Illawarra Amateur Radio Society

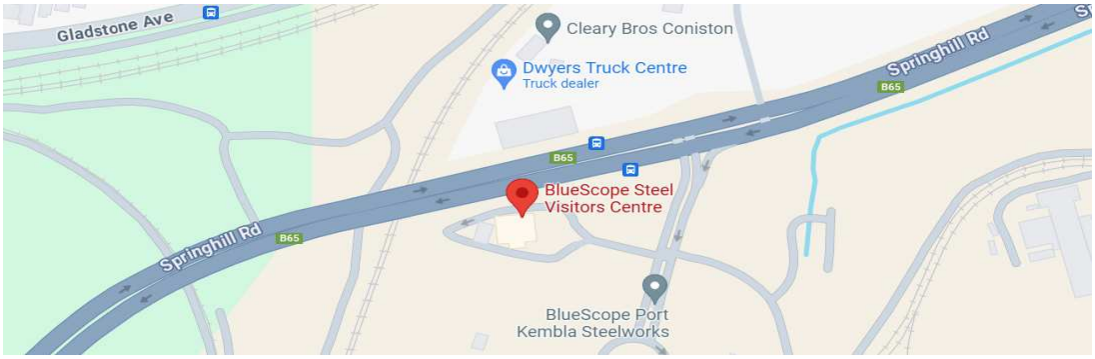
Propagator September 2025

-. . .-- ... / .- -. -.. / .. -. ..-. --- .-. -- .- - .. --- -.

Upcoming Meeting on the 9th September 2025

The next meeting will be at the Blue Scope Steel visitors centre 7.30pm

Blue Scope Northgate entrance off Springhill Road (See website for detailed map)



VK2RUW (Knights Hill)
34.6231° S, 150.6942° E
QF55IJ

AMATEUR RADIO IN THE ILLAWARRA SINCE 1948

VK2RMP (Maddens Plains)
34°15'30.6"S 150°56'47.4"E
QF55LR

VK2AMW

Our last meeting 12th August 2025

We have a newly elected committee.

Thank you to all members who have served the IARS for 2024/2025.
Dedication and hard work have been truly invaluable to the success of our society over recent years.
The IARS has a very strong foundation that will continue to strengthen as we move forward into the future.

At the same time, we welcome to our new committee members.

We are excited to have you on board with this year looking at fresh perspectives, ideas, and enthusiasm.

Here's to a positive and successful year ahead!

President : Simon VK2FO/XQX

Vice President : Rob VK2MT

Secretary : Keith VK2KQB/QH

Treasurer : John VK2EJL

Committee Member : Simon VK2KU

Committee Member : Adam VK2AEV

Committee Member : Shane VK2HCO

Committee Member : Mal VK2DXM

The IARS would like to thank our returning officer Ned VK2AGV, who oversaw the election with an eagle eye 😊

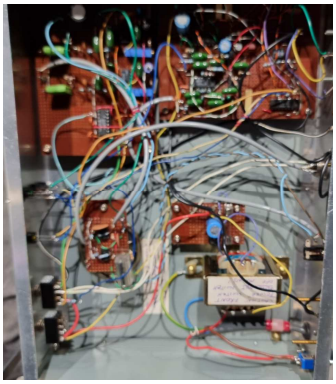
>><<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<

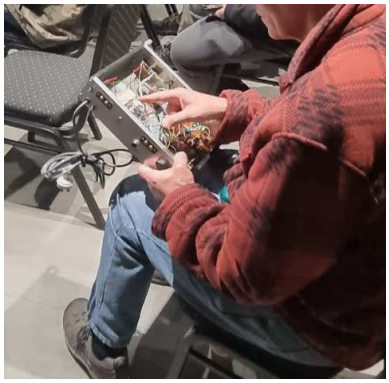
SHOW & TELL

After all the formalities were taken care of, the IARS settled down to an evening of Show & Tell.

First up was Ned, VK2AGV with an interesting couple of items or one can say “Devices” , one from the past and a newbie.

Ned shared with us his homebrew RTTY teletype printer modem made from discrete logic devices, and few op-amps and yes, even the famous 555 timer.




Ned's Home brew Modem form the past (very old 😊) and his latest and greatest Diplexer

Ned's Homebrew 2m/70cm Diplexer has a very low insertion loss although Ned has some ideas on improving it.

>>>>>>>>>>>>>>>>>>>><<<<<<<<<<<<<<<<<<<<

Next up we had Roger VK2VRK, with his new and improved Repeater in a Box. Using a Raspberry Pi and two rigs, this repeater could be used as a node/ hotspot.

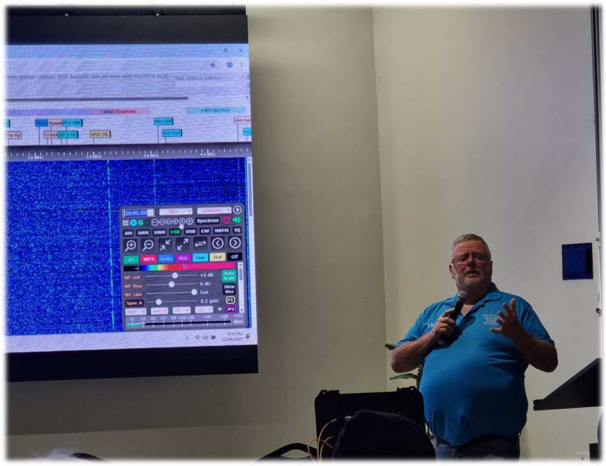
The Diplexer is nice and compact, making the overall unit very small and light, easily carried around by the handle.



>>>>>>>>>>>>>>>>>>>><<<<<<<<<<<<<<<<<<<<

Last but not least, Simon VK2XQX, our newly elected president, gave us a quick demonstration using Kiwi SDR.

Kiwi SDR is a fantastic tool for checking propagation and even just a s listening device. If you have trouble due to QRM or even QRN, tune in to a SDR on the other side of the country, or even across the big pond.



http://kiwisdr.com

Use this link or just type in kiwisdr in your browser to open the Pandoras box 😊

Thanks Simon, Roger and Ned for the interesting presentations

The Disposables Table

As always there was some great giveaways at the table last meeting with many items finding new homes
If you have anything you no longer use, bring it along to the next meeting and give it a second life.
Please bring along your unwanted parts, radios, microphones, antennas and anything else that may get some use at its new home.

For $5 you can earn some good cash, and all monies go to your society, win-win.

As usual see Simon VK2KU, the fella with the coloured balls and big smile

The Snowball had a winner 😂, Bruce VK2ZPN has the luck of an Irishman on Paddy's Day 😂. (won a few times)

Congratulations to Bruce, don't forget to buy a new radio .

NEXT Meeting…….

PROJECT I.A.R.S. *SimonVK2KU*

Next meeting our societies project manager Simon VK2KU will be sharing the latest and greatest project that can be built through the club. There are plans, pcb's and parts available at reduced cost, and there is always some help that comes along to get it going!

IARS assisted projects that Simon has under the belt!

- Electronically controlled soldering stations
- Noise Canceller
- SWR and Power Meter
- Crowbar protection PCB
- 100Watt Dummy load
- Anderson power pole module with display

Wow, the list is growing can't wait to see what Simon has installed for us next meeting.

Remember if you need any more information on the projects listed previously please send an email to iars.simonr@gmail.com or iars.keithb@gmail.com

There will be the usual meeting activities and refreshments.

Come along on the ……. To see what the next secret project will be.

Membership fees

We want to thank the members who have paid membership but there are a few fees still outstanding. Please support your club.

'Bank: IMB Wollongong
Account name: Illawarra Amateur Radio Society
BSB: 641800
Account number: 100023291

Please add your call sign or name with the payment, thank you.
(else we don't know who's paid)

Thank you!

Licensing and upgrades?

The IARS **can help** with obtaining your Foundation, upgrading to Standard or Advanced from *the comfort of your own home,* and its FREE!!! *

We have approved **ACMA** accessors that can offer remote or face to face assessments for the **ACMA**

Please contact Keith VK2KQB at iars.keithb@gmail.com for further information on training and assessments.

Your society supports further learning, please find out more on how we can help you.

This year the IARS has already assisted in getting seven new amateurs licenced, is it your turn next?

YES!!

The IARS is helping Amateur Radio grow in Australia!!! We are still maintaining an average of 1 per month

Australian Government | acma Australian Communications and Media Authority

If you would like to find out more about amateur radio upgrades, here are some handy links to help.

https://www.acma.gov.au/qualifications-operate-amateur-radio

https://www.acma.gov.au/amateur-radio-resources

https://www.acma.gov.au/amateur-radio-accredited-assessors

https://www.acma.gov.au/amateur-radio-licences

https://www.acma.gov.au/technical-details-amateur-radio-licences

https://www.acma.gov.au/amateur-radio-operating-procedures

https://www.acma.gov.au/amateur-radio-call-signs

https://www.acma.gov.au/amateur-class-licence

https://www.acma.gov.au/amateur-radio-related-fees

IARS NETS

1. Saturday Morning, the EAST COAST NET hosted by Steve VK2BGL at 9.30am

You are invited to join Steve every **Saturday at 9.30am** on our **146.850MHz** repeater (linked to 146.675MHz) or **VK2BGL-R** on Echo-link for a very enjoyable morning of general discussions from amateurs who log in from all over the world. This NET is linked to multiple repeater systems including VK2RFS south coast.
Join Steve and everyone for a very enjoyable 2 hours on Saturday morning.

The IARS would also like to thank Doug VK2XLJ and Angelo, VK2NWT who are is always willing to assist whilst Steve is away.

2. **IARS Tuesday evening weekly 80m NET on 3.666MHz at 8.30pm hosted by Mal VK2DXM using VK2AMW.**
   Every Tuesday evening, (expect the second Tuesday of the month) for a great get together on 80m. Signal reports, news and general discussions are the agenda. Normally runs for around 60minutes.

3. **IARS Wednesday evening weekly 6m NET, 8PM on 53.650Mhz with a – 1Mhz offset Hosted by Geri VK2UTE or Simon VK2XQX, (123Hz CTCS tone enabled due to interference) Maddens plains 6m Repeater**
   General discussions about building antennas for 6m, transceivers and what else comes to mind, this net is normally between 30 and 60minutes.

4. **IARS Thursday evening weekly 10m NET, 8PM on 28.466Mhz +/- for QRM/QRN Hosted by Tony VK2TS**
   General discussions about building antennas for 10m, transceivers and what else comes to mind, this net is normally between 30 and 60minutes.

5. **IARS Friday evening weekly 70cm NET , 8PM on 438.675MHz ** with – 7MHz offset (No CTCSS required) Hosted by Rob VK2XIC**
   General discussions keeping the repeaters in work, ***"If we don't use it, we may lose it "***
   ** note frequency changes as from 20th June 2025

IARS REPEATERS

VK2RUW (Knights Hill) **VK2RMP (Maddens Plains)**

146.675 MHZ >>>>> *linked* <<<<< 146.850 MHZ

Current Repeater STATUS

- **439.675 with a – 7MHz offset, C4FM Enabled. OK – On Air ****
- **147.275 with a + 600kHz offset NO CTCSS, C4FM enabled OK – On Air ****
- **146.850 with a – 600kHz offset (linked to 146.675) NO CTCSS OK– On Air**
- **146.675 with a – 600kHz offset (linked to 146.850) NO CTCSS OK– On Air**
- **53.650Mhz with a – 1Mhz offset (123Hz CTCSS tone enabled due to interference) OK– On Air**
- **438.725Mhz with a -5mHZ offset DMR only, OK – On Air**
- **1296.850Mhz Experimental Beacon/Simplex repeater, Maddens Plains OK – On Air *****
- **Echo-link VK2MT-R via 146.850MHz also linked to 146.675MHz and VK2BGL-L OK**
- **APRS DIGI-PEATER on 145.175MHz OK– On Air**
- **PACKET 2M on 147.575Mhz OK– On Air**

The IARS welcomes any feedback on our repeater systems.

Please send all your feedback to iars.keithb@gmail.com and it will be passed on to our repeater team.

Any donations to help us maintain our great repeater system will be greatly appreciated. Please check our banking details on our website at www.iars.org.au under the Contact details page. As reference of the donation please add your Call sign and the words “Repeater Donation”

If the repeaters are silent, why not just give out a call, who knows who may be on the other end of the tower.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Latest Repeater Report:

All systems A-OK

**** Please note the current new repeater frequencies as from the 20th June 2025**

***** Note, this will be changing to 1.293 800 GHz Simplex soon, however, plans are in place for it to become a Full Duplex repeater system, before the year end 2025. (Funding dependant)**

LOOKING FOR SOMETHING to SWAP, BUY, SELL, an OLD PART

Parts you may need for repairs or some radio gear you no longer need that could go to a new home…….?
Email iars.keithb@gmail.com

Electronic component and service suppliers

Need a quick PCB in a hurry to put that latest project on, JLCPCB

https://jlcpcb.com

element14 AN AVNET COMPANY https://au.element14.com

RS https://au.rs-online.com/web/

MOUSER ELECTRONICS https://au.mouser.com

DigiKey https://www.digikey.com.au

Minikits https://www.minikits.com.au

core ELECTRONICS https://core-electronics.com.au

Elite Communications & Electronics https://www.elitecommunications.com.au

Little Bird Electronics https://littlebirdelectronics.com.au

ATR Amateur Transreceiver Radio Supplies

https://amateurradiosupplies.com.au

VK RADIO **YAESU Sales and repairs** https://www.vkradio.com.au

DXing https://dxing.com.au

TELCO ANTENNAS https://www.telcoantennas.com.au

ALTRONICS **https://www.altronics.com.au**

jaycar **https://www.jaycar.com.au**

If you know of a good supplier of electronic stuff or services 😊, please share it with us so we can all benefit.

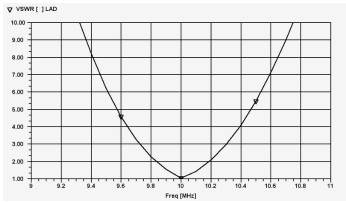
Send information to iars.keithb@gmail.com and we will publish it in the next propagator.

got an idea – Tech Corner

Share it with us, this could be suggestions, technical ideas, circuit diagrams, IARS community projects, pictures of your latest shack project, in fact ANYTHING of interest

Let us know by return email iars.keithb@gmail.com

If you have some IARS related pictures or information that we can put on the IARS *website*, *please let us know and we can get that happening.*



Standing Waves *part3*

CONTINUED from last month's Standing Waves and previous month SWR Myths.

So what happens to the reflected power ?

Many amateur articles are insistent that the reflected power is *absorbed by the transmitter* and causes damage or extra heating in the amplifier network components. It is simple to prove these arguments wrong.

- The reason they assume this occurs is because they treat the transmitter as a Signal Generator.
- In a signal generator a resistive attenuator network is placed between the oscillator and the output connector to ensure the load always sees a constant resistance (impedance).
- The reflected power from the load is totally absorbed by the attenuator network and dissipated as heat.

RF transmitters do not work this way, they are Conjugately Matched not resistively matched as the signal generator is

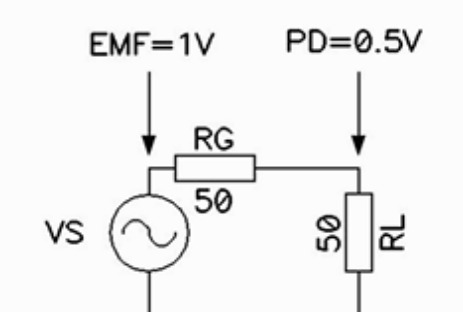
How to prove a transmitter is Conjugately Matched?

If the transmitter behaved as a signal generator it would have a source resistance (RG) of 50 Ω. The signal generator develops an open circuit output voltage we call the EMF. When the load is attached the output voltage falls to the PD value and 50% of the power is dissipated in the output resistance of the signal generator and 50% in the load.

This means the highest efficiency it can have is only 50%. Transmitters often exhibit efficiency figures of 60% or higher.

Hence, the transmitter does not have an output resistance of 50 Ω, but something quite different. Audio amplifiers designed to drive low impedance speakers have an output source impedance of as little as 0.01 Ω, RF transmitters are similar

RG and RL are connected in series and act like a potential divider network

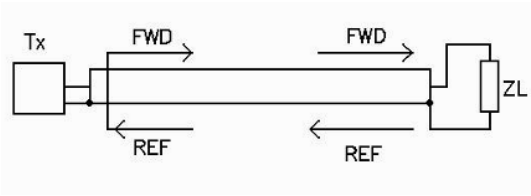


Conjugately Matched Devices and Reflected Power

In a conjugately matched power source, the output network is designed to transfer maximum current (and hence power) into the load or transmission line.
Although they are designed to operate into a given impedance (typically 50 Ω) they do not look like a 50 Ω resistive load when we look back into the output terminal.
Depending on how you analyse them they can be considered as a Current Source or a Voltage Source.
A current source has an output impedance of zero Ω and voltage source an output impedance of infinite Ω.
Hence, they present a very high SWR to any power which is reflected back towards them, the same as an open or short circuit antenna

Many amateurs regard the power reflected from the antenna as reflection loss.

The reflected power from the mismatched load end of the transmission line is repelled (re-reflected) by the conjugately matched transmitter.

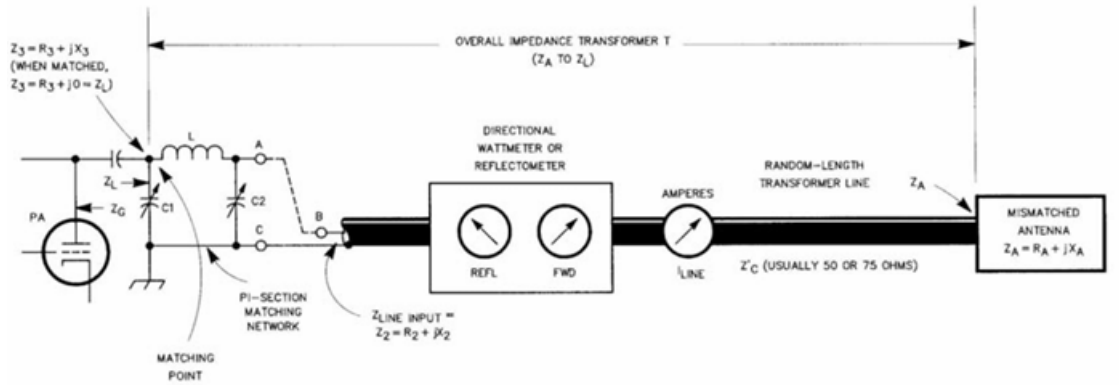


Upon re-reflection the phase again undergoes a 180° change (just like that which occurred at the antenna) and now the power is in-phase with the forward power. Hence, the re-reflected power and the forward power from the transmitter add to give an increase in the power entering the transmission line.

This is known as **reflection gain**. With a SWR of 3:1 on the line the forward power increases by 25% to an indicated 125% of the nominal power. (Many amateurs have observed this with their SWR meter but believe this is an incorrect measurement)

The re-reflection of the original reflected power cancels out the reflection loss and gives rise to an increase in the forward power. Suppose the transmitter is rated at 100-W into a 50 Ω resistive load and the line SWR is 3:1.
The forward power is now 125-W into the transmission line. Assuming the line has no loss, this same 125-W will appear at the antenna terminals.
The antenna needs to send back (reflect) some of the power when a SWR occurs. Since with a SWR of 3:1 the power to be reflected is 25-W and there is 125-W occurring at the antenna mismatch, the antenna needs to accept 100-W and reject the remainder. Hence, the full 100-W transmitter rated power is accepted and radiated by the antenna and the excess 25-W is reflected back to the transmitter. Although the SWR is 3:1 the full 100-W is radiated and no power is lost.
Therefore there is no reduction in field strength. Using the SWR meter we can determine the radiated power.
It is : Prad = (Pfwd-Pref)

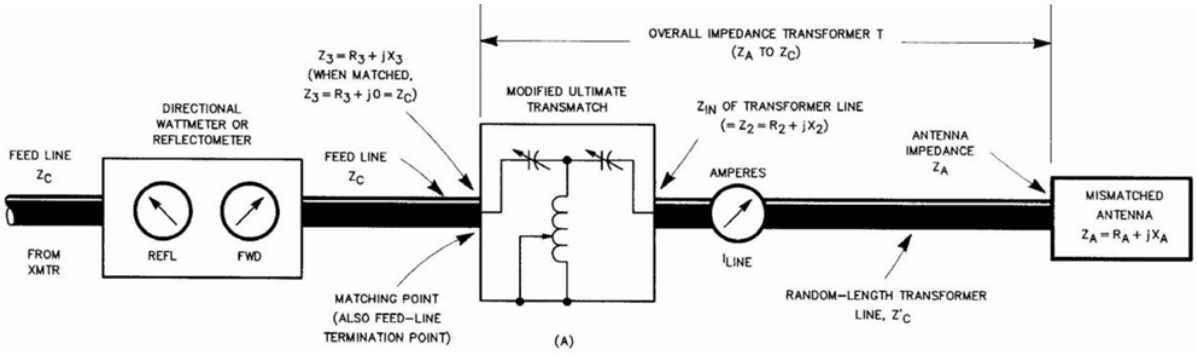
In a valve transmitter we have an adjustable matching network between the valve and the output terminal. Often this is a π network. A practical π network can match over a 100:1 impedance ratio with negligible loss. By adjusting the anode tune and load capacitors we can establish maximum power transfer (maximum current) into the antenna feed line by cancelling out the reactance seen at the input to the line



Any reactive component reflected down the feed line from a mismatched antenna will be inverted every λ/4 but can be corrected by adjusting the capacitors if they have sufficient range. A typical valve transmitter with a π network can match over about 3:1 to 5:1 SWR with minimal power loss. This allows us to work over a wider portion of the band with little effort.

In a solid state transmitter the output network is **fixed, tuned** and no adjustment is possible by the operator. It will only deliver its full power into a pure 50 Ω resistive load- begs the question , **is this progress?**

If the SWR presented to the transmitter is excessive the RF amplifier will not be able to deliver maximum power into the feed line. Typically when the SWR is about 2:1 the internal reflected power detector will begin to back-off the drive.
At a SWR of 4:1 it is almost totally shutdown.
To correct this, we need to insert an additional matching network, called an Antenna Tuning Unit (ATU) or Trans-match



Practical transmission lines with some loss

All the cases up until now have assumed zero line loss. In a practical feed line some loss will be present. If the line has loss then the indicated SWR at the line input will measure less than the SWR occurring at the antenna.
If the line has infinite loss then all the power input to the line will be dissipated as heat and none will arrive at the far end.
It behaves like a Dummy Load and the SWR indicated is 1:1.
By the way …… (30m of RG-58C at 432MHz has ≈ 17dB of loss and behaves like a dummy load)
https://kv5r.com/ham-radio/coax-loss-calculator/

For cases where the loss is less then we need to consider what the SWR meter will indicate if placed at the transmitter end of the line.
If the line has 3dB loss and 100-W are sent from the transmitter end only 50-W will arrive at the antenna.
Assume the antenna SWR is infinite. Hence, 100% of the applied power will be reflected back.
This is 50-W.
The reflected power traveling back to the transmitter is also reduced in level by the 3dB line loss and only 25-W arrive at the SWR meter. It uses the 100-W and 25-W to compute the SWR and arrives at a value of 3:1. But the real SWR is infinite

Percentage Reflected Power and SWR Some measurements which will be useful.

% Reflected Power	Indicated SWR
1%	1.22:1
2%	1.35:1
4%	1.5:1
11%	2:1
25%	3:1
33%	4.2:1
50%	6:1
67%	10:1

- If the line has 1dB of attenuation and the antenna end is either open or short the indicated SWR at the transmitter end is 9:1.
- If the line loss is 6dB the indicated SWR is 1.7:1 for the same fault condition.

We can use this method to measure the line attenuation

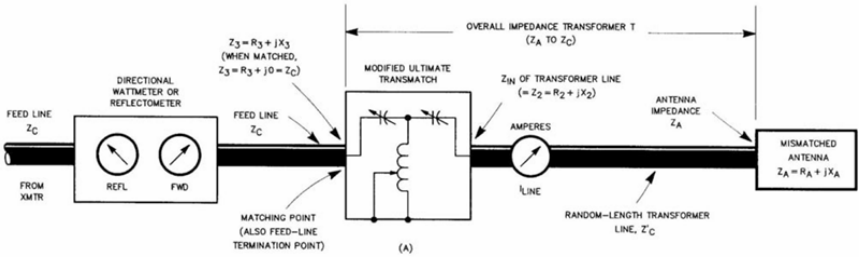
Antenna Tuning Unit

An ATU does in fact tune the antenna, despite what many amateurs believe.

To understand this, you must examine the reactance problem in more detail. We have seen that a λ/4 line inverts reactance whereas a λ/2 line does not. If the transmission line is exactly λ/2 in length (or multiples) the impedance and reactance occurring at both ends of the line are identical. If we need a reactance of, say, +100 Ω to be placed across the antenna feed point to correct a SWR, then it is more convenient to place this at the transmitter end where we can adjust it if necessary.

If the feed line is not an exact λ/2 it doesn't matter because we can vary the value and sign of the reactance to compensate. If the feed line happens to be odd multiples of λ/4 then we simply change the sign of the reactance from +100 Ω to -100 Ω.

To be strictly correct The ATU tunes the *antenna AND the feed line*, because the two work in conjunction



When we insert an ATU between the transmitter and the input to the feed line we are introducing an additional conjugate matching network. This is a case of two wrongs making a right.

By adjusting the ATU we make the transmitter see a low SWR. But the SWR occurring at the output terminals of the ATU is still the same as before. All we have done is to install a one-way valve to help prevent power flowing back into the transmitter.

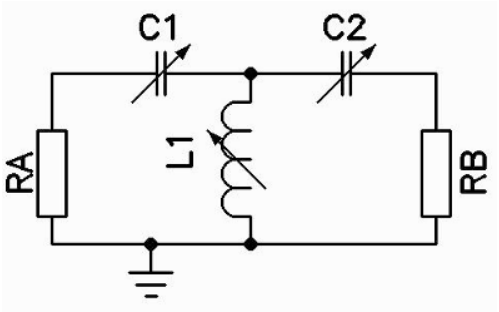
Any reflected power from the antenna is re-reflected by the conjugately matched ATU and it is sent back to the antenna reinforcing the forward power.

What is important is the insertion-loss of the ATU. If this is more than the power increase obtained from the transmitter when the ATU was used then we are no better off, or we could be worse off compared to the high SWR condition without the ATU.

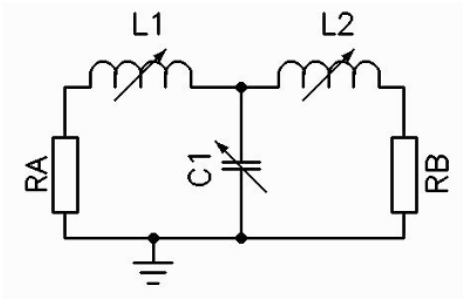
If a 100-W solid state amplifier backs off the power to 80-W when a SWR is present and the ATU has an insertion loss of 1dB (20%), then we are no better off with the ATU in circuit. We still only have 80-W entering the feed line, but 20-W is now being turned into heat in the ATU.

There are two main types of ATU, the Pi network and the T network.

- The normal Pi network behaves as a low pass filter and hence reduces the harmonic levels passed to the feed line.
- The normal T network behaves as a high pass network and does not significantly reduce harmonic levels. (In fact it can accentuate them with a particular phase angle of reflected power!) This can make the SWR appear higher than it actually is.
- The alternative T network topology acts as a low pass filter but has less matching capability and is more bulky.



Standard T network for an ATU



Alternative T network

Using a low SWR for the correct reason

There are only two special cases where a low SWR is essential, both of these apply to broadcasting stations.
• In analogue television transmitters standing waves on the feed line cause multiple over-lapping pictures to be displayed on the receiver, this is known as ghosting. This is due to the time delay caused by the reflected wave traveling from one end of the transmission line to the other and then back again. The way broadcasters overcome this is to use Isolators and Circulators to dump the reflected power on its first return into a dummy load. In this case the reflected power is lost but the transmitter always sees a low SWR.
• This proves that the re-reflected power is radiated by the antenna !
• In FM stereo transmitters the standing waves due to the reflections cause inter-channel interference which transfers left and right channel energy to the opposite channel. Again isolators and circulators can eliminate this effect, at the expense of lost power

Check your 50Ω SWR meter !

- Using low inductance resistors (carbon composition) we can check if our SWR meter indicates correctly. (Make the resistor leads as short as possible).
- Use a relatively low frequency to reduce the effects of lead inductance. Set the transmitter to about 1-W output.
- Connect two 100 Ω / 2W resistors in parallel to make a 50 Ω load. Measure the SWR, it should indicate exactly 1:1.
- Connect four 100 Ω / 2W resistors in parallel to make a 25 Ω load. It should indicate exactly 2:1. •
- Connect one 100 Ω / 2W resistor to make a 100 Ω load. It should indicate exactly 2:1.
- If the SWR meter passes this test then make up more load resistors to cater for 3:1, 4:1 etc and check these points.
- Many amateur SWR meters indicate incorrectly even with a pure resistive load, and we haven't considered the reactive components here!
- If the indicated SWR increases with higher power then the meter is defective. This points to a lack of directivity and hence the ability to distinguish between forward and reflected power. Very few amateur SWR meters have the necessary directivity to make accurate measurements when the forward power is high.

If inserting an additional λ/2 length of coaxial cable causes the SWR to change there is something wrong.
Adding an extra λ/2 should not change the line impedance or SWR. Either there are RF currents flowing on the outer of the coax, or the SWR meter is defective or both.

Similarly, adding an additional λ/4 in series - if the line is not matched by an ATU - should not change the SWR. Although the λ/4 section inverts the resistive and reactive portions and the impedance and sign of the reactance are different, the SWR is the same value.

Hence adding any random length of coax should not significantly alter the indicated SWR

High SWR on a transmission line is not a problem at the power levels used by amateurs.
In fact it can be a blessing in disguise because we can fit a shorter antenna into the available real estate.
For most flexibility when using non-resonant wire antennas the use of an ATU will allow more bandwidth to be covered.
Open wire balanced lines offer more flexible matching and lower transmission losses, much lower than coaxial cable can offer.
The power rating is also much higher.

Any SWR less than about 2:1 is perfectly acceptable, and any further reduction yields an insignificant increase of radiated field strength. Typically, at best 1/6th of a S point ……. was it worth the many hours spent to get it lower?

Next Month ……. More SWR, Feeding verticals, Yagi's , how many counterpoises for your vertical ? , baluns which one fits best?

Will supercapacitors replace batteries?

If batteries are your passion, you may have noticed some stories popping up recently about an all new portable energy storage product that some are claiming will make batteries a thing of the past. Articles have been circulating that there is a new technology in town with mind blowing potential.

The product is the super-capacitor.

Here are just a few characteristics that have super-capacitors turning heads:

- They can charge to full capacity within seconds.
- They can be made so thin they could form part of your clothing but are 100 times stronger than steel.
- They will charge and discharge an unlimited amount of times.
- They're much lighter than Lithium Ion (the battery type that powers phones and laptops) or to be more accurate they hold up to 10 times more power per kilogram.
- Its possible to 3D print or screen print them.

But before you start reaching for the champagne because you think the grindingly slow process of charging batteries is over and your coat can double as a spare power source for tomorrow … hold up, its not all positive.

- They will almost completely self-discharge within a couple of months – compared to sealed lead acid batteries or lithium ion batteries which only self-discharge by a few percentage points over the same period.
- They can't offer constant voltage or capacity during discharge
- They're very expensive to produce (at the moment)

Let's take a closer look.

A super-capacitor is a completely different beast compared to a battery when it comes to energy storage, so although many people refer to super-capacitors as batteries, they are actually nothing of the sort in the technical sense.

Batteries are made up of many materials and store power in a chemical form. Connecting them to a circuit causes a chemical reaction but one that can only take place at a certain speed. Try to charge or discharge too fast and the battery resists, building up heat and creating a potential for explosions and fires.

These chemical reactions cause wear on the internal parts and this is why batteries only have a limited time span, they can only charge and recharge a certain number of times before they die.

A super-capacitor on the other hand is based on graphene, a type of carbon. At an atomic level graphene is two dimensional (most material molecules are three dimensional) which gives it an ultra-thin quality.

Electricity can be stored on its surface. With no chemical reactions taking place it can charge and discharge in seconds and materials suffer minimal wear and tear in the process.

The principle of energy storage is the same effect that you experience when taking off a sweater and then feeling a shock as you a touch an earthed item such as a faucet. You took on the charge in an instant and discharged in a fraction of a second.

Graphene is also highly porous which means the surface area available to store power is optimized even though it is 2D. Not only can it take on power fast, but a small amount can also take a great deal of it.

While super-capacitors have some awe inspiring characteristics and are already replacing batteries in some areas, they are not perfect for every application.

Super-capacitors are nothing new. General Electric was trying out their potential in the 1950's, but the press today has suddenly become hot with stories that this technology will change the way we store power forever. There has even been speculation that batteries as we know them will never be the same again.
The excitement certainly does seem well deserved.

They have the ability to recharge within seconds and unlike all types of batteries which rely on internal chemical reactions and so wear out, super capacitors do not degrade over time. That means that a 2.7 volt super-capacitor today will be a 2.7 volt super-capacitor in 15 years time. All other current battery designs suffer gradual performance loss, meaning your 12 volt battery today might be an 11.4 volt battery in just 3 years time.

Perhaps the biggest attention grabber is that super-capacitors can be 3D printed, making them supremely versatile for any shape without needing to set up a production line. Causing equal excitement is their ultra-thin nature which means they could easily be integrated into clothing and other fabric.

So should we be preparing the history books for batteries?

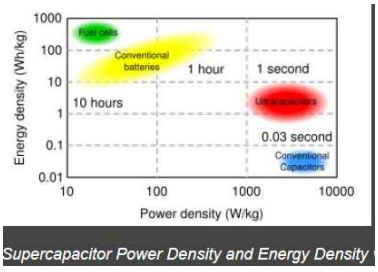
Not quite yet.

Progress in portable power has not been a linear one. Technological advances have not moved battery performance forward on every level each time. That's why while the lithium Ion battery that powers your phone came along in the 1990's, the one that starts your car is ***most likely still lead acid and based on a design which is over 200 years old!***

New usually only means better in *some* ways. Lithium Ion batteries are good at slowly discharging steady energy over long periods of time, but they are expensive. Lead acid batteries are good at producing large amounts of energy quickly and most importantly, they are cheap to manufacture.

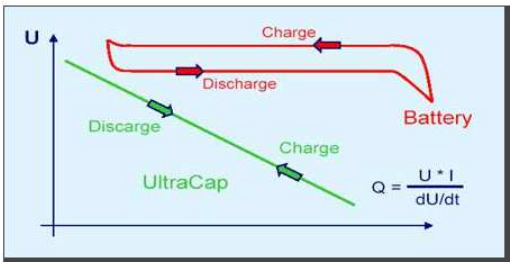
The history of the battery is littered with technical breakthroughs, but at each point older chemistries survive and continue in use because while the all-new concept grabs headlines, it is never better in *every* way.

Super-capacitors are no different … at the moment. While they can charge fast, last far longer, hold more power and operate at temperature extremes most other chemistries simply couldn't cope with, they are poor at providing constant power over long periods as the graph below shows.



Supercapacitor Power Density and Energy Density

In terms of power storage there is some common confusion. While a super-capacitor that is the same weight as a battery can hold more power, its Watts/kg – **Power Density** is up to ten times better than Lithium Ion batteries. Its inability to discharge slowly means its **Energy Density** (Watt Hours/kg or Wh/kg) is a fraction of that offered by Lithium Ion.



They are also pretty bad at holding onto their charge, self discharging to half their capacity within 40 days when not in use isn't the kind of characteristic you'll want under the hood of your car or in your smoke alarm.

Finally a super-capacitor cell has a voltage of around 2.5 compared to lithium ion's 3.6. You can start wiring them together, but the circuitry itself then becomes the cause of internal resistance that can reduce super-capacitor advantages.

In short there is still much that is left to be desired for anyone looking to completely replace all batteries with super-capacitors.

So why all the excitement?

Well just as the Lithium Ion battery made mobile phones possible, but did not replace car and truck batteries, the super-capacitor definitely has a role to play in portable power.

China is already using them in some hybrid buses since 2006. As the bus brakes to stop and take on passengers energy generated by the brakes is passed to super-capacitors. It is stored there while passengers board and then provides a ready source to help acceleration as the vehicle moves off.

This means the bus needs less Lithium Ion batteries (in some cases none at all), making it lighter and able to travel further on one charge. Dan Ye, executive director of Sinautec, a U.S. Chinese joint venture manufacturing super capacitor only buses, claims the vehicles can go 40% further than standard electric buses and it is 40% cheaper to manufacture.

But enthusiasm is cautious when it comes to cars. Buses stop and start all the time so there is a guaranteed regular source of energy moving from the brakes to the super capacitors. They also follow a regular route where backup charging stations can be placed should braking not charge the super-capacitors enough.

Joe Schindall is professor of electrical engineering and computer science at MIT. He notes these issues make super-capacitors "not well suited for electric-only cars".

Super-capacitors in smartphones and laptops?

This is unlikely at the moment, because although the ability to recharge within seconds has many people drooling with anticipation super-capacitors don't hold a steady voltage or capacity as they discharge.
This is exactly what smartphones and laptops need to function over long periods and so it seems that Lithium Ion batteries won't be toppled from their perch just yet.

When it comes to replacing other battery chemistries completely, the super capacitor isn't going to do that just yet.
They look instead to join batteries in the portable power world and offer improvements in some areas, but nothing near the total replacement many headlines seem to imply.

The Final Showdown

In general, super-capacitors are suited for applications that require fast charging and discharging capabilities where these times are measured in seconds or several minutes. For anything which requires power for longer, batteries remain the better solution.

Characteristic	Supercapacitors	Lithium Ion Batteries
kW/kg (Specific Power)	10	1-3
Wh/kg (Specific Energy)	up to 10,000	up to 3,000
Charge time (of a cell)	Seconds	minutes
Cell voltage	c. 2.5	3.6
Cycle Life	1 million+	up to 3,000
Operating temperature range	Discharge: –40 to 65°C (–40 to 149°F) Recharge: –40 to 65°C (–40 to 149°F)	Discharge: –20 to 60°C (–4 to 140°F) Recharge: 0 to 45°C (32°to 113°F)
Self Discharge	50% within a month	up to 3% per month

Intermod, Harmonics, TOI & ALC Basics

Heard some chatter about intermods on the radio? Or some interference caused by two transmitters operating in close proximity? Or that rusty bolt in the shack rectifying the RF and causing havoc, even if you have a filter installed, this may be why.

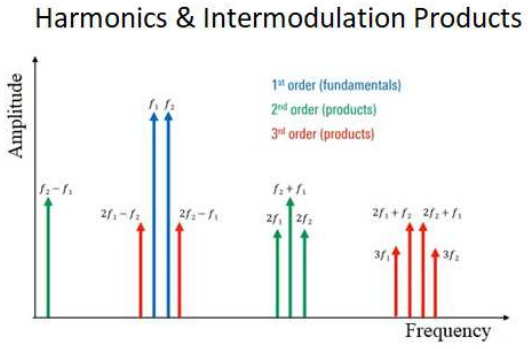
Intermodulation Distortion (IMD) occurs when two or more signals are used in a non-linear system. The spectrum at the output of the non-linear device will not only consist of the original signals but will also contain the sum and difference of the input signals along with their harmonics.

Hence, if a non-linear system has two signals at its input, say at frequencies f1 and f2 then the non-linearity will give rise to other output signals at various frequencies, i.e., f1 + f 2, f2 – f1, 2f1 and 2f2 which are also known as 2nd order intermodulation products.

The products 2f1 and 2f2 are known as "Harmonics" which are nothing but replicas of a signal appearing at integer multiples of the fundamental signal. These sideband frequencies are undesirable.

In the next step, these 2nd order intermodulation products will mix with the original signals that will give rise to 3rd order intermodulation products. It should be noted that each individual signal, including original signals (f1 and f2) and 2nd order intermodulation products (f1 + f 2, f2 – f1, 2f1 and 2f2), will be added and subtracted with/from each other to give rise to more signals.

Most of these intermodulation signals are not close to the original signal so can easily be filtered out or do not cause issues. **However**, there are two intermodulation products i.e., 2f1-f2 and 2f2-f1 which can be troublesome and can cause interference as they are close to the original signal. These products are known to cause intermodulation distortion and the 3rd order the biggest concern for troublesome interference.



The typical way of dealing with these troublesome IMD products is through filtering, but this becomes difficult when the products are very close to the desired (fundamental) frequencies. As seen in the drawing, the 3rd order products are very close to the fundamental.

These 3rd order intermodulation products are of great concern as they are difficult to filter out, unlike 2nd order distortion products, which appears to be at a greater distance w.r.t the original signals (f1 and f2).

The additional frequency content created by the 3rd order distortion is often referred to as 'Spectral Regrowth'. In a transmitter, spectral regrowth resulting from poor linearity can interfere with other wireless channels. In a receiver, by contrast, it can cause out-of-band signals to distort the signal of interest. IMD and harmonics create leakage into adjacent channels, noise or distortion, which degrades the overall systems performance.

- The amplitude of harmonics usually decreases as the harmonics order increases.
- Higher-order harmonics have very low amplitudes and thus can usually be ignored. And most of the higher-frequency products often fall outside of amplifier bandwidth, filter passbands, etc
- Third-order intermodulation products have an amplitude proportional to the cube of the input signal whereas second-order components have an amplitude proportional to the square of the input signal.

The best way to avoid IMD products is to operate the device in the linear region before it starts generating distortions.

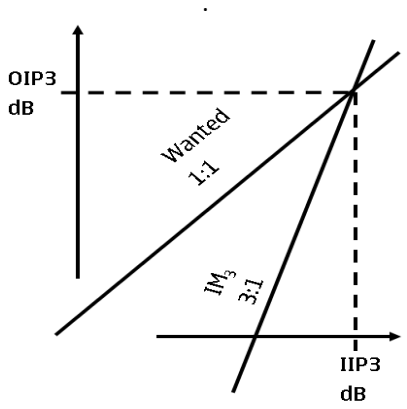
- The order of harmonics and intermodulation is the sum of their (unsigned) coefficients:

1. 2f1 is second-order (2)
2. f1 + f2 is also second order (1+1)
3. 3f1 is third order (3)
4. 2f2 – f1 and 2f2 + f1 are both third-order (2 + 1)

TOI (Third Order Intercept)

Another factor in spectrum analysis is the TOI, short for Third Order Intercept. Because the third-order nonlinear product will increase by 3 dB in power when the input power is raised by 1 dB, it can theoretically eventually reach the same level and cross over the fundamental frequency. Although it can never actually happen due to amplifier compression, it serves as a valuable tool with spectrum analysis calculations. Both curves are extended with straight lines of slope 1 and *n* (3 for a third-order intercept point). The point where the curves intersect is the intercept point. It can be read off from the input or output power axis, leading to input (IIP3) or output (OIP3) intercept point respectively.

Input and output intercept point differ by the small-signal gain of the device



So how do we reduce 2nd and 3rd order harmonics?

We can start by not overdriving the transmitter or interfering with the transmitter ALC.

What is an ALC?

ALC, or Automatic Level Control, is a function in electronic devices, particularly in transmitters, that reduces harmonics by limiting the output power. It achieves this by applying a bias voltage to the input signal, effectively clamping down on the signal as it increases, thus preventing the generation of excessive harmonics. (Google explanation but let's look further)

ALC circuits sense the output power and adjust the input signal to prevent it from exceeding a safe level, it stops the amplifier from going into compression/saturation where it cannot output any more without degrading the signal quality.

This is often achieved by measuring a sample of the output RF signal and reducing the amplifiers input voltage, effectively reducing the gain of the amplifier when the output power is too high
When an amplifier starts operating in a non-linear mode (compression), it begins to generate harmonics, even if the compression is small. These can seed the progression of 2nd and 3rd order harmonics.

In transmitters, ALC is crucial for preventing the generation of these spurious emissions, these emissions can interfere with other radio signals, so ALC is an essential feature for maintaining a clean and compliant output.

In fact it is illegal to operate a station when the harmonics exceed the maximum value. The rules clearly state that the harmonic of a transmitter has to be a minimum of -43dbc but can NOT exceed 23uW. 23uW is roughly -16.4dbm and it is an absolute value. So, harmonics have to pass 2 requirements in order for a transmission to be legal.

If you have a fundamental of + 40dBm for example, your harmonic has to be -56.38dBc (23uW) or lower.

The level of harmonics is often measured in dBc (decibels relative to the carrier), which compares the power of the harmonic to the power of the fundamental frequency. While ALC is an effective method for reducing harmonics within a transmitter, other techniques are also used to mitigate harmonics in wider electrical systems. These include passive filters, active filters, and careful load management (grouping and separation of non-linear loads).

Handy On Line Calculators

Send us your favourite handy calculator link so we can post it here!

Ladder line calculator www.smrcc.org.uk/tools/OpenWire.htm

Cavity Filter designer https://www.changpuak.ch/electronics/Coaxial_Tank_VHF_Filter_Designer.php

Cavity resonance calculator https://learnemc.com/ext/calculators/cavity_resonance/index.html

COAX LOSS Calculator https://kv5r.com/ham-radio/coax-loss-calculator/

Impedance ….. https://www.omnicalculator.com/physics/rlc-impedance

Wavelength …. https://www.omnicalculator.com/physics/wavelength

PI attenuator values …… https://www.omnicalculator.com/other/pi-attenuator

Xc …… https://www.omnicalculator.com/physics/capacitive-reactance

XL …… https://www.omnicalculator.com/physics/inductive-reactance

Cut Off ….. https://www.omnicalculator.com/physics/cutoff-frequency

VSWR ……. https://www.omnicalculator.com/physics/vswr-voltage-standing-wave-ratio

LM317 Regulator resistor selector ….. https://www.omnicalculator.com/other/lm317

Resistor Colour code calculator….. https://www.digikey.com.au/en/resources/conversion-calculators/conversion-calculator-resistor-color-code

Resistor Heat rise ……. https://calculator.academy/resistor-heat-calculator/

Volt Drop Calculator AC and DC …….. https://www.rapidtables.com/calc/wire/voltage-drop-calculator.html

Helix antenna calculator ……. https://sgcderek.github.io/tools/helix-calc.html

Parabolic dish calculator ……. https://www.everythingrf.com/rf-calculators/parabolic-reflector-antenna-gain

We are looking for more handy on-line calculators, if you have one that isn't listed above, please share with us so that more amateur radio enthusiasts can benefit ☺

OR

If you have any links to handy hints or inforamtion please send it to us!

How many of these can you still answer correctly?

Q1) The frequency of an electromagnetic wave which has a single cycle duration of 2.25 nanoseconds is approximately:

a) 28 MHz
b) 54 MHz
c) 144 MHz
d) 444 MHz

Q2) In satellite communications, Doppler effect causes an apparent:

a) frequency increase as the satellite moves towards the ground station
b) frequency decrease as the satellite moves towards the ground station
c) frequency doubling at the point of closest approach
d) frequency increase as the satellite moves away from the ground station

Q3) A half wave dipole antenna resonant at 28 MHz, would have an approximate length of:

a) 5 metres
b) 10 metres
c) 38 metres
d) 56 metres

Q4) A single side band transmitter could cause interference to stations on adjacent frequencies if it:

a) had shorted turns in the tank coil
b) had ripple on the power supply
c) had leakage of RF into the mains cable
d) was overdriven

Q5) When tuning a mobile antenna, the test instrument being used to measure the amount of RF radiated is a:

a) noise bridge
b) antenna impedance meter
c) field strength meter
d) digital frequency meter

Q6) If the voltage across a resistor is tripled the power dissipated is multiplied by:

a) 2
b) 3
c) 4
d) 9

Answers next propagator ☺

Answers to the last propagator questions … Q1 = C ; Q2 = D; Q3 = A ; Q4 = B; Q5 = D ; Q6 = C

How well did you do, will you still pass the Amateur Radio test?

OLD PROPAGATOR MEMORIES

NO.9/77 SEPTEMBER 1977 NO.9/77

THE MONTHLY NEWLETTER OF THE
ILLAWARRA AMATEUR RADIO SOCIETY

A Member Club of the Wireless Institute of Australia.
Published by the Illawarra Amateur Radio Society
PO Box 1838
WOLLONGONG NSW 2500

PRESIDENT

Bill Calvert VK2DJ
19 Springfield Avenue
FIGTREE 2525

Phone No: 71 3569

SECRETARY

Brian Boseley VK2BCI
Figtree Hotel
FIGTREE 2525

NOTICE OF MONTHLY MEETING - SEPTEMBER 1977

Members are advised that the monthly meeting of the Illawarra Amateur Radio Society will be held at the Wollongong Town Hall Meeting Room on Monday, 12 September 1977 at 7.30 pm.

AGENDA

1. Apologies and welcome to visitors.
2. Minutes of previous General Meeting.
3. Correspondence.
4. Financial Report.
5. General Business.
6. Lecture.

LECTURE

This month Keith VK2OB will demonstrate another of his construction projects - a low value capacitance bridge used to calculate the values of low value capacitors against known standard values.

Keith will have a circuit available at the meeting if anybody is interested in constructing this bridge.

STOLEN

Again this month we have another report of a MULTI-7 stolen from a parked car.

This MULTI-7 was removed from Richard Fox VK2ZFO's car while it was parked inside his yard in the drive way.

If you have any information on this set please contact Richard Fox at 57 Barton Street, Oak Flats.

Again make sure all your equipment is identifiable and as secure as possible. - If your set is easy to remove - remove it before someone else does.

ALARM SYSTEMS

Paul Gardner has developed an alarm system for mobile sets but for obvious reasons we will not publish details. If you are interested in constructing one of these, contact Paul or Geoff ZHU.

BAR-B-Q

The proposed BAR-B-Q to be held on the first Saturday in November will be on the foreshores of Lake Illawarra, in the area adjacent to the Illawarra Power Station. The cost will be $2 per head or $5 per family unit. Could we have an indication at the next meeting of the numbers interested so we can start to plan the catering.

FOR SALE

AWA 50 WATT Base Station on 2 metres. Complete with crystals for several channels. Cost $50. Contact Jim Walker VK2AJT C/O Telephone Exchange Nowra Phone 04426111.

DISPLAY OF AMATEUR RADIO

On Saturday, 17 September Burelli Street between Keira Street and Church Street will be converted into a Mall for a display of Recreational Activities. The IARC will have a display of Amateur Radio and we are looking for volunteers to assist in erecting the display and also to operate both HF and VHF equipment - we also require people at home to give us as many contacts as possible. Please contact the Secretary Brian VK2BCI if you can assist.

NSW DIVISIONAL WIA CONFERENCE

A conference of combined Clubs and Groups will be conducted in Sydney during November and your representative Geoff VK2ZHU will be attending. If you have any areas or questions you would like discussed etc please contact me as soon as possible so I can submit Agenda Items.

Will share more oldies next month.

To read more information about this old propagator and others, use the link below

https://www.iars.org.au/wp-content/uploads/2020/09/1977-09-September.pdf

NEWS

https://www.wia.org.au/newsevents/events/

<<<<<<<>>>>>>>

AND The winner is .....

Our very own IARS Vice President was not content in winning the Harry Angel Sprint this year but rolled up his sleeves to show us how it's done again, hard yakka!

Congratulations Rob VK2MT

WIA AGM to be held in Albury in 2026

Date : 02 / 08 / 2025
Author : Peter Clee - VK8ZZ

The date for the 2026 AGM has been finalised by the Board of the Wireless Institute of Australia.

The AGM is to be held in conjunction with the **VK SUMMIT** being conducted by the Albury Wodonga Amateur Radio Club
Link

More details about the Annual General Meeting will be issued later this year.

So save the date for the VK SUMMIT to be held over the weekend of 2nd and 3rd May 2026 including the WIA Annual General Meeting.

More details about the VK SUMMIT will be issued by the Albury Wodonga Amateur Radio Club in the next few months.

Peter Clee
WIA Secretary

2026

AGM

Upcoming Contests ……

Oceania DX Contest

Oceania DX (OCDX) Contest

Contest Manager

The Oceania DX (OCDX) Contest is managed by the Oceania DX Contest Committee.

Contact email is **info@oceaniadxcontest.com**

Contest Introduction

The OCDX contest is Oceania's only international style contest where contacts with stations all over the globe are able to participate.

Oceania stations may contact any station for QSO points whilst non-Oceania stations are required to contact any station in Oceania for QSO points.

The contest runs over the first two full weekends in October and has SSB, CW and SWL categories. Go to the contest web site for more information.

More information click this link > https://www.wia.org.au/members/contests/oceania/

23cm Fun day on the 23rd of EVERY MONTH !!

If you are interested in 23cm or higher communications, the local IARS members are getting together with the MSCARC members on the 23rd of every month to have a fun day around the Illawarra area.

The SHF team are even looking at 13cm fun day on the 13th of every month, for more information please contact the SHF organiser Rob Heyer VK2XIC at **vk2xic@gmail.com**

Mid South Coast Amateur Radio Club Inc.

www.mscarc.org.au

VK2RMU – 146.700 Mhz & 438.125 Mhz – Club Callsign: VK2HQ

&

IARS Illawarra Amateur Radio Society

Amateur Radio in Wollongong since 1948

Invite you to a

Joint picnic/day out

WHEN : 13th September 2025

TIME : From 09H30 till whenever

WHERE : Fitzroy Falls Reservoir Area

WHAT TO BRING : Lunch, refreshments, portable gear and fox hunting gear.

The club will be offering soft drinks for a gold coin donation

There are gas BBQ's, Hot Water and toilet facilities

For more information please contact

David VK2LDW
mscarcinc@gmail.com

Keith VK2KQB
Iars.keithb@gmail.com

Amateur radio news from around the world!

Use these handy links if you would like to see what is going on around the amateur radio world.

Radio Society of Great Britain https://rsgb.org/main

American Radio league https://www.arrl.org

Amateur Radio Germany https://www.darc.de/der-club/referate/ausland/english-version/

South African Radio League www.sarl.org.za

Italian Amateur Radio https://www.ari.it

Amateur radio France https://www.radioamateurs-france.fr

Amateur radio Russia https://srr.ru/sbory24_6/

Amateur Radio Japan https://www.jarl.org/English/

DX ATLAS DOWNLOAD https://dxatlas.com/Download.asp

Communications Satellites

Status information and latest updates >>> https://www.amsat.org/two-way-satellites/

https://amsat-uk.org/satellites/frequencies-of-active-satellites/

https://ararm.org/status.html

>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>><<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<

PICTON HAMFEST

23rd November 2025

Upcoming IARS meeting presentations ………………………………

- **September 2025** : Project mania with Simon VK2KU
- **October 2025** : **IARS AUCTION !!!!** Moved from November to avoid clashing with Picton Ham Fest in November 2025
- **November 2025** : Amateur Radio Trivia with Kahoot – Prize will be a Nano-Vna
- **December 2025** : Christmas dinner party (surprise 😊) with Home Brew Contest awards
- **January 2026** : No Meeting
- **February 2026** : Presentation Roger VK2VRK
- **March** : SMD Soldering workshop

Fun Corner

Please send in your funnies to iars.keithb@gmail.com

Thanks to all that sent in funnies.

The **IARS needs YOUR input and support,** any technical items, amateur radio news, any projects you would like to share, in fact any AR related goings on are welcomed.
Feedback is also very important for us as it helps maintain a good read, if you would like to see more of something, or would like to see a subject added. Please let us know iars.keithb@gmail.com

That's all for now, hopefully catch you all at the
Blue Scope visitors centre on the 9th September 7.30pm,

73
Keith VK2KQB
IARS Secretary

IARS, Amateur Radio in the Illawarra since 1948