Illawarra Amateur Radio Society

Propagator June 2025

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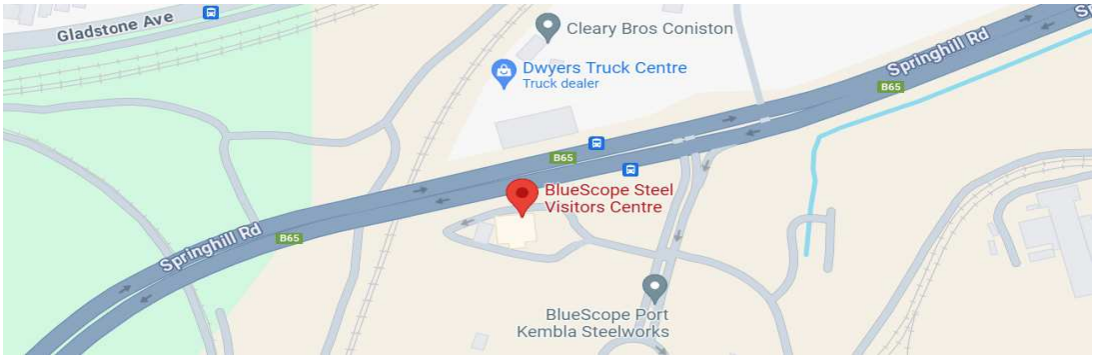
Upcoming Meeting on the 10th June 2025

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)



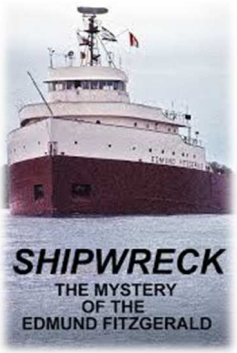
VK2RUW (Knights Hill)
34.6231° S, 150.6942° E
QF55IJ

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 13th May 2025



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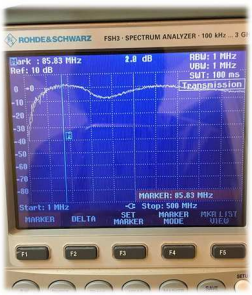
Edmund Fitzgerald Part2 and insertion loss testing

I was a great evening with Ned sharing the reports and conclusions of the sinking of the Edmund Fitzgerald. The story is so intriguing that many have started reading about it themselves. This year will be the 50th anniversary of the sinking.

The Diorama of the wreck laying at the bottom of the lake.

After Ned's presentation there was a quick round of testing a few common amateur radio parts such as antenna switches, SWR meters and Diplexers. The surprise was the homebrew unit outperforming the commercially available unit



Another great evening of entertainment for

IARS members.

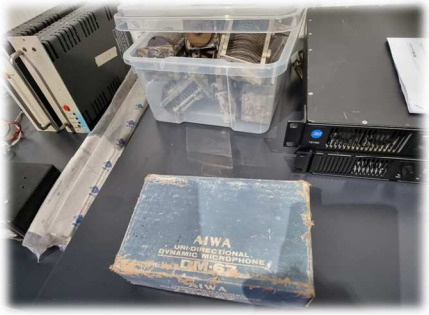
Great Giveaway to all members attending:

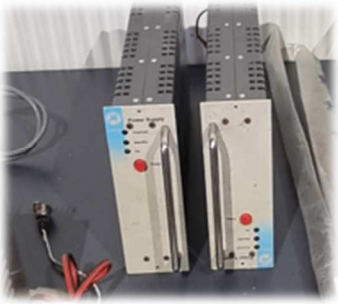
All the members at the meeting were surprised to find two brand new heatsinks placed in front of them as a challenge to use them in a homebrew project. Simon VK2XQX (who donated the heatsinks) suggested a homebrew dummy load.
It will be very interesting to see what comes of it.

As always there was refreshments and a good chinwag afterwards.

The Disposables Table

The disposals table was very interesting this month with an assortment of goodies.
From complete repeaters systems, power supplies, rotators, variable capacitors, to a new ribbon microphone. What a bargain was to be had!!





Big thanks to Mark VK2PH, Simon VK2XQX and anyone else that brought along some items to be place on the table.

If you have anything you no longer use, bring it along to the next meeting and give it a second life.

SNOWBALL

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 number was drawn and the IARS member who took home

$120 $$$$$$ cash was Barry VK2ADQ

Congratulations Barry

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 five new amateurs licenced, is it your turn next?

YES!!!

The IARS is helping Amateur Radio grow in Australia!!! Avg 1 per month

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 438.225 with – 5MHz 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 "***

IARS REPEATERS

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

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

Current Repeater STATUS

- **438.225 with a - 5MHz offset. OK**
- **146.975 with a -600kHz offset NO CTCSS, C4FM enabled Temporary OFF AIR**
- **146.850 with a – 600kHz offset (linked to 146.675) NO CTCSS OK**
- **146.675 with a – 600kHz offset (linked to 146.850) NO CTCSS OK**
- **53.650Mhz with a – 1Mhz offset (123Hz CTCSS tone enabled due to interference) -OK**
- **438.725Mhz with a -5mHZ offset DMR only, OK**
- **1296.850Mhz Experimental Beacon with simplex repeater function, located Maddens Plains – OK**
- **Echo-link VK2MT-R via 146.850MHz also linked to 146.675MHz and VK2BGL-L – OK**
- **APRS DIGI-PEATER on 145.175MHz - OK**
- **PACKET 2M on 147.575Mhz - OK**

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.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Latest Repeater Report:

All systems A-OK

BUY..SWAP..SELL..GIVEAWAY

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

There is a huge collection of new vacuum tubes available to IARS members.
Please email the part number to vk2kqb@gmail.com

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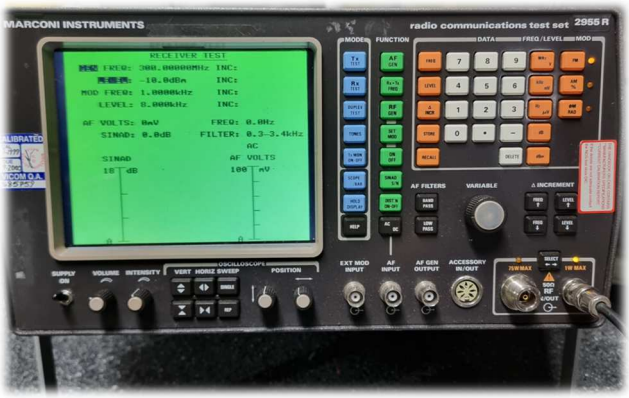
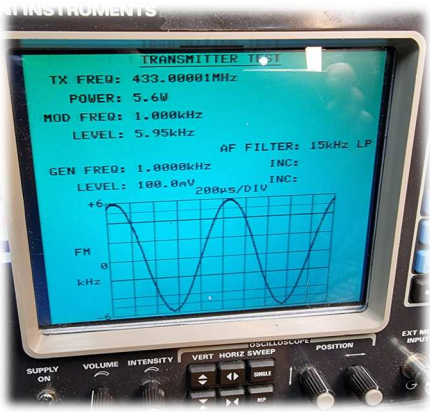
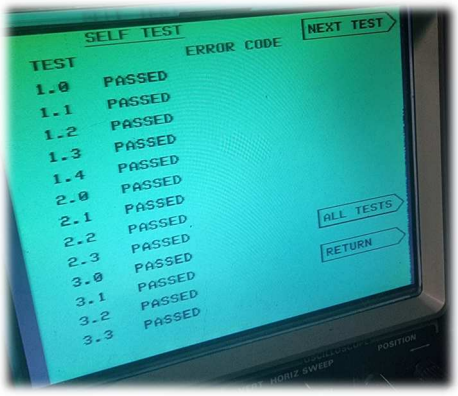
Marconi 2955R communications tester in good working condition, looking for realistic offers

Passes all self-tests, has the upgraded CRT to Colour LCD panel with newly installed and calibrated 10MHz OCXO, great for amateur radio servicing. (Background colours can be changed via supplied remote control)







Email vk2kqb@gmail.com for more information and operational videos of the unit of interested.

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

Wagner Electronics Super Store https://www.wagneronline.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.

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.*

Choke cookbook for the 160-10m bands (part2)

The Spreadsheets The RS Data:

Values are coded with colors and bold type to indicate their relative values. Black indicates RS of 5K or more; Black Bold is a step up, red (not bold) is the next step up, and Bold Red is very high RS. Grey indicates bands where the choke may be useful in series with another choke to provide the desired RS. Attenuation is computed for the length of wire needed to wind the choke with some additional length for leads, and is based on my measurements of each wire type for each band. The greatest attenuation for a recommended choke on a recommended band is 0.06 dB for Teflon, 0.07 dB for RG400, and 0.1 dB for NM. **(Exception: RG179 has approximately twice the loss of RG400.)**

Dissipation and Power Handling

Dissipation in a choke is the sum of two components. Differential Mode Dissipation: This is the dissipation inside the winding due to normal power flow through the resistance of its conductors at the operating frequency for 1,500W key down. The spreadsheet computes this from the attenuation. (Below UHF, virtually all dissipation is due to conductor resistance for practical line types in good condition). Worst case differential mode dissipation in the portion of the feedline that forms the choke (that is, transmission line loss) for a recommended choke is 20W, and for most recommended chokes is 15W or less. Common Mode Dissipation: A high value of RS increases the ability of the choke to handle higher transmit power. Dissipation due to common mode current is I2RS, where RS is the series equivalent resistance of the choke and I is the common mode current. Because power is current squared, it falls twice as fast as R is increased, so power approaches zero with very high RS. Common mode dissipation can be estimated in an NEC model by adding the feedline as a single wire in the model (approximating as closely as possible it's actual path from antenna to shack) and adding a Load equal to RS + jXS at the point(s) where the choke(s) is (are) to be inserted. The added wire should be connected to one side of the antenna, to ground at the other end, should be the diameter of the coax shield or twice the diameter of the paired conductors, and insulation corresponding to the outer jacket of the coax. A two-wire feedline terminated in the shack to an inductively coupled input may not be ground referenced. The tuner schematic should be studied to determine whether this is true (if there's a ground on the antenna side of the transformer, it's ground referenced). Such a system does not eliminate the need for a choke – without one, the feedline is still connected to the antenna, and common mode current can be present if the antenna itself is unbalanced in any way.

Temperature

The permeability of ferrite materials varies as a function of both frequency and temperature, and different mixes behave very differently (Fig 5). Any RF current that produces a field in the ferrite will cause heating in the ferrite (and IR losses in the wire). If the current is small enough, and if the choke is exposed to free air, the heat will be radiated and/or conducted as fast as it is produced. Larger currents, however, can cause temperature to increase. In the #43 and #73 materials, this will in turn cause permeability to fall, which in turn allows more current, which produces more heating. In other words, thermal runaway can occur if the current is large enough and the core is small enough. At some high temperature (the Curie temperature), the ferrite will temporarily lose its magnetic properties (until it cools). The Curie temperature is different for each mix. The #31 material has somewhat better temperature characteristics, especially on the lower HF bands, where impedance actually increases with temperature up to about 100°C, but a rather low Curie temperature. Thermal runaway can still occur, but is a bit less likely.

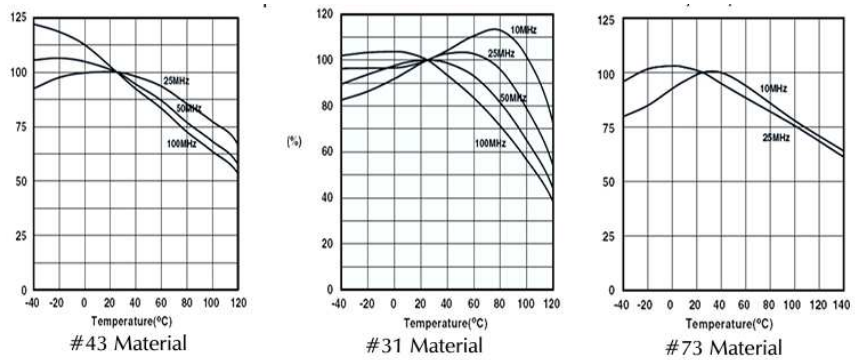


Fig 5 – Impedance vs. Frequency and Temperature as a percentage of impedance at 25°C

In general, it is important to use ferrites in a manner that 1) saturation is avoided, and 2) permeability does not significantly drop with temperature.

Avoid Putting Transmitting Chokes in Enclosures – it greatly reduces the transfer of heat to ambient air, and can easily cause destructive overheating. In general, it's best to leave the choke exposed to air, weather-proofing connections as needed. In the process of upgrading the N6RO super station, Gary Johnson, NA6O, carefully studied this issue in the lab, and came to the conclusion that any enclosure for a transmitting choke should be ventilated. Fig 6 shows an enclosure Gary made for matching and switching in one of the 4-squares. Ventilation holes, protected by wire mesh, are on the right in the photo, and face downward when the enclosure is installed. In the photo, the choke, wound with enamelled wire, is mounted to the lower side of the enclosure

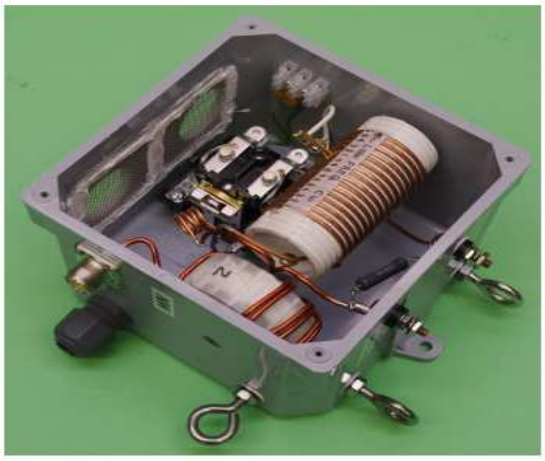


Fig 6 – Ventilated Enclosure

Avoid conductive enclosures – chassis-mounted coax connectors would short out the choke, and even if insulated, stray capacitance between the choke and the enclosure would likely detune it.

Duty cycle: The importance of dissipation is destructive heating of the choke, both of the core and conductors. For contesting and DXing, duty cycles of 20-33% are typical for CW and SSB and in the range of 35-40% with WSJT modes, but can exceed 50% with RTTY. Longer transmissions typical of ragchewing can increase short term heating, damaging the choke. Power handling is maximized when the choke by maximizing is exposed to free air, and by maximizing RS.

Weight and Cost Estimates: Weight can be important if the choke is at the feedpoint of a wire antenna. The spreadsheet includes estimates of both weight and cost. They include the core(s), the coax or paired wires, connectors, and a simple frame or structure needed to build the choke. Estimates are conservative (high) – they assume, for example, two Amphenol silver plated, Teflon dielectric connectors, with silver reducers when needed for RG400. While Teflon insulated wire and coax is expensive, relatively short lengths are required.

An Important Note About Measured RS Values

While these values are tabulated to four digits from cursor readouts on my measured data, they should be viewed has being no closer than +/- 10% to chokes that we wind. That's because ferrite cores are a rather wide tolerance part! Fair-Rite's specifications for their suppression products are for minimum values of impedance at several spot frequencies for a single turn through a core. Quoting the data sheet for a 2.4-in #31 core: **"Suppression cable cores are controlled for impedances only. Minimum impedance values are specified for the + marked frequencies. The minimum impedance is typically the listed impedance less 20%."**

Attempting to account for this wide tolerance, before developing the new Cookbooks, I characterized more than 250 toroids – 200 2.4-in o.d. toroids and 75 4-in o.d. toroids. 90 of the 2.4-in cores were from my "stash" or loaned by NCCC members N3ZZ, K6GT, and W6GJB, all accumulated over a span of 12 years. The remainder were purchased as a lot of 10 in May 2018 and a lot of 100 in June from well known industrial vendors. I labeled each toroid with an identifier, wound ten turns of a very flexible RG58 patch cable around it, made a log frequency sweep of its impedance from 1-30 MHz, and saved the data as a screen plot of ZMAG, RS, and XS, with cursor readouts for principal ham bands. ZMAG, RS, and XS values were transferred to a spreadsheet, and four samples were selected at the high and low limits of RS and XS at 1.8 MHz for the both sizes of the recently purchased cores.


Fig 7 The Test winding

This study revealed extremely wide variations in the fundamental properties of the 2.4-in cores purchased over a period of 12 years, and variations of +/-10% for the newly purchased cores. These variations have profound effects on the characteristics of chokes wound on these

cores. A choke wound on a lower μ' core can have much lower choking impedance on the lower bands than on an "average" μ' core for the same number of turns and winding style! But that lower μ' core will yield much greater choking impedance on the higher HF bands because resonance occurs at a higher frequency. Compare, for example, the impedance below about 5 MHz for these 10 turn chokes wound with RG58 on three different #31 2.4-in o.d. toroid cores.
http://k9yc.com/TestL109-31.png http://k9yc.com/TestL3B31.png http://k9yc.com/TestL3A31.png
The differences are entirely due to their inductance, which in turn is the result of the cores having different μ' values. For the Cookbook, chokes using the three cable types were wound and measured on each of these cores, and cursor readouts for the ham bands transferred to a spreadsheet. RS values for each choke are the lowest at each frequency for the four toroids on which they were measured. Details of my measurement setup are in Appendix Two. There is no question about the mix of the cores I've measured – Fair-Rite is the manufacturer of virtually all ferrite toroids commonly used by hams, and each of the mixes we use has a distinctly different curve of impedance vs. frequency.
See k9yc.com\Fair-Rite.pdf and k9yc.com\ 2TurnTests.pdf

Your Mileage Will Vary, depending on the luck of the draw for any toroid you happen to choose! In general, the widest variations in RS from one toroid to another are at the upper and lower ends of the useful range of each choke. By measuring so many toroids and chokes, I've tried to increase the likelihood that the chokes we wind will have RS higher than Cookbook values. And when you see choke data published by others, ask them how many cores they measured!

Winding Guidelines
Starting The Winding: Wind a cable tie around the cross section of the toroid where you want to start the winding and pull it not quite tight. Feed the cable through the toroid from below, and use another cable tie to secure it to the first one, leaving enough free cable to connect the choke when it is complete. I like to snip the end cable ties with a half inch or so remaining that I can use needle-nose pliers (or even my teeth) to tighten it, then snip them cleanly when I'm finished winding. The choke in Fig 8 starts at 3 o'clock and is wound counterclockwise around the core.
Wind In Sequence:
Take care that turns are wound in order – out of sequence turns can cancel. Turns can be continued on a second layer when the first layer is filled by overlaying the starting turns of the winding. In Fig 9, the winding starts at the upper left, completely fills the first layer around the core, and continues with five more turns overlaying the start of the winding.
Turn Spacing:
Measured data are for windings tight to the core, with adjacent windings touching on the inside of the core.
Paired Lines:
Take care that pairs are not twisted as they are wound. Twisting can reduce choking impedance. Using different colors for the two conductors makes it easier to see twisting, and also to count turns. Solid conductors are preferred over stranded because turns tend to stay in place. Stranded wire is much less disciplined, although the #12 Teflon wire I found tends not to have that problem, with turns staying in place pretty well. The pair was shorted for measurement. Leads for both of the chokes shown were purposely cut short for measurement – long leads add measurement error.


Fig 8 – An RG400 Choke


Fig 9 – A Teflon Choke

Maintain polarity between the two ends of the choke – that is, make sure that the same conductor of a parallel pair is connected to the coax shield at both ends of the choke. This is especially important with arrays, and can be an issue with lightning protection for a choke added to the line not at the feedpoint. If the polarity is reversed, the choke will still work but the array won't, and static buildup on a coax shield may not be as well discharged.

Pairing the wire: Loss, VF, and ZO data are for the paired conductors touching, held in place every 3-6 inches with Scotch 33 or 35 (because they are thinner than 88, it can help squeeze an extra turn on 2.4-in chokes for 160M). Wider spacing will increase ZO and decrease attenuation, especially with enameled pairs (because proximity effect is reduced).

Enameled wire: Contact with the core while winding and positioning turns tends to scratch the insulation from enameled wire, allowing windings to make random electrical contact with the core, seriously degrading performance. I experienced this with high quality enameled wire. Given this issue and that both loss and differential mode dissipation in enameled pairs due to proximity effect are double that of RG400, winding chokes with enameled wire is not recommended, and no cookbook data has been developed.

RG8, RG213, RG11, RG6: For several reasons, I am no longer including these coax types in the Cookbook. The chokes are heavier, more expensive, and have greater loss (because they use more cores and more coax). Designs are repeatable only if turns pass through the core(s) sequentially, and if they have the same radius and spacing. That's not easy to do with these sizes of coax.

Additional Considerations For Chokes Wound on 2.4-in o.d. Cores:

Two Cores or One? Winding a choke on two cores rather than one doubles the inductance and approximately doubles the value of stray capacitance in parallel with that inductance. This has the effect of dividing the resonant frequency by 2 and doubling the impedance at resonance. Compare, for example, 13 turn chokes wound with NM12 on one core and two cores. http://k9yc.com/240-1-NM12-13T.png and http://k9yc.com/240-2-NM12-13T.png

Transmission Line Data

These data were obtained from S11 for short lengths with the far end open and the far end shorted, post processed using AC6LA's ZPlots Excel spreadsheet. An SDRKits VNWA3e was used for the S11 measurements.

Line Type	Z_O @ 5 MHz	VF @ 5 MHz	10 MHz Loss
#12 THHN Solid	91.2 Ω	.725	1.2 dB/100 ft
#10 THHN Stranded	92.4 Ω	.73	1.5 dB/100 ft
#12 Teflon (Ag/Cu)	96.6 Ω	.833	.76 dB/100 ft
#10 NM	86 Ω	.725	1.5 dB/100 ft
#12 NM	91 Ω	.73	1.2 dB/100 ft
#12 Enameled	43.4 Ω	.77	2.45 dB/100 ft
#10 Enameled	41.3 Ω	.66	2.36 dB/100 ft
RG400	50.8 Ω	.69	1.22 dB/100 ft

Notes On the Data: The significantly greater loss in the enameled pairs as compared to THHN and NM pairs is the result of proximity effect. The higher ZO of the Teflon wire pairs is the result of it's lower dielectric constant as compared to PVC insulated NM/THHN wire.

Construction Ideas

Here are two of W6GJB's ideas for integrating chokes with the center insulator for a dipole. The rope in Fig 10 is Vectran, a very strong material, but one that has poor UV resistance. Glen has built a dozen or so of these in several variations. All of the penetrations of the tubing are very well sealed. The same tubular construction can be used for "inline" chokes to break up the feedline by mounting SO239 connectors on both end-caps. Glen's latest concepts is shown in Figs 11 and 12 (next page). At left, before weather-proofing; at right, Glen holds the completed insulator, rigged at the center of his 80M dipole, ready to raise. The wire for the dipole is #9 hard drawn bare copper, the green loops are #12 stranded THHN (so that the connections to the antenna can flex in the wind). Copper split bolts are used to connect the stranded #12 to the solid #9. Glen built a few like this, using a structure of GPO3 fiberglass, a high voltage electrical material, with high fiber volume fraction and good structural properties. He quickly abandoned that material because of the very unhealthy fiber particles generated as his CNC router cut the parts. A UV resistant Lexan is under consideration. Fig 12 shows two inline chokes for 160M. They are wound for 160M, and used in feedlines for high dipoles to prevent their interaction with my 160M Tee vertical. The black tape on the form of the RG400 choke provides UV protection for some "liquid" electrical tape. No, he doesn't want to build and sell any of these things.

Fig 10

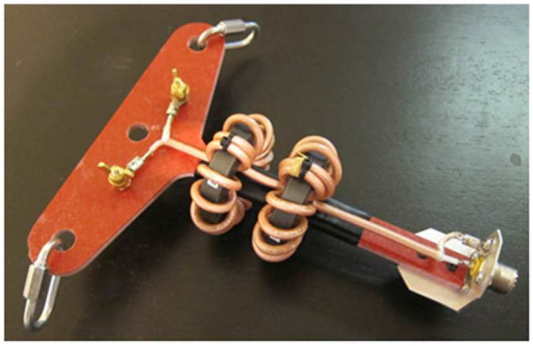


Fig 11 – W6GJB's Dipole Center Insulator With Two RG400 Chokes

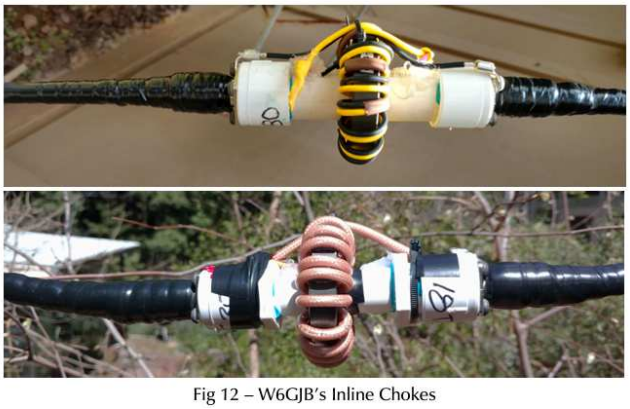


Fig 12 – W6GJB's Inline Chokes

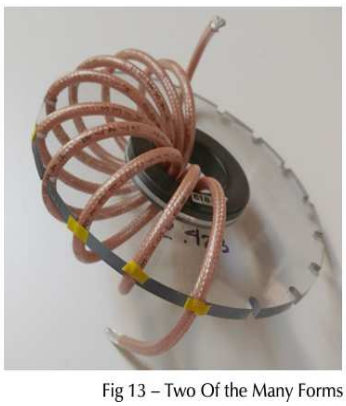


Fig 13 – Two Of the Many Forms W6GJB Built To Measure Coax Chokes

For my research, Glen designed several special forms and built nearly a dozen chokes with specified bend radii of 1, 4, 6, and 8 inches. Not only would the forms be difficult for most hams to build, the resulting chokes would have been expensive and weren't all that useful. Two are shown in Fig 13. It was not possible to get consistent or meaningful measurements without those forms to discipline the windings, and even with the forms, the resulting chokes were never the best for a given application. The Lexan form to fit the 2.4-in o.d. cores presented a surprising challenge – there's enough "slop" in their o.d. that each form had to be custom milled to fit it's assigned core, as indicated by the "magic marker" annotation on the Lexan!

Acknowledgements Thanks to N3ZZ, K6GT, and W6GJB for loan of cores for this work, and to numerous hams who, by asking questions, have both improved my writing about it and caused me to investigate new avenues. Most notable is GM3SEK, who caused me to investigate bifilar chokes wound on a single core, and subsequently, chokes wound with RG400 coax.

BIBLIOGRAPHY

The K9YC website includes numerous tutorials and applications notes on RF interference, and a tutorial on AC power systems. http://K9YC.com/publish.htm

A Ham's Guide to RFI, Ferrites, Baluns, and Audio Interfacing, Revision 7, Jan 2019 k9yc.com/RFI-Ham.pdf

Fair-Rite Products Catalog, http://www.fair-rite.com This 200-page catalog (online as a pdf) is a wealth of product data and applications guidance on practical ferrites. This company is a class act. The vast majority of ferrite parts available at retail in North America are made by Fair-Rite.

Chuck Counselman, W1HIS, ***Common Mode Chokes*** Self published 2006

E. C. Snelling, ***Soft Ferrites, Properties and Applications,*** Chemical Rubber Publishing, 1969 This, like all of Snelling's books, is geared toward non-suppression applications of ferrites. Lots of math and physics. All are long out of print. This is where I learned about dimensional resonance.

E. C. Snelling and A. D. Giles, ***Ferrites for Inductors and Transformers,*** Research Studies Press, 1983 Even more math and physics.

E. C. Snelling, ***Soft Ferrites, Properties and Applications, Second Edition,*** Butterworth-Heinemann, 1989 I've never seen this book, but it's now online as a pdf.

Jerry Sevick, W2FMI and Raymond Mack W5IFS, ***Transmission Line Transformers, Fifth Edition***, SciTech Publishing, Edison, NJ 2014 The last version of Jerrry's landmark text, with careful editing of later material by Raymond Mack.

Jerry Sevick, W2FMI, ***Building and Using Baluns and Ununs***, CQ Communications, 1994

Doug DeMaw, W1FB, ***Ferromagnetic Core Design and Applications Handbook***, Prentice Hall, 1996

Appendix

Transmission Line Data

This data was obtained by measuring S11 for 30-50 ft lengths of each cable type with the far end open and with the far end shorted, then post processed using AC6LA's ZPlots Excel spreadsheet. For each dataset, three plots are shown. The last of the three is un-smoothed raw data as input to ZPlots. By curve-fitting, ZPlots computes K0, K1, and K2, which are parameters for a model devised by Johnson and Graham and used by major manufacturers (including Belden and Times Microwave) to plot the data for their cables, and by SimSmith to model cable parameters. The First two plots were computed by ZPlots from K0, K1, and K2.

Complete data, including plots vs. frequency of Zo, VF, and Loss is at http://k9yc.com/ChokesTLData.pdf

#12 THHN Pair: Zo (nom) = 90 Ω, VF (nom) = 0.728, 1.2 dB/100 ft @ 10 MHz, K0=0.000012, K1=0.203588, K2=0.055205

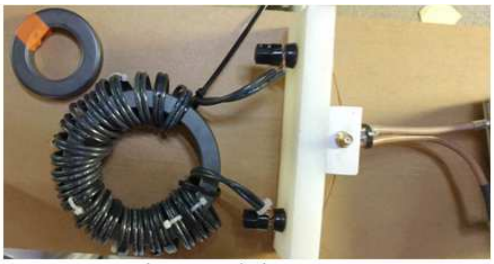
#12 Y/BK (Teflon) Pair: Zo (nom) = 96 Ω, VF (nom) = 0.834, 0.76 dB/100 ft @ 10 MHz, K0=0.000013, K1=0.098622, K2=0.044982

#10 THHN Pair: Zo (nom) = 90.95 Ω, VF (nom) = 0.7491, 1.5 dB/100 ft @ 10 MHz, K0=0.000008, K1=0.278518, K2=0.060604

#10 NM Pair (w/o ground): Zo (nom) = 84.44 Ω, VF (nom) = 0.7368, 1.5 dB/100 ft @ 10 MHz, K0=0.000003, K1=0.275865, K2=0.047031

#10 Enameled Pair: Zo (nom) = 40.5 Ω, VF (nom) = 0.7435, 2.36 dB/100 ft @ 10 MHz, K0=0.000014, K1=-.409901, K2=0.106527

RG400: Zo (nom) = 49.76 Ω, VF (nom) = 0.703, 1.225 dB/100 ft @ 10 MHz, K0=0.000014, K1=0.364280, K2=0.0088752


4-in o.d. THHN Choke In Test Fixture

The Measurement Setup For Chokes: Chokes were measured with an SDR Kits VNWA 3E. For the measurement, W6GJB built a test fixture based on my conceptual design that places the choke in series between the input and output of the VNWA, forming a voltage divider between the choke and the 50Ω input impedance of the VNWA. The VNWA was calibrated to a measurement plane at the point where the choke is inserted, and S21 (the gain from output to input) is measured.

Understanding The Plots: In a vector network analyzer, S21 is complex – that is, the result contains both magnitude and phase data. Math functions built into DG8SAQ's VNWA software solves the voltage divider equation to convert S21 (the voltage divider ratio) to ZMAG, RS, and XS. The Blue curve is S21, Orange is ZMAG, Magenta is RS, Black is XS. Values for each parameter are displayed by a table of markers placed at the limits of the 160, 80, and 40M bands, and at points near the 30, 20, 15, and 10M bands. Values are in Ohms. The sweeps, approximately 60 seconds long, use 4,192 data points, logarithmically spaced. Data tends to be noisy for high values of ZMAG, so a running average was applied to smooth it. The flat sections of each plot at the left and right of each curve are the result of this smoothing. When comparing plots, note that the scales are varied from one choke to another for the best view of the data. Vertical units/division are shown along the left axis; a log frequency axis is always used, but its limits vary.

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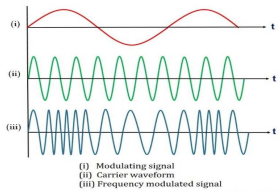
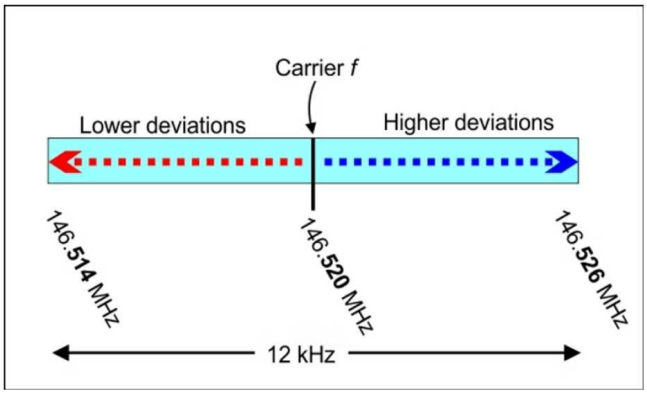


FM Modulation and Deviation (Bandwidth)

Frequency deviation

In Frequency Modulation (FM), frequency deviation refers to the maximum change in the carrier frequency from its nominal value, caused by the modulating signal. It's essentially the range within which the carrier frequency swings to transmit the audio information. For example, in FM broadcasting, the deviation is typically +/- 75 kHz but in amatuer radio it is 16kHz. This is the total deviation allowed for a transmitter on limited frequncy bands. What does this mean and what would happen if we “over deviated”?

Many times, the terminology we use for ham radio can be a bit confusing. For example, the terms ***wideband FM*** and ***narrowband FM***, can be used to mean different things. Let's take a look at the bandwidth of a typical FM signal and shed some light on whether it is wideband or narrowband in nature.



An FM signal spreads out on either side of the carrier frequency, to occupy a range of frequencies.

FM Bandwidth
The bandwidth of an RF signal is the amount of frequency spectrum the signal uses. Radio amateurs often talk about being on a particular frequency such as 146.520 MHz, but the actual signal being transmitted is wider than just that frequency. In other words, our typical FM signal on 146.520 MHz will actually spread out across 146.514 MHz to 146.526 MHz (and maybe further).

The bandwidth of the signal will be determined primarily by the ***peak frequency deviation*** of the FM signal. The peak frequency deviation is the maximum amount of instantaneous frequency change, relative to the carrier frequency. (The carrier frequency is the "resting frequency" of the signal with no modulation applied.) In the early days of FM mobile radio, higher peak frequency deviations were used, typically plus or minus 15 kHz. Later, the standard frequency deviation was reduced to plus or minus 5 kHz, considered **"narrowband"** at the time, which remains the standard today for ham use. (I mention this because you may find older technical articles referring to 5-kHz deviation as "narrowband.") .

You might think that the bandwidth of an FM signal is just twice the peak frequency deviation? That is, for a 5-kHz peak deviation, the instantaneous frequency swings 5 kHz in the positive direction and then 5 kHz in the negative direction. The total frequency swing is 10 kHz. Ah, **but the world is not quite that simple**, as the frequency content of the signal spills out beyond this 10-kHz frequency swing. This behaviour is quantified by Carson's Rule.

Our typical 5-kHz deviated signal actually has a bandwidth of about 16 kHz!

In 1922 ***John Renshaw Carson*** formulated his rule for estimating the bandwidth of FM signals using these two parameters. Since the actual bandwidth of the FM signal will vary with the modulating signal amplitude, Carson’s Rule is an estimation of the *maximum* bandwidth that an FM signal will occupy. Thus, an FM signal will vary in bandwidth commensurate with the audio signal amplitude, but with a maximum bandwidth estimated by Carson’s simple equation, as follows:

FM Bandwidth = 2(*Δf* + *fm*),

Where ***Δf*** is the peak frequency deviation and ***fm*** is the highest modulating frequency.
Now we can compute an estimate for the bandwidth of the question’s transmission, with a peak deviation of 5 kHz and a modulating high frequency of 3 kHz:

FM Bandwidth = 2(5 kHz + 3 kHz) FM Bandwidth = 2(8 kHz) FM Bandwidth = 16 kHz , now you can understand that the 5kHz bandwidth is your maximum setting for a 16kHz limit.

The 5 kHz peak deviation is considered "standard FM" on VHF and UHF amateur bands. Further, a typical modulating audio signal generated from a human voice will have a high frequency of around 3 kHz.

Narrowband and Wideband?

Today, there are three FM deviations that you are likely to encounter in modern ham radio gear. The widest of these is used for FM broadcast with a whopping 75-kHz peak deviation. This is definitely wideband by most standards and is used to support the high-quality audio normally associated with FM broadcast stations.

Many VHF/UHF ham transceivers have the capability to receive FM broadcast stations (88 to 108 MHz) and may refer to this **receive mode** as wideband FM. (We will see later that this terminology is fading.) The other two FM deviations commonly available on ham gear are 5 kHz and 2.5 kHz.

The 5-kHz deviation is considered standard and is often referred to as wideband FM. Similarly, the 2.5 kHz deviation is often called narrowband FM. You can see how this can be confusing: what used to be narrow is now considered wide.

This table summarizes the three frequency deviations, their resulting bandwidth, and channel spacing. Channel spacing is roughly consistent with the bandwidth of the signal but may be different depending on how tight the channels have been scrunched together.

Some amateur transmitters provide a 2.5 kHz peak deviation option, thereby generating a narrower bandwidth FM signal. For instance, given the same high modulating frequency of 3 kHz, a 2.5 kHz peak deviation results in a bandwidth of 11 kHz, in accordance with Carson's Rule.

The narrower bandwidth signals provide for more efficient use of available RF spectrum but can result in a lacklustre audio signal.

Name	Peak Frequency Deviation	Bandwidth	Channel Spacing
Narrowband	2.5 kHz	11 to 12.5 kHz	12.5 kHz
Wideband Standard	5.0 kHz	13 to 16 kHz	15 to 25 kHz
FM Broadcast	75 kHz	180 to 200 kHz	200 kHz

What if you Use the Wrong Deviation?

The vast majority of the analogue FM repeaters and radios are set up for 5-kHz deviation. (This is because so many pieces of ham gear in use can only do 5-kHz deviation.) Unless you have good reason to do otherwise you should set the FM deviation to Wide (5-kHz) deviation.

If you happen to set your radio to 2.5-kHz deviation, your signal will have a lower modulation level and will sound quieter on a typical repeater or simplex channel that is set to 5kHz.

If the repeater you are using is set up for narrowband deviation and you are using wide deviation, your signal will sound louder and may be distorted. This will also happen if your deviation exceeds 5kHz on a 5kHz repeater or simplex receiver. You can compensate for this by talking quieter but it would be best to change the setting to the desired deviation level. Generally, wideband and narrowband radios can talk to each other, but you may encounter annoyingly quiet audio or loud, distorted signals. So try to have your radio set correctly but the world won't end if you make a mistake.

How to measure FM Frequency Deviation without special equipment using Carrier / Bessel Null

See this video link below

https://www.youtube.com/watch?v=8IBOYoIV5m8

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?

Question 1 An oscillator that slowly moves in frequency of "its own accord" is said to:

a) overmodulate
b) drift
c) have distortion
d) chirp

Question 2 Two tone tests are done to test the:

a) linearity of an FM transmitter
b) power output of a CW transmitter
c) linearity of an SSB transmitter
d) symmetry of an FSK transmitter

Question 3 A capacity hat or capacitive top loading is used on a vertical antenna to:

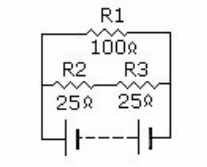
a) to increase the bandwidth of the antenna
b) make the antenna more stable in high winds
c) to decrease the electrical length of the antenna
d) to increase the electrical length of the antenna

Question 4 A linear repeater station accepts:

a) FM signals only
b) SSB signals only
c) SSB, FM and CW signals
d) RTTY signals only

Question 5 In this circuit R1 dissipates 10 watts. What power is dissipated in R2 ?

a) 10 watts
b) 5 watts
c) 2.5 watts
d) 20 watts



Question 6 The approximate wavelength of the second harmonic of a 144 MHz transmission is:

a) 1 metre
b) 2 metres
c) 3 metres
d) 4 metres

Answers next propagator

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

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

OLD PROPAGATOR MEMORIES

THE PROPAGATOR

THE MONTHLY NEWSLETTER OF THE
WIRELESS INSTITUTE OF AUSTRALIA
ILLAWARRA BRANCH

Published by the Illawarra Branch of
the Wireless Institute of Australia
P.O. Box 110
DAPTO 2530

No 6/75 JUNE 1975 No 6/75

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WOONONA 2517

SECRETARY:

Ian Bowmaker VK2ZJA
15 Akuna Street
KEIRAVILLE 2500

NOTICE OF GENERAL MEETING

Members are advised that the next GENERAL MEETING of the Illawarra Branch of the W.I.A. will be held at the Wollongong Town Hall Committee Room on Monday, 9th JUNE 1975 at 7.30 p.m.

THE AGENDA READS AS FOLLOWS:

1) Apologies and welcome to visitors and new members.
2) Minutes of previous meeting.
3) Correspondence.
4) Financial Report.
5) General Business.
6) Raffle.
7) Lecture.

DX PANORAMA

Gerry VK2APG

I haven't been very active on the HF bands within the last month so therefor have some information from John VK2BHO to help make up the page. On 20 mx, conditions have been wide open to North America and Canada with quite a few Alaskans were also heard and worked, Openings have been around 0100-0800z to the states and Canada.
John 2BHO reports several openings to VK4 & VK5 on 6 mx.
On Thursday 29-5-75 between 0900-1100z worked 7 VK5's.
On Friday 30-5-75 heard ZL TV and VK5VF beacon.
On Sunday 1-6-75 heard ZL TV and worked VK4ZAN and VK4FH at 0630z.
Also heard VK4RTL Townsville 6mx beacon.
Also here's one for Harry 2BJL, John 2BHO worked W7JLU at 1035z on 3.5 Mhz with 549 reports both ways, on 17-5-75.
That's about it for now. Hope to have more interesting notes next month.

73's

Gerry 2APG

P.S.

The Mid-Winter VHF contest will be held on the Queen's Birthday weekend on 14,15 & 16th June. There will be many stations operating partable from various mountain tops around the area.There should be plenty of 6 &2 metre contacts to be had, perhaps even an opening or two on 6 interstate like that occurred 2 years ago. So keep this weekend in mind and let's see lots of participation in providing numbers for the stations who are looking for them. Good luck in the contest to all.

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/2020/09/1975-06-June.pdf

Upcoming Contests ……………………………

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VK Shires Contest

VK SHIRES 7th - 8th June 2025

Contest Manager

Diane Main: VK4DI. Long time contester and DXer.

Contest Introduction

Held the Saturday and Sunday of the weekend prior to the second Monday of June every year.
Starts: 00.00 UTC Saturday Ends: 23.59 UTC
VK Stations work VK Shires and CQ Zones whereas international stations only work VK Shires

Reworking stations is allowed in 4-hour blocks. The rules for the blocks are, however, somewhat different to what is allowed in the John Moyle Memorial Field Day or VHF-UHF Field Day use, so read the rules carefully.

More information use this link >> https://www.wia.org.au/members/contests/wavks/

Trans-Tasman Low-Band Contest

Trans Tasman Low Band Contest

Contest Manager

Alan Shannon VK4SN

Contest Introduction

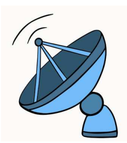
Next contest - 19 JUL 2025

The Trans-Tasman contest, held on the 3rd weekend in July, aims to encourage Low Band activity between VK and ZL

Only contest bands 160 80 and 40M are allowed with SSB, CW and Digital (RTTY OR PSK)

From 2018 this contest is an official WIA Contest and will count towards the Peter Brown Contest Champion Awards.

For more information use this link https://www.wia.org.au/members/contests/transtasman/



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**

Joint picnic day out feedback!

The Mid-South Coast amateur radio club, Goulburn and Illawarra Amateur Radio Society had an awesome day out with friends and family. As always there was some serious cooking and discussions about that special antenna and low SWR 😊. Gerhard from MSCARC setup his station with a dipole antenna and got some very good signal reports, this area had very low QRM.

Dipole antenna setup

Telescopic J POLE antenna



Who would have thought that a FABRIC J-POLE was a thing , yes it worked very well !

Looking forward to the next get together , keep an eye on future propagators and the IARS Facebook page

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IARS Illawarra Amateur Radio Society

PICTON HAM FEST

The Illawarra Amateur Radio Society and the Picton Show Ground Trust are looking for expressions of interest to attend a Radio field day / swap meet in November 2025 at the Picton Show Ground.

At this stage we would like you to ask for expressions of interest from everyone.

We are asking you to please collect the numbers of people interested in attending such an event so that planning can be made for the event to take place on ***23rd November 2025****.*
This information needs to be communicated to the IARS club website (iars.org.au) and or the IARS club Facebook page ***before the 15th of June 2025****.*
At this stage , entry fee would be $5 per person. If you wish to sell from your car boot/ table, you need to book through the Picton Show Ground Trust once the event has been organized.

PLEASE be aware that the Picton show ground does not have the same facilities of the Wyong Race course. There are public toilets available and food vans would be organised for the day.

There are no powered sites available.
It may be possible to camp over on Saturday night for setup. if you require this, please communicate this with your expression of interest.
The Hume highway is not far from the Picton show ground which is located on the main road from the Hume into Picton.
Picton railway station is less than 200m from the show ground and some off-street parking will be available.
Gates open for general admission from 8.30 am and for traders from 7.00am

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……more AR NEWS

ARISS School contact with students from Girton Grammar School Bendigo

05/ 05/ 2025 Watch the video of the ARISS School Contact with Takaya Onishi KF5LKS with students from Girton Grammar School Bendigo part of the WIA AGM & Technical Expo 2025.
Read the full story...

Link for full story https://www.wia.org.au/newsevents/news/2025/20250505-1/index.php

⇐ Apr 24th, 2025 (Thu) -- May 10th, 2025 (Sat) **00:00 - 23:59 UTC**

80th Anniversary of Operation Manna, humanitarian food drops at end of
Club: WA VHF Group Inc. Callsign: VK6WHO
State: UTC
Brief Description : Comemmorating humanitarian food drops at end of WWII

Full Details : Amateurs here and abroad commemorate Operations Manna and Chowhound, humanitarian food drops into The Netherlands 80 years ago at the end of WWII.?? Details on QRZ.com, search VK80MAN, GB80MAN or PH80MAN.?? Or visit manna80.radio Please make contact with us late April through mid May.?? For info please contact VK80THMANNA@gmail.com

To put this into your calendar use link here https://www.wia.org.au/newsevents/events/

May 25th, 2025 (Sun) **09:00 - 15:00 AEST**

ARNSW Bi-Monthly Members Meetup, Trash & Treasure + Radio experimenter
Club: Amateur Radio New South Wales Callsign: VK2WI
State: VK2
Brief Description : ARNSW Bi-Monthly Members Meetup, Trash & Treasure + Radio experimenters group

Full Details : "Members Morning Meetup" at ARNSW Dural 63 Quarry Road, Dural 2158. Gates open from 8am for parking and set-up, with the event kicking off at 9am.

Trash and Treasure, boot sales, disposals tables, plus tea, coffee, and cold drinks available throughout the morning.

The BBQ will be sizzling from 9:30am with a sausage sizzle, and all proceeds will go towards supporting youth participation in amateur radio.

Later in the day, just after midday, we'll welcome members interested in the Radio Experimenters Group. As always, all those coming are invited to bring along an item for "show and tell". More info: www.arnsw.org.au

To put this into your calendar use link here https://www.wia.org.au/newsevents/events/

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IARS HOME BREW project competition

The IARS invites you to participate in a "HOME BREW" amateur radio project competition with the judging to be done at our Christmas meeting at the end of the year. Anything from Crystal sets, low power CW transmitters to a Superhet receiver to those who want a more challenging task 😊.

The prize will be a trophy, one year free IARS membership and a $30.00 gift card. The judging will be based on originality, effort and presentation.

More information to follow on the club website, Facebook and email.

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

HAM RADIO DELUXE SOFTWARE®
The Radio Amateur's Best Asset

Ham Radio Deluxe Software® Makes Satellite Communications Easy

https://www.hamradiodeluxe.com/features/sattrack/

>>

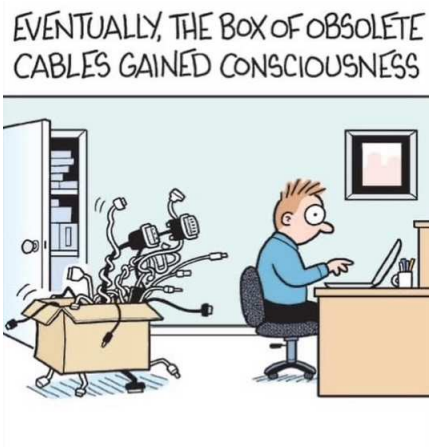
Upcoming IARS meeting presentations ……………………………

- **June 2025** : **SHOW and TELL,** bring along that latest project ot share with us.
- **July 2025** : Project mania , Simon VK2KU unleashes the next awesome IARS project
- **August 2025** : IARS AGM
- **September 2025** : **SHOW and TELL,** bring along that latest project ot share with us.
- **October 2025** : Surface mount soldering and reworking "HANDS ON" workshop. Let's do it!
- **November 2025** : Famous IARS Auction with Simon VK2XQX
- **December 2025** : Christmas dinner party (surprise 😊) with Home Brew Contest awards

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 10th June 7.30pm,

73

Keith VK2KQB

IARS Secretary

IARS, Amateur Radio in the Illawarra since 1948