VK2DSH - DALE HUGHES          | -VK2XCC - RAY BALL     |
| SOCIAL DIR     | -VK2XCC - RAY BALL             |                        |
| CANTEEN        | -VK2DYU - BILL CHADBURN        |                        |
| STORE          | -VK2XSV - VIC HEE              |                        |
| TOWER CO-ORD   | -VK2XSV - VIC HEE              |                        |
| DOTC LIASON    | -VK2OB - KEITH CURLE           |                        |
| LIFE MEMBERS   | -VK2CAG - GRAEME DOWSE         | -VK2OB - KEITH CURLE   |
|                | -VK2ALU - LYLE PATISON         |                        |