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Another Use For A Music Stand

How many times have you been working on the bench and needed a third hand?

Many a time when working on a project with the workbench getting cluttered, I have thought to myself, if only I had some place to put this circuit so it doesn't get so mangled ....
Having a disused music stand, I thought that's the very thing!
Get it out, open it up, and hay, just the thing to rest the circuit diagram on, just at the right height and angle to be able to work without it being in the way. It's like having an extra hand, so give it a go.

Vaughn VK2KBI

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vk2xic@yahoo.com.au

Do TNC's cause interference to co-located sensitive VHF receivers?

This article was supplied for inclusion in the Propagator some time back, my appologies go to John Simon VK2XGJ.

I have recently taken the opportunity to observe electromagnetic compatibility of the MFJ-1270B as used by several of our NET/ROM nodes. (some of this may apply to other brands also.) T4e initial results were not as good as they should have been. The question was 'Do the TNC's cause interference to co-located sensitive VHF receivers ?' The answer is YES, depending on the situation.

In two different sites measured, the noise coming from the TNC was sufficient to cause 4-7 dB worth of desense to a 0.2 uv (12 db SINAD) receiver (145.01). There are two types of noise that radiate from the MFJ-1270B. One type is broadband in nature (probably due to data/address bus activity and DC-DC converter operation) the other kind is harmonics from the crystal oscillator and sub-multiples thereof ((4.9152/2) * 59 = 144.998 MHz). The broadband noise can cause interference on all frequencies if a sufficiently sensitive receiver in a quiet location is involved. The harmonic energy can cause problems on specific frequencies.

This interference is detrimental to the weak signals that several of our nodes are required to operate with. In addition it may cause problems to the communications of our hosts when we share a commercial site.

It is relatively easy to determine if you have a harmonic problem because the receiver noise will go quiet when the TNC is turned on. The broadband noise usually cannot be heard unless you observe the noise level in the presence of a weak signal. (With the normal antenna connection, inject a signal that provides 10 dB of quieting then turn on the TNC and observe the change in noise level. If you have a 0.5 uV receiver or are in an otherwise noisy location you may not be affected. With a 0.2 uV receiver you may loose 6 dB of quieting.)

Cleaning up the MFJ-1270B

Sufficient reduction in the energy emitted by the 1270B can be had with some relatively simple modifications to the 1270B. These modifications should reduce the broadband noise level to an insignificant level for most sites. Harmonics that cause problems to specific frequency can usually be moved far enough off frequency by 'rubbering' the crystal with the trimmer in the TNC.

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1. Scrape the paint from the inside of the cover and the outside of the chassis near the four screws that hold the cover on.

2. Remove the circuit board from the chassis and scrape the paint from the top of the four posts that hold the circuit board.

3. Add a low inductance strap from the mounting hole near the power switch to the ground trace at the edge of the circuit card. (The bottom side of the card works the best.)

4. On the bottom side of the card add a 'small' 0.001 uF capacitor from each of the four active pins on the DIN connector to the ground foil immediately adjacent.

5. Add a ground strap from the foil on the bottom side of the card under the DIN connector. The ground end of this strap can be left dangling until the card is reinstalled and then looped to the outside of the chassis and grounded with a small self tapping screw on the lip just below the DIN connector.

If you are at a shared site, you owe it to the other services to be a good neighbor.

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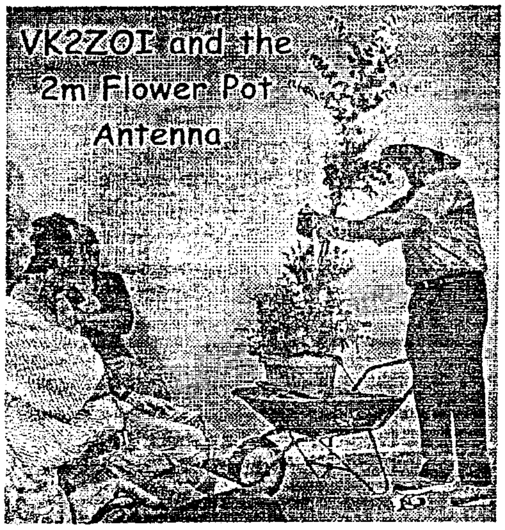
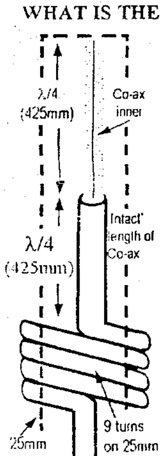
The article on the next four pages is a copy of a presentation given by John VK2ZOI at the July 2002 meeting of the IARS.



As promised at my talk last month, I said that I would provide the details of the various Flower Pot antenna designs in QUA. This month, I will cover the basic half-wave antenna for both two and six and, next month, I will cover the two designs that have gain. By that time, I hope to have been able to undertake some more tests and should have the indicative gain figures. For those who were not able to be present for the talk, I have also provided some of the background about this antenna for your information.

WHAT IS THE FLOWER POT? The "Flower Pot Antenna" belongs to that class of antenna of end-feed, co-axial construction utilising co-ax cable as the antenna elements and having a resonant choke formed in the co-ax feed to provide isolation between antenna elements and the feedline. I first constructed one of these antennas in early 1993 based on an article by Ian Keenan, VK3AYK published in AR Magazine of May 1986. Having successfully built the antenna and noting its good points, it was described in QUA of March 1993, with follow-up articles in April, September and December of that year. VK3AYK's dimensions are in the sketch above. It was found however, that these dimensions needed a small capacitive hat fitted to the top to bring the antenna to in-band resonance (and broaden its response). Otherwise, it performed very well and it was less than 1.2:1 across the 2m band. Several Club members built up the antenna during 1993, and these have been in service since then, with no major problems reported. It is a good 2m antenna.



Why the name "Flower Pot"? The photo opposite really says it all. By carefully placing plastic flowers over the antenna (it is built using a plastic conduit cover or 'radome'), you can effectively disguise it. This would be particularly helpful if you lived in a unit and did not want your neighbours to realise it was an antenna. As you can easily see, unless your neighbour holds a Masters Degree in Horticulture, they would be unable to identify this as a radio antenna (hi hi)! Other suggestions at the time included making a fake patio umbrella but the name "Flower Pot" has stuck for the last 8 or so years.

Back in '93, an attempt was made to scale the Flower Pot to 6m. Needless to say, this didn't work and, although the 6m Flower Pot project has occasionally been worked upon since then (unsuccessfully), in the main it has lay dormant for eight years.

WHAT MAKES A GOOD ANTENNA PROJECT?

A good antenna project has a number of essential characteristics. In addition to being an efficient and effective antenna, the other criteria are:

1. Cheap and Easy to build
2. Easy to replicate the design and obtain the stated performance.
3. Accommodates wide tolerances - dimensions not overly critical - you can use a tape measure rather than a micrometer
4. Robust to its electrical environment – not easily detuned by nearby objects.
5. No gimmicks to make it work.
6. Will provide long service – not susceptible to UV degradation, moisture ingress and corrosion effects, etc.
7. Solid State Output Safe (although the modern rigs these days are very rugged).
8. Easy and SAFE to erect/de-erect (no sharp/ pointy bits, radials and bits easily broken, etc)

The original Flower Pot essentially meets these criteria but it did have a gimmick - the "capacitive hat"

GERMINATING A NEW FLOWER POT.

There obviously has been a long desire to have a 6m version of the Flower Pot; however, the storms prior to last Christmas removed the 6m vertical antenna from the ZOI/DB QTH and provided the urgent need to get on with this project.

About this time, I came across another magazine article in the WIA Library at Parramatta (unfortunately, I didn't record the source/author details at the time) which gave a set of formulae for co-axial dipoles. These were 'bare bone' construction dipoles, ie they were not encased in any type of radome. Encasing the antenna in conduit can pull the resonance down by up to 2% (depending on frequency), so allowance for this has to be made when building this style of antenna. Details were also given for a 2m and 6m resonant choke. The formula and resonant choke details are given in the figure on the next page.

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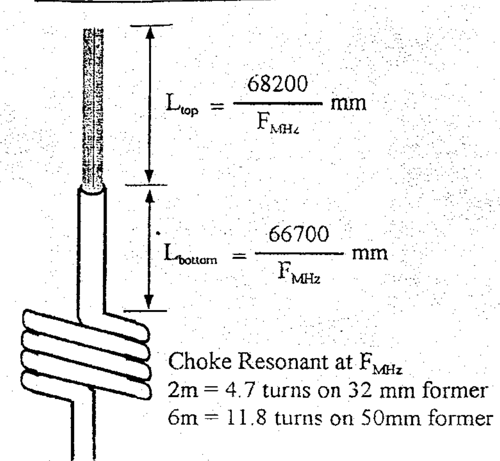


In the above dimensions, there is about a 2% difference between the top element and the bottom element. This probably allows for the loading effect (and hence shortening) on the bottom element due to the presence of the choke and the difference in the wavelength to diameter ratio between the top and bottom elements which would require the top to be longer for resonance.

The element lengths are still shorter than 'conventional' antenna lengths as can be seen in the following table, but are about halfway between the original Flower Pot and a 'normal' antenna.

	2m (147 MHz)	6m (52.5 MHz)
λ/4 (free space)	510 mm	1428 mm
'Normal' λ/4 antenna length	495 mm	1370 mm
Flower Pot λ/4 antenna length	425 mm	1201 mm
Above Formula		
Top Element	464 mm	1299 mm
Bottom Element	454 mm	1270 mm

I considered that the quoted fractional turns of the choke coil was in the realm of 'fiddly'. To meet the criterion of wide-tolerance and to accommodate any possible variations between co-ax cable brands I prefer a design based on specifying unit turns. Measurements on various sized coils of co-ax were undertaken so to find out self resonant frequencies as a basis for experimenting with the design. The results are given in the table at the top of the next column.

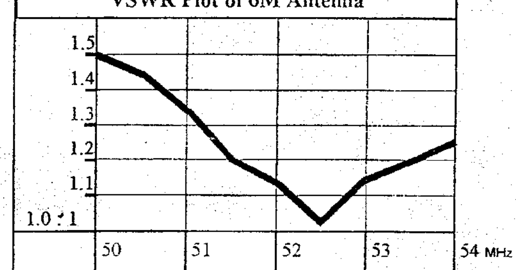
A 6m antenna was assembled using the formula element measurements for 52.525 MHz (1299mm top/ 1270mm bottom) and using a 12 turn coil on a 50mm PVC conduit former. As you can see from the VSWR plot opposite, these dimensions provide a very usable antenna for the FM portion of the 6m band.

Bouyed by the success of the 6m antenna without having to resort to a lot of cutting and fitting things like capacitive hats to get it to work, I revisited the 2m Flower Pot to see if it could be improved.

Co-ax Coil Self Resonant Frequency (MHz)

Coil Turns	PVC Conduit Former 25mm	32mm	50mm
4	-	160	-
5	150	136	85
8	142	106	65
9	135	100	60
10	129	95	57
12	117	84	52
15	105	-	47

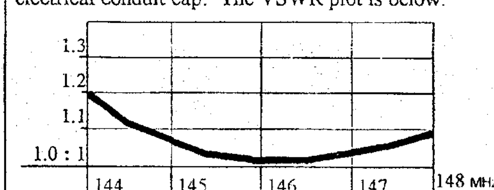
VSWR Plot of 6M Antenna



I did do some adjustment to the calculated lengths and the final 2m version dimensions are:

Top element: 457 mm
Bottom element: 447 mm
Coil: 9 turns on 25mm former.

Don't fit a conductive cap to the antenna (like a black rubber chair end) as this will pull the antenna resonance low (like a capacitive hat). Instead, use a proper PVC electrical conduit cap. The VSWR plot is below.



The need to shorten the calculated lengths was probably due to the effect of the PVC conduit radome. The choke is resonant below the band (135 MHz) but this appears to help the flattening of the VSWR plot across the band. Observing the flatter VSWR plot of the 2m antenna versus the 6m, I did experiment with the 6m coil (increasing up to 15 turns); however, the 12 turn coil was the optimum size for the FM portion of the band for the given element lengths (also note, 1 MHz bandwidth at 6m equals approx 3MHz BW at 2m).

Next month details of the two higher gain versions (the 'single' 5/8 and the 'double' 5/8) will be given in QUA.

73 de John VK2ZOI

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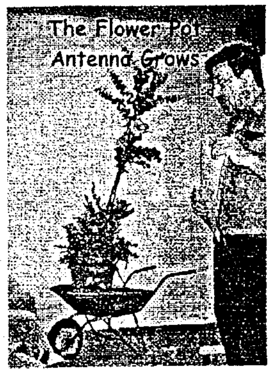
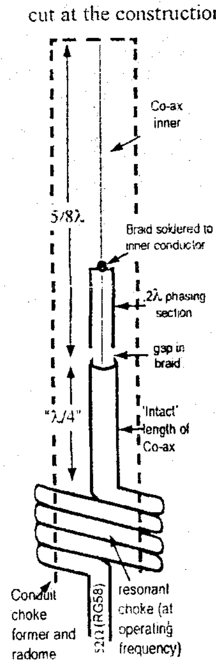


The basic 2m and 6m half-wave Flower Pot Antennae were described in QUA last month. From the details given, you should also be able to design and build an antenna for other bands in the VHF region (such as the boating, air bands etc). This month, details of the two variants of the Flower Pot which have gain, are provided. These two antennae are referred to as the Single 5/8 and the Double 5/8 (Flower Pots).

SINGLE 5/8 FLOWER POT

In its simplicity, this antenna substitutes a 5/8 wave section for the top quarter wave of the basic Flower Pot design. The arrangement is shown in the sketch below. The 5/8 radiator uses a 0.2λ (shorted) co-ax phasing stub to resonate the 5/8 element. In a conventional 5/8 mobile whip, an inductor is used to bring the 5/8 element to resonance; however, in this Flower Pot style of antenna, using a co-ax phasing (or delay) stub suits the construction technique and has the advantage of being able to be precisely determined and cut at the construction stage.



The antenna configuration is similar to, but slightly shorter than, the "Gain Sleeve" antenna described in the RSGB Handbook (6th Edition – figure 13.99, which itself is derived from the reactance –or shunt– fed 5/8λ monopole antenna at figure 13.84). The Gain Sleeve antenna achieves an effective radiating element length of one wavelength and, since the aperture is about twice that of a half wave dipole, a theoretical gain of 3 dBd (gain over a dipole) could be achieved. However, note that the Handbook indicates that in practice, the Gain Sleeve antenna would realise about 2.5 dBd. The effective radiating element length of the Single 5/8 Flower Pot is 7/8λ suggesting it would have somewhat less than 2.5dBd gain.

Antenna gain measurements of the Flower Pot variants are discussed on the next page. Construction of the Single 5/8, whilst a little more involved than the basic antenna, is again fairly simple. At the feedpoint, you cut away the outside sheath and braid so as to leave a gap of about 2 to 4mm. From the edge of the braid, measure off the distance for the .2λ section (for 2m and solid dielectric cable, this distance is 276mm, for 6m it is 755mm). From this point, expose sufficient braid to be able to make several pigtails to be soldered to the inner conductor and then the remainder of the braid and outer sheath can be stripped off. At the .2λ point, cut into the inner dielectric to expose about 3mm of the inner conductor and solder the pigtails to the conductor.

Trim the top element to length, leaving a small, extra margin to allow some adjustment (because we are amateurs and will always want to trim and adjust!). It's not a problem anyway if you end up with a length that's a bit short, because a another piece of wire or a piece of the discarded braid can be soldered to the top. I use a piece of solid wire at the top because, in the final assembly, I cut a small nick in the edge of the conduit and nip this wire in the nick so that when the end cap is fitted, it clamps the wire solidly in place. Another method of holding the top element straight and in place within the conduit is to use hot glue etc. In the final assembly, the conduit will need to be trimmed off so as to be reasonably flush with the top of the element.

The distance from the feedpoint to the top of the coil needs to be marked with a piece of tape, string, paint spot, or whatever, so as to be a reference/stop point when inserting the cable into the conduit.

Two holes need to be drilled into the side of the conduit such that the coil turns will be firm and secure. The actual hole diameter and the spacing between the holes will depend on your choice of cable brand and/or where it was manufactured.

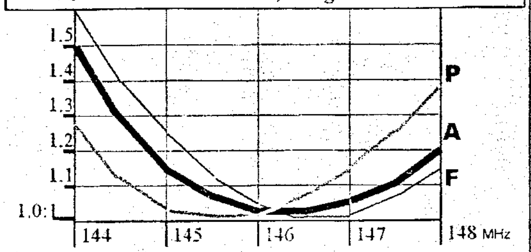
The antenna is assembled by inserting the radiating portion through the top coil hole and pushing it upwards until the aforementioned reference/stop point disappears into the hole. The coil is then wound on the outside of the conduit and the remainder of the cable inserted through the bottom coil hole and pushed down. Using firm but careful manipulation, the cable is pushed and tugged through the exit hole until the coil is tightly wound and secure. This must be done without altering the bottom radiator length (you should continue just to see your 'mark' through the top hole.

Finally, fit a connector, measure the VSWR, trim and cut the top element as appropriate and, cap the top, securing the top element in place.

The Single 5/8 has a slightly sharper VSWR response than the basic Flower Pot and, although a VSWR of less than 1.5:1 across the 2m band can be achieved, the antenna can be cut to favour the high FM portion of the band or the lower packet portion. The dimensions derived during my experiments for 2m were:

Desired Portion of Band	Upper 5/8 element	Bottom 'λ/4' element	Choke Coil
Across the Band (A)	1228mm	465mm	9 turns
FM & Repeaters (F)	1224mm	465mm	on 25mm
Packet low band (P)	1236mm	480mm	former

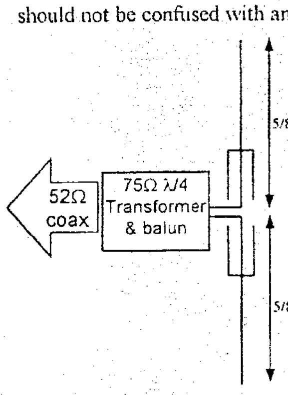
VSWR Plots of 2 Metre, Single 5/8 Antennae

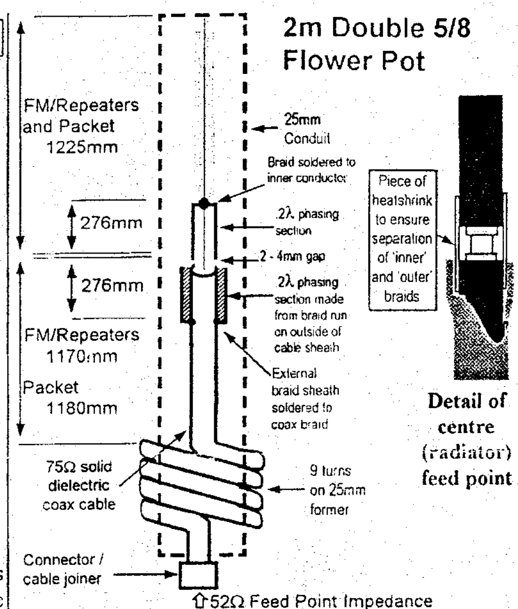


The VSWR curves for the three antennae are shown in the figure above. Note that the "Across the Band (A)" curve purposely favours the higher end of the 2m band.

DOUBLE 5/8 FLOWER POT ANTENNA.

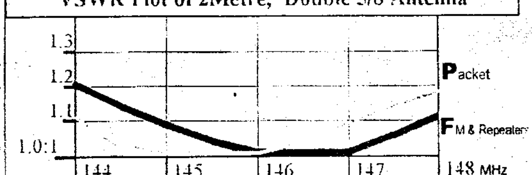
The Double 5/8 seemed a natural extension of the Single and uses a 5/8 element for the bottom section. It is an (co-) axially fed variation of the 1¼ wave (vertical) dipole shown in the following diagram. This antenna should not be confused with an in-phase 5/8λ over 5/8λ collinear. If it was horizontal, made of wire and cut for HF, an old-timer might call it an extended double Zep. However, in addition to having gain over a half wave dipole, it has a predictable 100Ω feed impedance that readily will transform close to 52Ω by a 75Ω quarter wave line transformer. Also, this 75Ω section can be wound into a current balun to allow co-axial cable feed. We fashion this antenna into the Flower Pot co-axial design by constructing the antenna using 75Ω cable and bringing the feed co-axially down through the bottom element. The longitudinal reactance of the resonant choke performs the dual role of providing isolation of the high impedance at the end of the bottom element and acting as a balun. Several quarter waves (note it must be an odd number) of 75Ω cable are required for the length of the 5/8 element and the coil winding. Seven quarter wavelengths of solid dielectric cable (2.36m) were needed for the 2m protypes and the overall arrangement is shown in the next sketch. There are two 'fiddly' parts in making this antenna. The first is forming the .2λ section at the feed point of the bottom element. I ran a piece of braid on the outside of the cable sheath carefully soldering this to the coax braid at the .2λ point and used heatshrink to hold it tight against the sheath. I assumed a velocity factor of .66 for this section. Care is needed when soldering to the coax braid - and this dictates the use of solid dielectric cable. The second is ensuring that the braids don't short at the feed point and I found a piece of heatshrink solved this.





The sketch above also shows the detail at the radiator feedpoint and the piece of heatshrink acting as a separator. A small variation in the bottom radiator length gives favour to either the high or low end of the band and the VSWR plots are are follows:

VSWR Plot of 2Metre, Double 5/8 Antenna



All the antennae will require some form of 'Cocky' shield over the coil. The shield must be non-conductive and I found an empty Silicone Seal cartridge (enlarge the hole at the top and cut to length) neatly fitted over a 2m antenna coil. Wrap the coil and the entry/exit holes with tape before fitting the shield to minimise water entry and ensure any condensation inside the conduit can drain away (don't seal the bottom of the conduit).

GAIN MEASUREMENTS

I do not have a means of accurately measuring antenna gain but set up each antenna with a switched attenuator in the feedline to a receiver. The attenuator was not ideal for this purpose, it had only 3,6 10 and 20 dB steps. However, using a local 2m beacon as a signal source and the basic λ/2 Flower Pot as a reference, and within the limits of available accuracy and resolution, I determined that the Single 5/8 had about 2 dB gain over the λ/2 antenna and the Double 5/8 was discernably in excess of 3db gain (but, of course, much less than 6db).

WHAT'S NEXT?

In a future QUA I will describe the work done on multi-banding the Flower Pot 73 de John VK2ZOI

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Coming Events

Next Meeting
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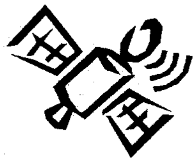
The IARS Repeaters



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Below is the listing of frequencies in use.

Access tones are not required.
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The listing below also includes the Satellite Gateway and BBS run by John Simon VK2XGJ.

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VK2RMP	52.650/53.650	6m Voice	Maddens Plains	
VK2RBT	146.075/146.675	2m Voice	Mt Boyne	RMP/RIS
VK2RMP	146.250/146.850	2m Voice	Maddens Plains	RIS/RBT
VK2RIS	146.375/146.975	2m Voice	Saddleback Mtn	RBT/RMP
VK2RUW	433.225/438.225	70cm Voice	Knights Hill	RGN/RHR RGI/RTW
VK2RMP	433.725/438.725	70cm Voice	Maddens Plains	APRS "Wide"
VK2AMW-1	145.175	APRS Digi	Knights Hill	
VK2AMW-3	144.700	Packet Digi	Sublime Point	
VK2AMW-5	147.575	Packet Digi	Mt Boyne	
VK2AMW-7	147.575	Packet Digi	Mt Murray	
VK2XGJ	53.100	BBS/Satgate	Dapto	
VK2XGJ	144.700	BBS/Satgate	Dapto	
VK2XGJ	147.575	BBS/Satgate	Dapto	
VK2XGJ	440.050	BBS/Satgate	Dapto	

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Club meetings are held 7:30 PM on the second Tuesday of each month, (except January) at the SES Building Montague Street North Wollongong

Committee meetings are held on the third Wednesday of each month.
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