Amateur Radio

Volume 88
Number 3 ▶ 2020
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110 Years Anniversary
1910-2020

WIRELESS INSTITUTE OF AUSTRALIA
www.wia.org.au

Dude! Spotless?

Surving solar minimum

- ▶ Clothesline wire ☑ HF Antenna ☑
- ▶ Raspberry Pi saviour project
- ▶ DIY digital voice working 20m DX
- ▶ DIY HF Transceiver continues

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Technical

General

Columns

This month's cover:
The spotless Sun, photographed by NASA JPL on 1 February 2018, when it had been spotless for almost two weeks! Our main feature starts on page 11.

Contributions to Amateur Radio

Amateur Radio is a forum for WIA members' amateur radio experiments, experiences, opinions and news. Manuscripts with drawings and/or photos are welcome and will be considered for publication. Articles attached to email are especially welcome. The WIA cannot be responsible for loss or damage to any material. Information on house style is available from the Editor

Back Issues
Back issues are available directly from the WIA National Office (until stocks are exhausted), at $8.00 each (including postage within Australia) to members.

Photostat copies
If back issues are unavailable, photocopies of articles are available to members at $2.50 each (plus an additional $2 for each additional issue in which the article appears).

Disclaimer
The opinions expressed in this publication do not necessarily reflect the official view of the WIA and the WIA cannot be held responsible for incorrect information published.

Amateur Radio Service

A radiocommunication service for the purpose of self-training, intercommunication and technical investigation carried out by amateurs; that is, by duly authorised persons interested in radio technique solely with a personal aim and without pecuniary interest.

Wireless Institute of Australia

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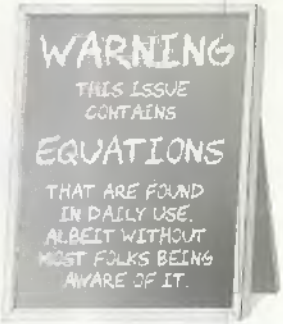
Editorial

Roger Harrison VK2ZRH



Courtesy Carmel Morris VK2CAR

This issue, I have introduced a new occasional-to-regular feature, called Building Blocks. The general idea is, in relatively short articles, to cover concepts that are germaine to electronics and radiofrequency technologies. As the worlds of science, technology and engineering are built on mathematics, from time to time I expect equations to be used. Hence the billboard in the right hand column, here.

I have been a subscriber to a number of email reflectors for many years. The concept and use of the technology pre-dates Facebook and Twitter, the ubiquitous 'social media', but email reflectors (or lists) still serve their purpose of enabling people that share a particular interest to maintain connection, share knowledge and discuss matters of the day. I have noticed a curious development over recent years where there has been parallel development between email reflectors and Facebook groups.

That said, I have been astonished to see over this year the explosion in activity over these media in developments on the 122 GHz / 2.5mm band – one of the frontiers of amateur radio. It is a global phenomenon! Subscribers to email reflectors and Facebook groups come from all over the world.

As could be expected, interest and activity has not stopped there, pushing on to 241 GHz and, very recently, to 700+ GHz. From there, we're into lightwave territory, which amateurs across the world have experimented with in fits and starts over decades. Indeed, those attending the presentation sessions accompanying the 2018 WIA Annual Conference at SeaWorld on the Gold Coast, were treated to a *tour-de-force* demonstration of amateur radio lightwave communications. The annual Gippsland Technology Conferences held mid-year in Churchill, Victoria (cancelled for 2020 during this COVID-19 pandemic), has included demonstrations and presentation of radio amateur lightwave communications.

DX records on the mm-wave bands have been successively set and extended almost month-by-month over recent times. Progression in technology, techniques and DX records are being regularly documented in AR magazine's VHF-UHF – An Expanding World column issues by issue. I am reminded that this very much reflects what was happening in amateur radio a century ago, only on the bands below 200 metres at the time.

For those older amateurs returning to their interest in the hobby, having left it fallow for years for a host of entirely legitimate reasons (life!), and despairing because it is not what they remembered, amateur radio is very much 'alive and kicking', has expanded enormously the range and variety of areas to explore and today offers so much more than yesteryear that every licensee is spoiled for choice.

73
Roger Harrison VK2ZRH
Editor in Chief

Board comment

Greg Kelly VK2GPK

Last issue I mentioned the saying *"May you live in interesting times!"* and its applicability to recent widespread events that have negatively impacted Australians. These unwelcome "interesting times" have certainly continued with the state of Victoria reverting to full pandemic lockdown (Stage 4) for Melbourne residents following widespread community transmission of the SARS-CoV-2 virus.

Smaller-scale 'second wave' outbreaks have also occurred in New South Wales, and Queensland. Borders remain closed, or have re-closed, to all non-essential traffic across all Australian states.

RUOK?

The WIA is aware of the considerable personal and mental health impacts that the new lockdown in Victoria must be having on our Victorian members in particular, as well as the continuing impacts on almost all Australians.

The WIA kindly asks our members Australia wide to be as active as possible in getting on the air – not just listening, but actually calling CQ – whether HF and/or VHF, during this time of increased social isolation. And remember, it won't hurt to ask 'Are you OK?'. If you are not coping, ask for help, it is readily available, at no cost, from various community counselling services such as Lifeline, Beyond Blue, etc. A comprehensive list of telephone counselling services is detailed at *www.healthdirect.gov.au/mental-health-helplines* – it is worthwhile checking this site to become aware of the wide range available so you can direct friends or family to these valuable resources in times of need.

Internet Collaboration

I encourage local clubs to conduct regular "virtual" informal video conference meetings to help maintain social contact. Remember that the WIA has a standing offer to all WIA affiliated clubs for free access to the corporate version of Google Suite, which overcomes the many limitations – including privacy and security – of the free alternatives for video conferencing and member collaboration.

There are many features and benefits of this offer, which is worth approximately $5 per month per member of your club. Each club is issued with a unique internet sub-domain and, once set-up, can manage their own administration of Google Suite, such as adding and deleting users. Feedback from the "early-adopter" clubs already using this offer has been excellent.

Annual General Meeting (AGM) wrap-up

The WIA held a successful and constructive "virtual" meeting for the 2020 WIA AGM via video conferencing. The meeting was also live-streamed on YouTube.

The WIA thanks all members who attended the meeting and/or provided proxies.

This meeting was held based on a special determination from the Australian Securities & Investment Commission (ASIC) that allows "virtual" meetings – this determination is due to expire in November 2020. The Corporations Act currently precludes holding "virtual" general meetings, requiring a physical location.

The draft minutes of the meeting, including the President's Report is planned to be available on the WIA website by the end of August. After the formal meeting concluded, an hour-long "Ask us any question!" session was held, which covered a wide variety of topics.

A link to the full conference video will also be on the WIA website. Based on the success of this format, the WIA will consider making interactive videoconferencing a feature of future AGMs, even when (if?) we revert to a physical location as currently required by the Corporations Act.

Youngsters on the Air (YOTA)

The first ever IARU Region 3 YOTA camp to be held in Thailand this October has, unfortunately, now been postponed due to COVID-19 and will be rescheduled for a later date.

The initial Americas' YOTA camp for young amateur radio operators in North, Central, and South America that was postponed in the summer of 2020 is now scheduled for July 11-16, 2021.

The goal of YOTA is to welcome new and young amateur radio operators to amateur radio. We live in a world where communication is being digitalised in a way that is becoming all-pervasive, and the relevance of Amateur Radio is far from self-evident. YOTA is an IARU initiative about creating the next generation of amateur radio enthusiasts, bringing new energy and innovation potential.

The current IARU focus is on a "Train-the-trainer" approach to train

Continued on page 4

Board comment

Continued from page 3

younger radio amateurs as "Ham Evangelists" to then get more young people interested in becoming Radio Amateurs.

RD Contest

The 2020 Remembrance Day contest was held recently with great success and featured a very high level of participation.

This radio-sports contest commemorates Australian radio amateurs who have died in the service of their country. Each year, this major contest is held over the weekend closest to 15 August, the anniversary of the date, in 1945, on which hostilities ceased in the southwest Pacific. This year marks 75 years since the cessation of the Pacific hostilities, and which signalled the end of World War Two, more than three months after the fighting in Europe had stopped.

Internet Security

The WIA recently moved its primary web server, which is hosted at a datacentre, to a new and more powerful hardware platform and took the opportunity to upgrade both the operating system (Linux) and application software.

The WIA website now meets the highest standard (A+) of internet security, as verified by tests provided by SSL Labs, a non-commercial internet security research organisation. As an aside, if you happen to be still running any PCs with Windows 7 as the operating system, it is time to upgrade. Quoting Microsoft: *"Support for Windows 7 ended on January 14, 2020. If you are still using Windows 7, your PC may become more vulnerable to security risks".*

In closing

The WIA today, more than 110 years since it was founded, exists entirely due to the continuing contribution of many volunteers over many generations – consider becoming one of these volunteers and contribute, even in a small way, to the future of this great hobby.

73

Greg VK2GPK, *WIA President*

WIA news

Historic changes to callsign policy brought in

In July, the Australian Communications and Media Authority (ACMA) announced significant administrative changes to radio amateur callsign structure, allocations and formats.

Three principal changes were made:

(1) all amateur licensees can obtain a three-letter suffix callsign;
(2) the association between callsign suffixes and qualifications has been removed; and
(3) if you move to a new state or territory, you no longer need to get a new callsign, although you can get one if you wish.

These changes provide a "callsign for life" for all licensees, says the ACMA.

Upon obtaining a Certificate of Proficiency, a candidate can apply for a three-letter suffix callsign which they can maintain for as long as they live and pay the renewal fees, no matter where they reside throughout Australia including changing their location from time to time. This means that the numeral following the callsign prefix no longer always signifies the state or territory location of a licensee's station. A VK3 may move home to live in VK8, or a VK6 move to live VK2, for example.

For the already-licensed seeking to change their callsign, those holding a Foundation, Standard or Advanced licence, can apply to the callsign administrator, the Australian Maritime College (AMC), for any available three-letter suffice callsign. As with prior callsign policy, only Advanced licensees can apply for a two-letter suffix callsign, where available.

Foundation licensees are the main beneficiaries of the changes. Firstly, it enables them to engage in using the wide variety of data modes available, many of which cannot accommodate 7-character callsigns. Use of data modes by Foundation licensees were permitted following changes to the Licence Conditions Determination (LCD) in September 2019.

The ACMA said that, as the callsign structure is not a concern of its regulatory functions, "we believe that this administrative policy should be guided by the consensus view within the amateur radio community."

See: *www.acma.gov.au/changes-amateur-radio-call-sign-policy*

To implement the changes to the LCD, the ACMA and the callsign administrator, the Australian Maritime College (AMC), considered submissions on callsign policy from the Australian radio amateur community.

The WIA has previously held a national poll on the matter and made subsequent submissions to the ACMA about callsign allocation.

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WIA Board 2020-21

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WIA news

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Callsign processing delays

As a result of the announcement about changes to the callsign template and the large amount of callsign variations received, the ACMA had to grant an extension in processing times from 15 to 45 days, until 31 October 2020.

The AMC requested that, unless the matter was urgent, applicants should use email rather than telephoning. This will allow the Amateur Radio Office team to maintain all other services within the expected 15 business days, said the AMC.

In addition, the AMC said it was working to update the 'Publicly Available Callsigns Database' to match the new callsign template, and apologised for delays experienced due to this. See: *https://amc.edu.au/industry/amateur-radio/news-updates*

Global HF digital mode band plans in review

Recent explosive growth in HF digital modes, particularly FT8, has led to significant activity in the narrow HF digital band segments.

In response, the three International Amateur Radio Union (IARU) regions have formed working committees to discuss band planning. It is the first time all three regions have planned directly together.

The WIA is playing a role in this important global review. The WIA IARU Region 3 representative, Grant Willis VK5GR, is working though the WIA on behalf of the IARU Region 3 Band Plan committee Chairman, Sion 9M2CQC.

Discussions with HF stakeholders, including the WSJT Development Group led by Joe Taylor K1JT, known for FT8 and other digital mode developments, has begun discussing arrangements to maximize the sharing of the digital band spectrum space available in the HF bands, to reduce congestion and minimize interference to other digital mode users.

Recent IARU administrative changes mean that changes can be implemented without waiting for the IARU regional conferences held every three years.

Full details of the announcement are available via: *www.iaru.org/2020/hf-digital-mode-band-plan-review/*

Building Blocks

Dude! What is it with these decibels?

Phil Wait VK2ASD

Shakespeare had Hamlet ask the eternal question: dB or not dB? Phil Wait VK2ASD sheds some light, or maybe sound, on the decibel.

When working with any type of audio, communications, engineering, or signal processing technology it's not long before you encounter the term **decibel (dB)** to show the ratio between two powers, or other quantities such as voltage, current, field strength, or sound pressure, etc.

The decibel was devised by Bell Systems in the US to measure signal power in telephone networks.

It is a very useful measure, because it is based on a *logarithmic scale*, and therefore has the ability to show small changes within a very large range as well as to condense very large ranges of a quantity into manageable numbers.

Human vision and hearing have a near logarithmic response to strength and intensity, so decibels also relate well to human perceptions of light and sound.

The decibel is used in a very wide variety of electronics, communications, and sound engineering applications as it is a very convenient way to describe a change in value, such as the gain of an amplifier, the loss through an attenuator, the 'shape factor' of a filter, the efficiency of an antenna, the signal-to-noise ratio of a signal, or the noise factor of a receiver – or anywhere a comparative logarithmic scale is appropriate.

It can have either a positive or a negative sign, such as +dB or –dB.

Decibels as a power ratio

When expressing the ratio of two **powers or sound intensities**, the formula is:

$$dB = 10 \log (P1/P2)$$

A change in power by a factor of 10 corresponds to a change of 10 dB, 100 times is 20 dB, 1000 times is 30 dB, and so on.

A doubling of power is +3 dB, and a halving of power is -3 dB. You will run across this building block remarkably often.

A sound intensity variation of 1 dB is a 26% increase or decrease in power, or a 12% increase or decrease in voltage, but it is barely noticeable to a human. For instance, the difference between an 80 watt audio amplifier and a 100 watt audio amplifier might sound like a worthwhile increase in the specifications, but it probably wouldn't be noticeable when listening to music played through it. (If you want to buy a more powerful amplifier, go for an increase of at least four times to make the exercise worthwhile!).

Decibels as a voltage or current ratio

When expressing the ratio of **two voltages or sound pressures**, the formula is:

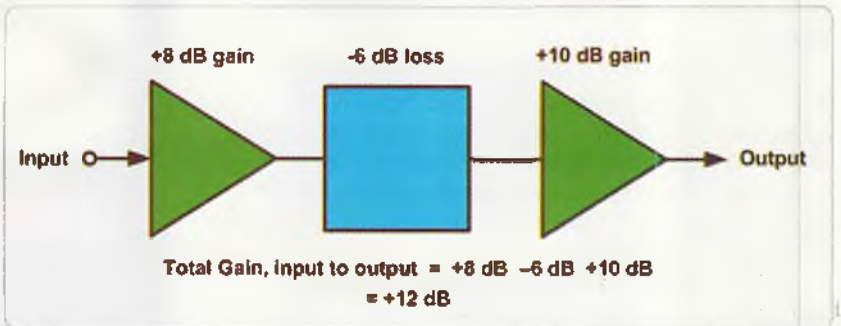
$$dB = 20 \log (V1/V2)$$

A change in voltage by a factor of 10 corresponds to a change in level of 20 dB, 100 times is 40 dB, 1000 times is 60 dB, etc.

A doubling of voltage is +6 dB, or halving voltage is -6 dB. This is another building block you will run across everywhere.

The multipliers of 10 and 20 corresponding to voltage/current and power are very convenient, because an X dB increase in *either* voltage or current will cause in the same X dB increase in power. An (X) dB increase in *both* voltage and current will cause a 2X dB increase in power.

The decibel also allows easy addition or subtraction of very large or very small numbers, such as gains and losses through each part of a circuit. For instance:



This block diagram of a 'signal chain' demonstrates the use of decibels in setting out the overall performance of a circuit block, showing the gains and losses at each stage.

Decibels referenced to an absolute value

Decibels can also show an *absolute* value, by describing amplitude as a number of decibels above or below a reference level. For instance, dBm is the decibel ratio of power above or below one milliwatt, originating from Bell's original telephony applications where a milliwatt is a commonly used signal level. This principal is widely used and pretty much an essential building block of understanding everything from basic circuits to communications systems.

Some commonly used reference dB expressions are listed in the table, here.

So, dude. dB or not dB?: what was the question?

	Common decibel expressions
dBm	dB with respect to 1 milliwatt; hence 0 dBm is 1 mW
dBW	dB wrt 1 watt; 0 dBW is 1 W
dBμV	dB wrt 1 microvolt; 0 dBμV is 1 μV
dBV	dB wrt 1 volt; 0 dBV is 1 V
dB(μV/m)	Electric field strength wrt 1 microvolt per meter.
dB (SPL)	Sound pressure level, where 0 dB SPL is the quietest sound an average human can hear.
dBA **dBB** **dBC**	Variations of SPL using frequency 'weighting filters' (A, B, C) to approximate the human ear's response to sound.
dB(i) **dBi**	The gain of an antenna compared to a hypothetical isotropic antenna (a 'perfect' antenna that radiates and receives power uniformly in/from all directions).
dB(d) **dBd**	The gain of an antenna compared to a 'perfect' half wave dipole. 0 dBd = 2.15 dBi
dB(C) **dBC**	The relative level of noise or sideband power wrt carrier power in a transmitted signal.

Election of Directors 2020

Wireless Institute of Australia

I, John Marshall, the returning officer of the Wireless Institute of Australia hereby declare that in accordance with The WIA Constitution, Clause 14.1c and the Regulations (as amended November 2017), nominations were called for three positions which will be vacant after the 2020 AGM. Vacancies on the Board are created by the resignation of Director Harry VK6YBZ and the retirement of Directors Aidan VK4APM and John VK4JJW at the conclusion of the 2020 AGM. The retiring members were eligible to re-nominate.

Continuing Directors elected at the 2019 AGM will retire in 2021 are:

Greg Kelly VK2GPK
Peter Clee VK8ZZ
Mike Alsop VK8MA

The vacancies were advertised and nominations sought in the November / December edition of *Amateur Radio* magazine.

I further declare that three (3) nominations were received to fill the vacancies as advertised. An election is therefore unnecessary.

Accordingly I hereby declare that the following members have been elected unopposed to the position of Board Member of the Wireless Institute of Australia.

Phillip John Shields VK2CPR New Director
Lee Moyle VK3GK New Director
Oscar Eduardo Reyes Salazar VK3ZZX New Director

These three members have been elected for a period of two (2) years from the conclusion of the 2020 Annual General Meeting of the WIA to be held in Hobart on 9th May 2020*.

John Marshall
WIA Returning Officer

[Note that, owing to the restrictions of the COVID-19 pandemic, the Hobart AGM was postponed and the WIA held an online AGM on Saturday 25 July 2020].*

Clothesline wire makes easy 'multi-band' antenna

Carmel Morris VK2CAR

Here's a slightly different homebrew off-centre-fed (OCF) antenna which I still use today made from low-cost clothesline wire. It's easy to prepare and would make an ideal first antenna for Foundation license holders. It's also a low-budget antenna that'll get your signal out to the world.

The asymmetric OCF antenna design theory is based on the classic Windom design but that'd be the only similarity. OCF dipole lengths are typically in thirds; two-thirds one end, one third the other. However I needed to experiment with different lengths due to the physical locations of trees around the house.

I changed the radiating lengths to 32 meters one end and eight meters the other. I then connected a homebrew 4:1 balun using a cheap Jaycar L15 core. I know I'm a real cheapie, but on 100 W the balun doesn't overheat. These lengths in

Photo 1: Proportions of the OCF clothesline antenna.

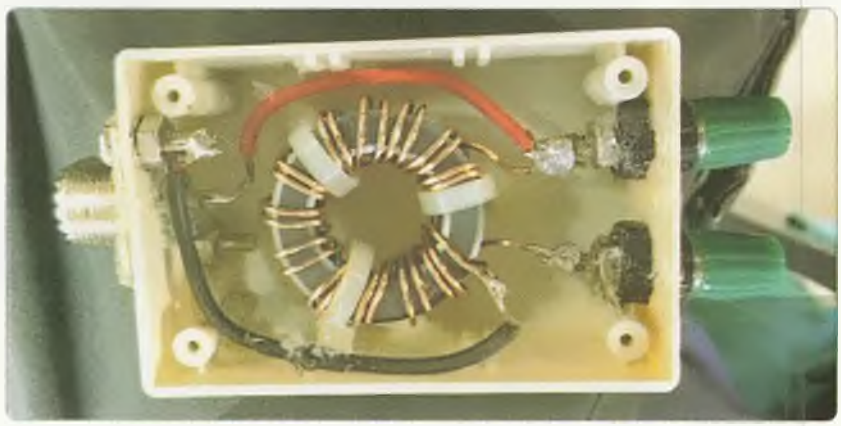


Photo 2: My homebrew 4:1 balun using the Jaycar L15 core with 2 x 10-turn windings.

Photos 3 & 4: 'Reely good' clothesline wire. I keep the spare wire on a builder's line reel.

fifths were superior to other lengths I tried in that you can work more bands given the right mounting conditions.

Many say a 6:1 balun is better due to high impedance at certain heights, and impedances also go up the more the antenna feedpoint is off-centre.

The original Windom antenna was developed in the 1920s by General Lorn Windom. He used a single wire feeder, connected off-centre and leading straight from the antenna wire to the radio, which was also part of the radiating element. This is different from my OCF, which can use parallel wire ladderline feeder, or coax as I have.

So what's unique about my antenna? Mostly, it's the durability and longevity of the copper-clad steel clothesline wire. Apart from some country hams who love barbed-wire fence antennas, I know some of you may say steel is not as good as a copper conductor but this antenna wire is copper-coated and covered in nice, stealthy UV-resistant green PVC.

The advantage of steel is it won't stretch and, given the skin effect in wire, most of the RF amps are working hard around the outer core anyway.

The clothesline antenna wire is dirt cheap – around $22 for a 60 metre roll at your favourite Bunnings. I keep my spare field day OCF wound on a builder's line reel; very easy to deploy! Some folks use a feedline choke, but I didn't find the need for it. As I am told it's good practise to have one, that'll be a job for 'next time'.

Characteristics

As is typical for this type of antenna, my Sark vector network analyser (www.sark110.com/home) shows that the impedance (at my end of the coax) varies quite widely, but the VSWR is low on each of the amateur bands 3.5 MHz, 7 MHz and 14 MHz, but not on 21 MHz. It's not great on 28 MHz either, but acceptable. I'm told that that may

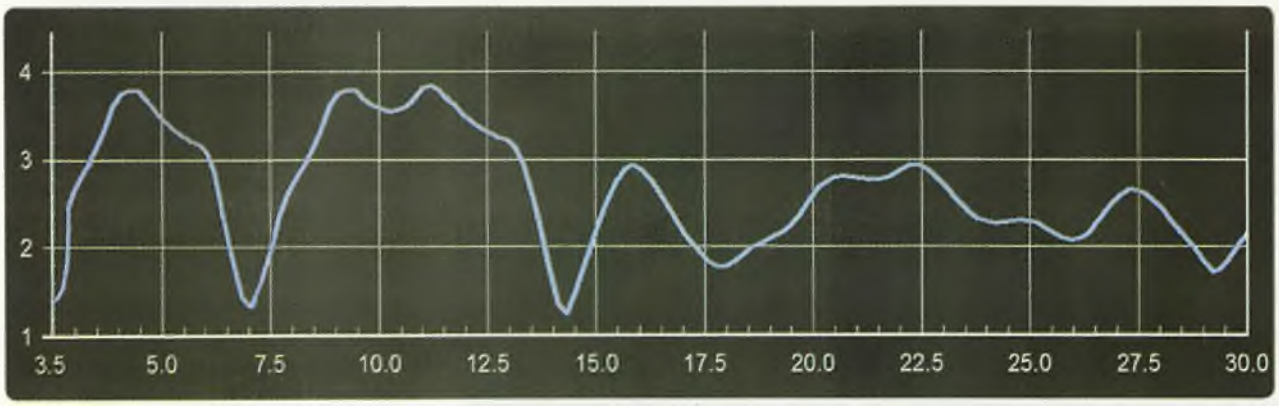
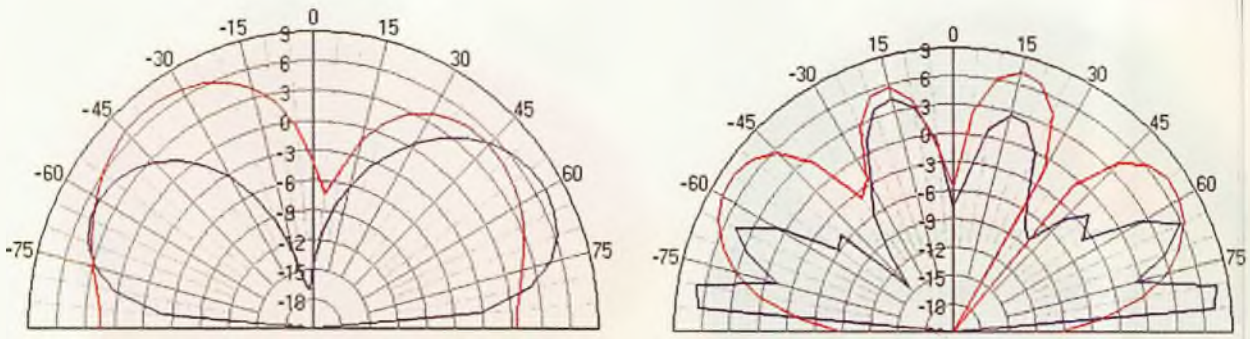


Photo 5: My vector network analyser output plot: the vertical scale is VSWR, while the horizontal scale is frequency. This demonstrates that the antenna works well on the three bands of 80m, 40m and 20m, but its report card says 'could do better' on the higher bands.



Photos 6 & 7: Models of the antenna design's radiation performance at 7 MHz (left) and 28 MHz (right). The blue trace on each is for the antenna at 12m height, the red trace for lower height.

be a result of not using a feedline choke, and the antenna may be coupling to currents flowing on the coax shield. That 'next time' job may come around real soon.

Of course you may have a differing experience at your location if there are coupling problems with nearby metal roofs, or big hills or massive MacMansions nearby (like we have).

Model your antenna

If you want to first experiment with your own OCF antenna design try 4NEC2, a freeware Windows app that can help you model a functional antenna without wasting money. I found this useful when determining the lengths for my antenna (*www.qsl.net/4nec2/*).

The radiation pattern will vary depending on your setup, but would most likely be similar to mine.

The OCF antenna design is versatile and great for portable use, despite the added weight of a balun. The benefit of the steel clothesline wire is strength and, unlike copper wire, the steel won't stretch.

If setup conditions are not ideal, you could turn your OCF into an oblique inverted V, or even bend the radiating section around a tree without acceptable compromise on performance. Naturally, the radiation patterns will vary. I should experiment with an OCF loop one day.

At the longer end of my OCF installation I have the support rope over a pulley. I can easily lower the antenna for stronger local contacts and raise for DX, though most of the time the best balance is having the antenna at around 10-12 metres high.

If you wanted to experiment with grounding, you may check to find out if there's a noticeable difference in adding a ground rod somewhere beneath the antenna.

Presently, my current antenna position is not ideal due to some downed trees in a recent storm, with only four metres of height at the shorter end and part of the longer line swaying over my roof. Still, the antenna works well across 80-40-20m, with a recent contact getting into Southern France on 7.130 MHz (though his antenna was probably bigger than mine). There are plenty of 4:1 balun instructions online you could follow to make your own.

This is one cheap antenna that'll definitely save you money over commercial wire antennas.

Photo 8: You can mount the feedpoint and balun as high as you can and slope the antenna wires downward. This is good if you don't quite have the space.

Photo 9: Kinking your antenna around a tree if there are space restrictions might give you some interesting take-off angles in the radiation pattern.

Spotless! Surviving solar minimum

Roger Harrison VK2ZRH

There is a plethora of chatter on social media, and on local contacts around the HF bands, that "DX is dead!" But perhaps the naysayers should heed the philosophy of the wily old fisherman – it depends on patience and where you fish.

Radio amateurs have been concerned with solar-terrestrial – Sun-Earth – relations since they were known as wireless experimenters, back at the beginning of the 20th century. Once amateurs began exploring what they could do at ever-higher frequencies, the leading DX exponents of the day took an interest in what affected propagation daily, seasonally and from year-to-year.

Parallel to these developments in amateur radio, the sciences of ionospheric physics and ionospheric radio propagation developed and those leading exponents of DX took a keen interest in what the scientists were thinking and doing. Indeed, some of those scientists held amateur licences! The tradition extends to present day.

Having an interest in how solar activity affects propagation, you can learn when and where there are opportunities to **have more fun on the air** and when to turn off the rig and do something else (for 6m enthusiasts, that means "if you dare"). Tales of past solar cycles and propagation abound; of sunspots and DX and "magic" contacts. The Sun and the solar cycles rule, from the HF bands through to even 432 MHz !

Our friend – old Sol

The Sun is an average beast – as stars go. To us, it's HUGE ! At 700,000 km, its radius is 100x that of the Earth. Its mass is 300,000 times that of this third rock from the Sun. And, it's a long way away: 149 million kilometers. Light from the Sun takes some 8 minutes and 20 seconds to reach us!

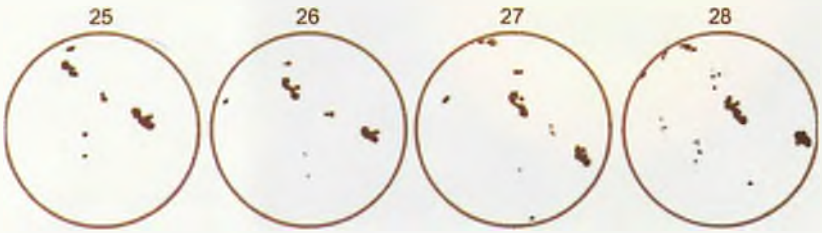


Figure 1: A sequence of sunspot drawings by Galileo, made over late June 1612, showing the motion of spots over the 25th to the 28th of the month. The Sun's rotation is immediately obvious (NASA).

The Sun is a continuous nuclear *fusion* reaction, converting hydrogen to helium. It produces light, heat, and energetic radiation over a wide spectrum. The part we see – the photosphere – is hot, close to 6000° Kelvin. The corona, which extends above the photosphere, reaches 1,000,000° Kelvin! Its enormous wideband electromagnetic radiation also takes some 8 minutes and 20 seconds to get here. Seen through a suitably equipped telescope, the Sun's 'surface' appears as a roiling mass of convection cells, plasma (ionised gases) and magnetic fields. It should come as no surprise that a lot is always happening beneath the surface we see (McNamara & Harrison, 1985).

Old Sol is our friend, because it creates the ionosphere. Extreme UV and X-ray radiation ionises portion of the thin, wispy upper atmosphere. Only some atoms and molecules succumb to ionisation, the rest remaining unaffected – the 'neutral atmosphere'.

A matter of spin

The Sun's rotation plays a big role in solar-terrestrial relations and thus ionospheric radio propagation. Galileo Galilei made the first systematic, daily observations of the Sun from 1610 over many years. He inspired other astronomers across Europe to maintain a constant watch on the Sun, triggering the compilation of a remarkable database of observations by a variety of observers, stretching from the 17th into the 19th century.

The Sun rotates. Not a surprise to us, but it was predicted by Galileo's contemporary, Johannes Kepler, a German astronomer and mathematician, best known for his laws of planetary motion. However, solar rotation seems to have been first recorded by Galileo – see Figure 1, showing images of Galileo's *actual* drawings!

The Sun's rotation varies, being faster at its equator and slower

SAFETY NOTICE

Do NOT view the Sun directly. You risk blindness. Make a simple solar viewer.
See: *www.jpl.nasa.gov/edu/learn/project/how-to-make-a-pinhole-camera/*
Or: *https://spaceweather.com/sunspots/doityourself.html*

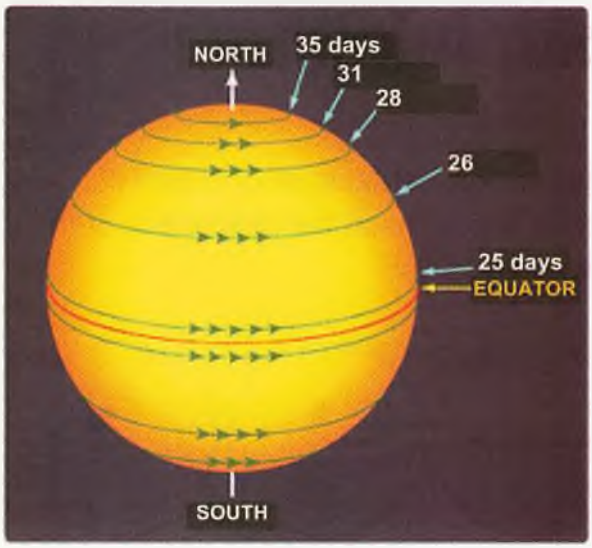


Figure 2: Being a ball of ionised gas (i.e. plasma), the Sun has differential rotation – faster near the equator, slower near the poles.

towards its poles, as illustrated in Figure 2. The average rotation is 27 days, ranging from about 25 days at its equatorial regions, to 35 days toward the poles. This differential rotation is the key to why the Sun has spots and a sunspot cycle.

Dude! Twisted and kinky

The Sun has strong polar magnetic fields. These are generated from circulating electric currents deep within its core of plasma (ionised gas), which is highly conductive and rotates with the Sun. From solar minimum, the polar field gets *pulled* into a toroidal field because of the Sun's differential rotation.

The toroidal field lines rise to the Sun's surface. Turbulence creates magnetic 'kinks' in the toroidal field lines, which develop into loops that 'pop' above the photosphere forming sunspots and sunspot regions. The number of sunspots and sunspot regions, and the area they cover, grow over a number of years, reaching a peak at solar maximum. The whole process takes an average of about 11 years. The sunspot cycle can range from 9 years for a short one, to around 14 years for a long one. All that twisted magnetic tension gets resolved by flipping the direction of the Sun's polar field – N becomes S, and vice versa. This happens at every alternate solar maximum, about every 22 years.

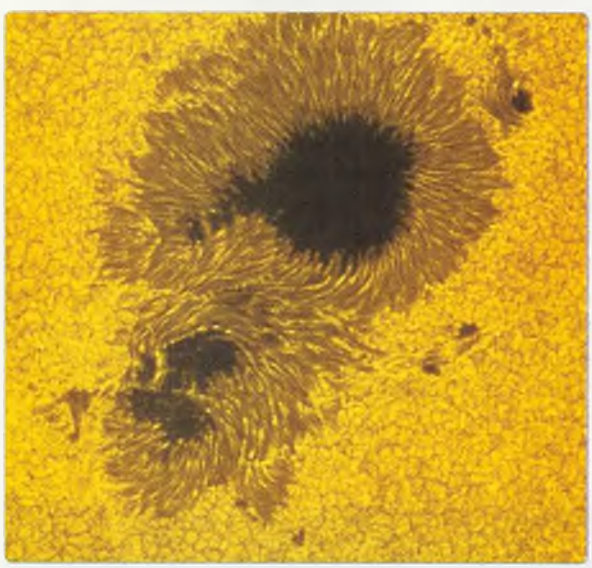


Photo A: Granular-like structure of the Sun's surface surrounding a pair of sunspots – the biggest is around 20,000 km across (visible light image from NASA's Solar Optical Telescope in Japan).

Just what are sunspots ?

Sunspots are dark patches against the bright surface of the visible sphere. They're dark because they're cooler than the photosphere. The spots are around 3000-4000° Kelvin; seen against the ~6000° of the photosphere. That's a big difference.

Individual spots, and spot groups, vary enormously in size. The diameter of 'typical' sunspots is greater than the Earth's diameter (which is 12,740 km). Spot groups can reach up to 150,000 km across! (McNamara & Harrison, 1985). Up close, sunspots look like the image in Photo A. The pattern of the 'penumbra' surrounding the spots indicates that they have strong magnetic fields, ranging from a few tens of gauss to more than 3500 gauss.

Sunspots aren't static. They change as the Sun rotates. For those that last long enough, they take about 13 or so days to cross the visible face of the Sun, and another 13+ days on the other side. If the spots are still there, they re-emerge around 27 days (plus/minus some days) after they were first seen. And so do their effects, which gives rise to the well-known 27-day cycle of geomagnetic disturbances. In general, the larger the sunspot group, the longer they last.

Sunspots up close and personal

An edge-on view of the photosphere and chromosphere reveals a seething soup of loops of magnetised plasma and spikey projections called spicules, as can be seen in the image at left in Figure 3. The chromosphere (literally, "colour sphere", as it's reddish) lies just above the photosphere and is about 2000 km thick. Being not so bright as the surface of the photosphere, the chromosphere can only be seen via telescopes fitted with special filters tuned to a particular spectral line. The spicules arise from convection cells in the plasma beneath.

The right hand diagram in Figure 3 illustrates what's going on. The magnetic field lines confine the myriad of free electrons, which spin relentlessly round the field lines in great spirals, generating electromagnetic radiation across a wide spectrum, from HF through microwaves to extreme UV and X-rays – the latter two creating the Earth's ionosphere. The wideband

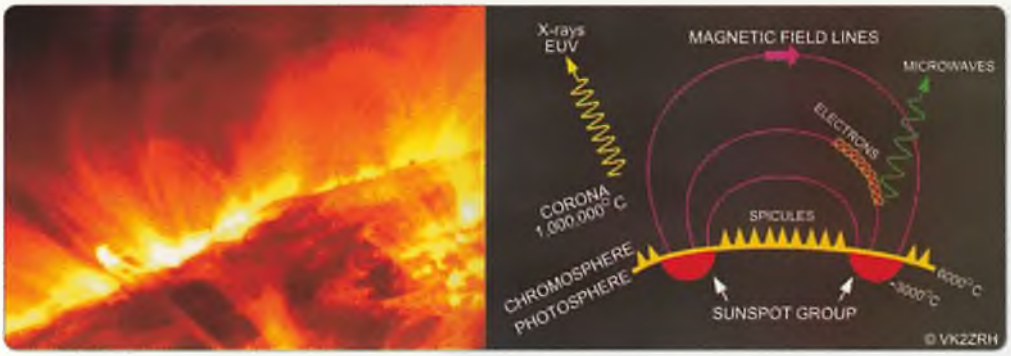


Figure 3: An edge-on view of the photosphere and chromosphere, at left, reveals a soup of loops of magnetised plasma and spikey little projections called spicules. The processes involved are illustrated at right.

electromagnetic noise can be heard on Earth with sensitive receivers – and is both a boon and a bane for moonbounce enthusiasts. Solar noise can be used as a distant 'source' to check and calibrate receiver-antenna systems, but it can limit system performance on other occasions. The strength (flux) of solar noise at a wavelength of 10.7 cm (2800 MHz) – the solar flux – is an important measure of solar activity.

And what is the sunspot number ?

Over the late 19th century, a Swiss astronomer and mathematician, one Johann Rudolf Wolf, encouraged other scientists across the world to take up systematic observations of the Sun and defined the way to measure sunspot activity – on which today's observations are based. He also reconstructed solar cycles back to Galileo's time, finding the average cycle to be around 11 years. Who'd have thought it?

Wolf devised the following equation:

$$R = 10G + S$$

R is the *relative sunspot number* (aka the 'Wolf' number).

G is the number of sunspot groups.

S is the number of individual spots visible.

This makes one group as important as 10 individual spots. If only a single spot is visible, R = 11, because one spot is regarded as one group. It's a statistical 'nicety', if you like. If there are three groups and 11 individual spots altogether, then:

$$R = (10 \times 3) + (11)$$
$$= 41$$

If there are no spots (we've seen weeks and weeks like that!), then R = 0. R has been observed to reach 250 (MacNamara and Harrison, 1987).

The daily and monthly sunspot numbers are collated, calculated and issued by the Solar Influences Data Center (SIDC) in Belgium (*http://sidc.oma.be*). SIDC calculates the relative sunspot number R, averaging the results from all observers – there are more than 60 around the world – using a modified version of Wolf's equation:

$$R = k(10G + S)$$

Each observing station is individually 'calibrated', with an 'observer factor' – k – that increases or decreases the value of R; k ranges between 0.4 and 1.7.

The method statistically 'evens-out' variability in the reported sunspot numbers (i.e. "nobody's perfect" !). The SSN issued is known as the International Sunspot Number, the ISN. It comes in several forms, but we won't go into all that here.

The sunspot cycle

Sunspot *cycles* are measured from minimum to minimum. In terms of the peak amplitude and the period, **every sunspot cycle is different!**

The mean period of sunspot cycles is 11.1 years, that's 133 months. The period has been as short as 105 months – almost 9 years – and as long as 168 months – 14 years! (MacNamara and Harrison, 1987). Cycle 20, when I had a lot of fun working the DX from Antarctica, lasted 140 months from minimum to minimum. The smoothed sunspot number (SSN) was above 100 from December 1967 through August 1970. You'd have to say that that was a pretty good run. Cycle 20 peaked in 1969 with a SSN of 110.8.

As the graph in Figure 4 here shows, the rise of a sunspot cycle is steeper than the decline. The average

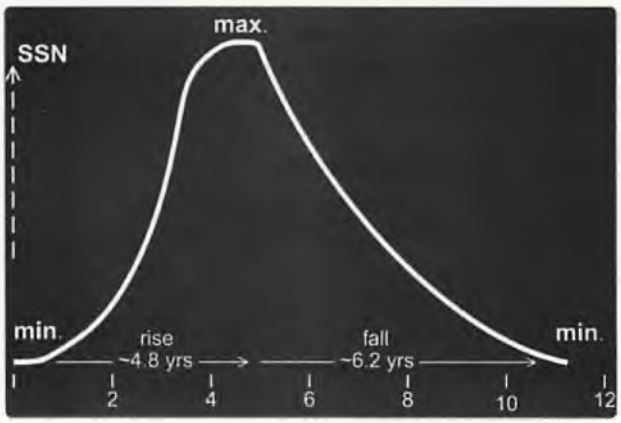


Figure 4: From minimum, the sunspot cycle rises fast to the peak, then declines slowly.

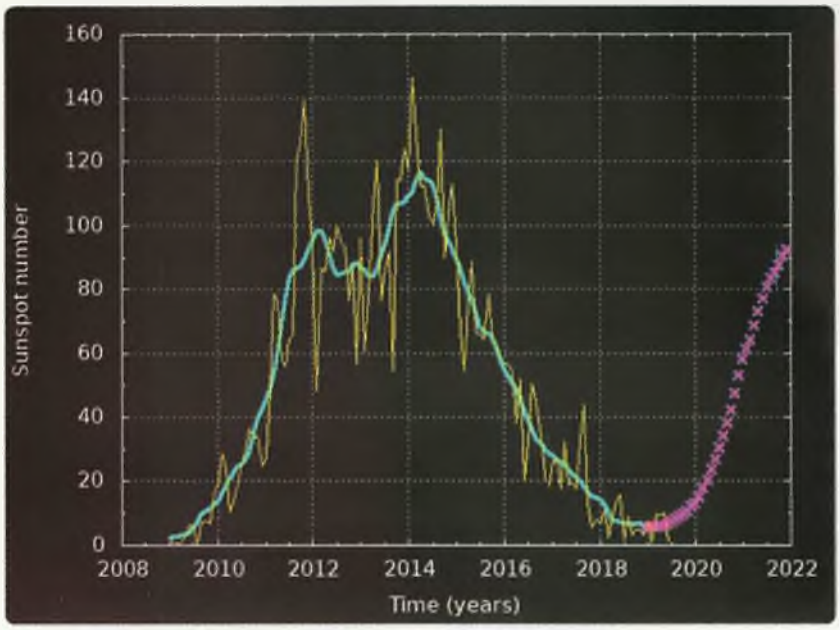


Figure 5: Pilgrim's progress - current solar cycle (No.24): the observed monthly sunspot number (thin yellow line), observed smoothed monthly sunspot number (thick turquoise line) and predicted smoothed monthly sunspot number (magenta crosses). From SWS.

period of the rise is around 4.8 years, and can be as short as 3 years. The average length of the decline is approximately 6.2 years, and can be longer than 7 years. For the mathematicians, the rise of a solar cycle is a cubic function – $f(x) = ax^3 + bx^2 + cx + d$ – while the decline is an exponential function, $y = e^{-x}$ (Hathaway 2008, MacNamara and Harrison, 1987).

As we're travelling through a minimum at present, the good news is that we're hurtling towards the coming peak!

Spotless days of despair

The Sun has been exhibiting weeks of consecutive spotless days over the past year or 18 months. The period from 14 November through 23 December last year was spotless week after week, for 40 days (almost six weeks!). It had many hams in despair. Indeed, it was one of the longest series of spotless days since the beginning of daily solar observations in 1849. It's up there with a period during the transition between solar cycle 22 and 23, when the Sun went spotless for 42 consecutive days from 13 September till 24 October 1996.

Keep your fingers cross that we don't experience something like the longest period recorded, which extended 140 days (nearly five months!), in the early 19th century(MacNamara and Harrison, 1987). Thankfully, that was before wireless, ham radio and all that stuff.

Are we there, yet? The 'official' minimum is determined from the long-term (13-month) smoothing of monthly sunspot numbers. We're not going to know when it occurred until months after the event. In the meantime, we guess. Like the kid who was always an optimist – finding a pile of horse manure in his backyard, he dug through it, exclaiming "I know there has gotta be a horse in here!"

When will we hit minimum?, is "the big question." Why does it loom so large; what's so important about when the minimum occurs? For us, the simple answer is – "pretty soon, the DX returns"! Actually, it marks the transition from least HF-VHF DX opportunities, to a growing number of them. In other words, more opportunities for fun on the air! Mind you, DXers keen on 160m-80m-40m have been currently exploiting the conditions favourable to the 'lower' bands.

Where are we headed?

Like a number of space weather and solar research agencies across the globe, Australia's Space Weather Services (SWS) keeps a 'running score' and what's happened with the solar cycle and provides forecasts of what they believe to be coming. Figure 5 shows a recent plot of the SSN and the forecast.

The double-hump of the past solar cycle results from the appearance of sunspots in each hemisphere of the Sun being out of

FLUX	CONDITIONS TO EXPECT
50-70	160-40m favourable; higher bands RS to poor
70-90	160-40m so-so to fair; higher bands RS to poor
90-120	Rising MUFs, 40-10m day; 160-80m ~ night is right
120-150	Improving MUFs & DX opportunities all bands to 6m
150-200	Excellent MUFs & DX opportunities all bands to 6m
200-300	**Pan-de-bloody-monium!**

Table 1. Reading the solar flux.

A/Ap	K/Kp	Means
0-3	0-1	Quiet. Enjoy the peace. Get on with it !
4	1	Quiet to unsettled. Get on with it, but be alert
7	2	Unsettled. Get on with it, but stay alert
15-27	3-4	Active. Uh oh! Don't panic. Watch the indices
48	5	Minor storm. Expect 20-10m to be poor
80	6	**Major** storm. Trouble + Strife opportunities !
132	7	**Severe** storm. HF RS ~ go Trouble + Strife
208-400	8-9	**Very** major storm. ***Panic now! (Go 2m/70cm)***

Table 2. What the A and K indices tell us.

phase. This has characterized every solar cycle since No.20 (1969-70). Note the 'spikiness' of the monthly SSNs. It is clear that we're presently 'bumping along the bottom' as we proceed through the solar minimum.

As the Pope entreated Michelangelo atop his scaffolding while painting the ceiling of the Sistine chapel: "When will you make an end?"

Watch the donut, not the hole

To get a sense of prospects week-by-week as Cycle 25 progresses and we coast out of the minimum, keep an eye on the 10.7 cm flux (F10.7) not the SSN. As the sunspot activity increases, F10.7 rises – albeit with some variability. Solar flares facing in Earth's direction boost flux numbers and upper-HF and VHF propagation prospects for a day or so immediately following the flare, after which geomagnetic disturbances tend to trash ionospheric conditions. To parody the chorus from an old music hall song: "It's the flux wot brings the pleasure and the flares wot brings the pain".

Table 1 provides a convenient guide to propagation opportunities versus the 10.7 cm flux.

A guide to band conditions day-to-day can be gleaned from the geomagnetic A and K indices, in Table 2 (Pool, 2002).

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- McNamara, L.F. and Harrison, R. 1985, Radio Communicators' Guide to the Ionosphere, Australian Electronics Monthly, October pp 100-106.
- McNamara, L.F. and Harrison, R. 1987, Kiss your last big solar maximum goodbye!, Amateur Radio magazine, January, pp 14-17.
- Hathaway, D.H. 2008, Solar Activity Cycles Past and Future, Solar Activity during the Onset of Solar Cycle 24 meeting, Dec 8-12, Napa, California USA.
- Poole, I. G3YWX, 2002, Understanding Solar Indices, QST, September.

www.arrl.org/files/file/Technology/tis/info/pdf/0209038.pdf

Resources

- Basic Concepts K9LA *http://k9la.us/html/basic_concepts.html*
- The quiet Sun is much more active than we thought: *www.sciencedaily.com/releases/2020/08/200804111457.htm*
- Follow the solar cycle *www.swpc.noaa.gov/products/solar-cycle-progression*

  www.swpc.noaa.gov/communities/space-weather-enthusiasts

- Monthly sunspot numbers *www.sws.bom.gov.au/Solar/1/6*
- The solar cycle *www.sws.bom.gov.au/Educational/2/3*

- Graphs of historical solar cycles *www.sws.bom.gov.au/Educational/2/3/1*

Australian digital voice mode cracks DX on the 20m band

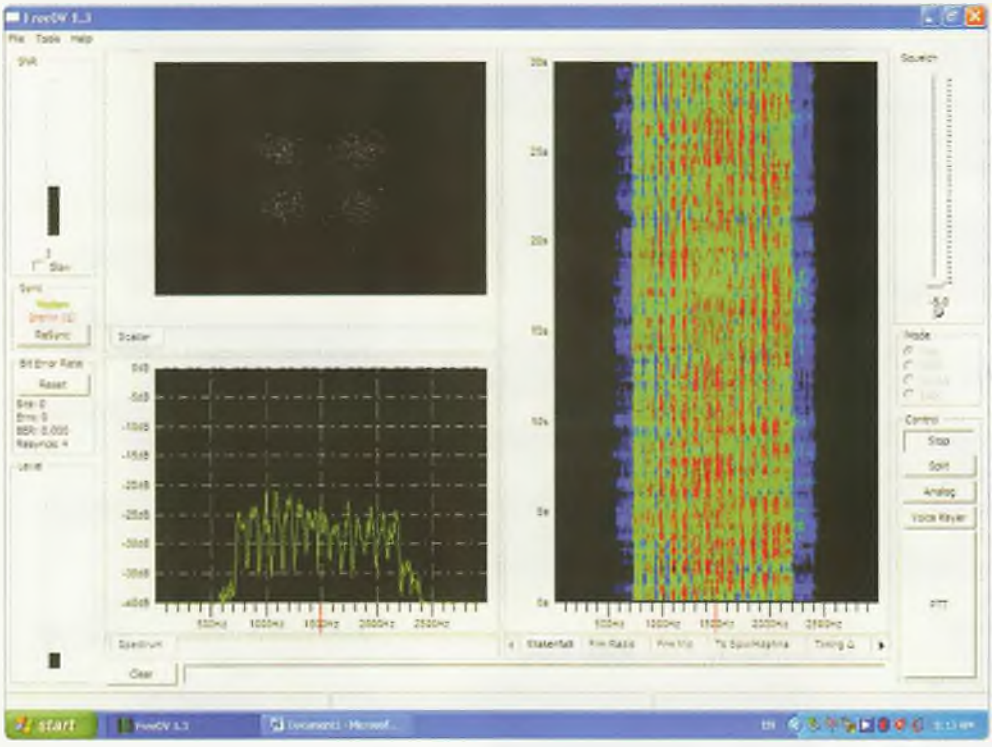
Peter Wolfenden VK3RV and David Rowe VK5DGR

Once, single sideband (SSB) was 'the way of the future'. That future has come and gone. Now, the colloquial slogan is 'digital is the way of the future'. But most amateurs take digital to mean computer code, derived from a PC keyboard. Terms like JT65, PSK31 and FT8 are bandied about with abandon. No more! The 'natural' way people communicate is by speaking. Digital voice communications is now within reach of every Australian amateur, without needing buckets of money or an IT degree.

While many amateurs are complaining about 'poor conditions' and that the sunspot count is running at zero, or near enough to it, things are still happening. To add to the current situation, our normally reliable 'near vertical incidence skywave (NVIS) contacts on 40m are few and far between these days, which seems to have put a dampener on a number of amateur activities.

However, if you are around at the 'right time' and located in the 'right place', it is possible to have some interesting and at times long-range contacts, even when making use of some of the more unusual modes such as ***Free Digital Voice*** (FreeDV), with which David VK5DGR had a lot of input, particularly the codecs (digital compression and decompression) – hence the Australian connection.

Yes, I know about FT8 and its relatives, but I like a real "conversation" with someone



Reception at VK3RV of the 700C mode signal on 20m from LU5DKI over a polar path – very weak, but quite readable.

actually at the other end, hence my interest in FreeDV. That's not to say that there aren't good applications for FT8 etc, especially with the increasing man-made residential RF noise levels which most of us have to contend with.

This short article is aimed at seeking to encourage more VK and ZL stations to have a crack at some 20m FreeDV DX contacts. Perhaps we can even encourage amateurs in other countries to try FreeDV and generate further opportunities for DX. You can get more information and download the software from: *freedv.org*

The current scene

Most FreeDV activity in Australia up until a year or so ago usually revolved around 40m, and in particular, the AREG (Amateur Radio Experimenter's Group in SA) relay of the WIA Sunday broadcast through VK5ARG on 7177 kHz at 10.30 am EST. This broadcast gave everyone an opportunity to test their equipment on a known transmission and then attempt calling back to the VK5ARG control station.
Some 70 Australian stations have been active on FreeDV during this time, over the past few years.

Even if the broadcast faded out in a given area, there were often local groups would pop up and continue to communicate locally using FreeDV. Poor conditions, in particular no NVIS, brought this to an end, resulting in little FreeDV activity on 40m.

But here is the good news, and it is largely initiated from outside of Australia, spurred on by a couple of very keen overseas amateurs and David VK5DGR.

Of DX and SDRs

On Christmas Eve 2019, Klaus 4E1ADW, operating from Tagytay Philippines, was heard testing and calling CQ on 14.236 MHz using the 700D FreeDV mode (which occupies only 1.6 kHz bandwidth). At times, he had a very good signal into VK3 and VK5. Over the next few days, he was worked by Graeme VK3NE, Dieter VK3FFB, Peter VK5APR, and Peter VK3RV/5 near Murray Bridge in South Australia.

Hopefully, there were others, as an attempt was made to pass the word around about Klaus. He was worked each night in VK until he returned to his present home base in Singapore on 29 December, where, unfortunately a poor radio location with only a couple of short wire antennas for the higher HF, bands restricts his operation.

However, the result of this contact with Klaus was the passing-on of information relating to the use of remote software defined radio (SDR) receivers for testing long-distance paths with FreeDV. In particular, Klaus referred to those being employed by Jose LU5DKI in Coronel Pringles, Argentina. Mark VK5QI and David VK5DGR began using remotely-located SDRs for testing long paths and 700D FreeDV some years ago. Recently, David has been experimenting with Jose on FreeDV using the SDR "reflector" approach.

On 18 January this year, Jose's direct encoded FreeDV signal was heard intermittently on 14.236 MHz in Melbourne. As the night wore on, decoded words were clearly heard, but a deal of confusion took place because it was not initially apparent as to what was actually going on at the time with the intermittent nature of the transmissions from LU5DKI. As it transpired, Jose and David were working via the kiwiSDR, Northland in New Zealand.

Remote SDRs are used by many VKs with various modes and are very handy when 'normal', or expected, propagation conditions have failed. By using the appropriate web-based 'reflectors',

it is possible to continue a failing direct path contact, provided both ends of the QSO can 'get into' a particular remote SDR. So it is necessary to 'dig around a bit' for the most satisfactory remote SDR for your transmission circuit.

The long and short of all of this, is that Peter heard Jose calling "Peter VK3RV" and the word "ARGENTINA", was clearly displayed in his FreeDV Text Bar briefly. Later, Jose was heard to say "I'm hearing you perfectly Peter"! How could this be? His signal was largely at my noise floor, and when I did hear him, his signal was weak and fluttering with heavy QSB, and only decoded occasionally. It then dawned on me (in my ignorance at that time) that Jose was hearing my signal via the NZ Northland SDR, but I was trying to have a contact with him via a direct South Pole route, with the all the issues which can arise on that path! Great confusion indeed.

A flurry of emails subsequently ensued, which culminated in a good two-way contact between us, using the Northland SDR as a 'reflector' a few days later. Jose's signal traveled over 10,000 km and mine about 2600 km. The direct path between us is about 11,200 km and the de-coded SDR signal was almost perfect with good quality audio being recovered at both ends.

But there is the "sting in the tail" of this story. Part way through that first SDR-based contact, I passed my head-set over to Jenny VK3WQ, who called and had a good contact with Jose under her own callsign. He was in raptures! Working his first YL on FreeDV, encouraged him even further to say that her voice was far better than mine on the mode! And then, at the finish of the contact, suggesting that I should hand the control of my station over to her! Much hilarity ensued. Of course, this 'better transmission' was *only* due to the band conditions which *obviously* peaked at the time that Jenny had her contact that night! Well, that's Peter's version of the story anyway!

A few days later, an older mode of David's FreeDV software, 700C was tried – with great success! Tests switching between both 700D and 700C over a number of nights revealed consistently that the 700C FreeDV mode performed better over the direct 11,200 km path.

Discovering that the earlier 700C mode worked better than 700D for the polar path was quite a surprise! We believe this is due to 700C working better on channels with fast fading, as long as the signal-to-noise ratio (SNR) is relatively high. The 700D mode has powerful Forward Error Correction (FEC) and is designed to work better on low SNR paths, where the fading is moderate. These experiments can help us choose the best features to include in future *FreeDV* modes.

You just never know what is 'around the corner' with some amateur radio endeavors!

A good direct, two-way contact with Jose still has to take place. So those of you with 400 watts, a beam antenna and FreeDV software, or one of David's SM1000 interfaces, programmed for the 700D mode, have a look for LU5DKI on or about 14.236 or 14.240 MHz at around 1000 UTC. Jose is keen to try all modes, including 1600 and 2020.

Another approach is to organise a decoder using Virtual Audio Cable connections within your computer between the on-line SDR's output and the free, down-loadable FreeDV software, which will then enable you to decode any of the FreeDV signals. It will make the journey to Argentina (or other distant countries) a little easier. It will also help those with high local noise levels.

Hopefully, Jose will have a direct two-way QSO with VK soon (if not already).

Postscript

(a) It was an Argentinian amateur, Carloss Braggio CB8, who in May 1924, contacted Ivan O'Meara 2AC in New Zealand, over a distance of about 10,300 km. That contact on about 120m helped pave the way for long distance, low powered, international shortwave communications.

(b) The station at VK3RV is quite basic, an IC7300 modulated by a GUI version of FreeDV. Power is about 40 watts and the antenna is a ZS6BKW wire antenna with a good take-off in the ZL direction.

Homebrew HF Transceiver project

Part 2 Transmitter Fourth article

Luigi Destefano VK3AQZ

As advised previously, this project is being published over six editions of the magazine. This article completes the description of the transmitter, which began last issue. In following editions, the VFO system, construction and testing procedures will be covered.

Part 2H Transmitter low pass filters

The circuit of the low-pass filters is shown in **Figure 24** and the component values in **Table 4**. SVC filter design was used to calculate the component values (**REF. 8**). These filters, with the f_{co} listed in the table, predict third harmonic attenuation ranging from -60 dB for the 80 metre band, to -70 dB, for most of the others. In practice, these figures are not always attainable due to leakage around the filter. In my filter unit, the third harmonic attenuation is still pretty good.

There are eight filters used to cover the 10 amateur bands. One filter covers the 17 metre and 15 metre bands, while another filter covers the 12 metre and 10 metre bands. The remaining bands have one filter each. The filters are activated by the VFO logic for the band in use. Both VFOs can activate the appropriate filter for the band the VFO is tuned to.

The individual filters are 7-pole, Chebyshev, 0.2 dB ripple, designs. Ten amp, 12 volt, SPDT Relays switch the input and outputs. The relays are driven by 2N2222 buffer transistors, and an LED lights up on the activated relay. Initially, the relay voltages came directly from the switching lines feeding other circuitry. However, RF was leaking back down the cable bundle and causing problems. Ferrite clamps, beads, and bypassing were only partially effective. I then isolated the control lines to the filters using the transistor buffers and that cured the problem.

There are four filters on two printed circuit boards stacked and mounted on the outside of the rear panel with a shielded cover. Small SMA connectors and coax cable connect the filter unit to the PA, and to the antenna, via an SWR-and-ALC module. One thing to watch out for is the current carrying capacity of any thin coax used with the SMA connectors. Some of these cables have a centre conductor which has

Software relay	Filter	BAND	FREQ. MHz	2nd Harmonic	Filter components										
			MHz	MHz	Fco	C1,C4	C2,C3	L1,L3	Turns#	Turns*	L2	Turns#	Turns*	Wire	core
1	A		0.1-1.0	NO TRANSMIT IN THIS BAND											
2	B	160m	1.0 -2.0	4	2.3	1899	3149	4.76	29	29	5.2	30	30	0.5mm	T68-2
3	C	80m	2.0-4.0	8	5.2	820	1300	2.1	19	19	2.3	20	20		T68-2
4	D	40m	4.0-8.0	16	8.9	491	814	1.2	16	15	1.34	17	16		T50-2
5	E	30m	10.1	20.2	12.9	339	562	851n	14	12	926n	15	14		T50-2
6A	F1	20m	14	28	18.3	238	395	598n	12	11	651n	13	11		T50-2
6B	F2	17m	18.068												
7A	G1	15m	21	41	27.5	159	263	398n	10	8	434n	11	9	0.7mm	T50-2
7B	G2	12m	24.89												
7C	G3	10m	28-30	60	32	138	229	347n	9	7	377n	10	7	0.7mm	T50-6
8	H	6m	50-54	108	66	66	110	167n	8	see below	182n	10	see below		AIR

All capacitors should be 500 volt rating for 100W PA.
NOTE: Turns* = for actual measured inductance
Turns # = Turns as calciulated from equations

167nH L1,3 for 6m band are airwound: 13mm long, 6mm dia. 0.7mm wire.
182nH L2 for 6m band is airwound: 17mm long, 6mm dia, 0.7mm wire.
Check actual inductance on a meter for accuracy.

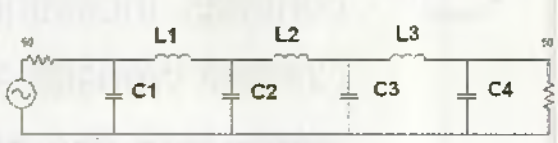


Table 4: Transmitter low pass filter details Chebyshev 0.2 dB ripple.

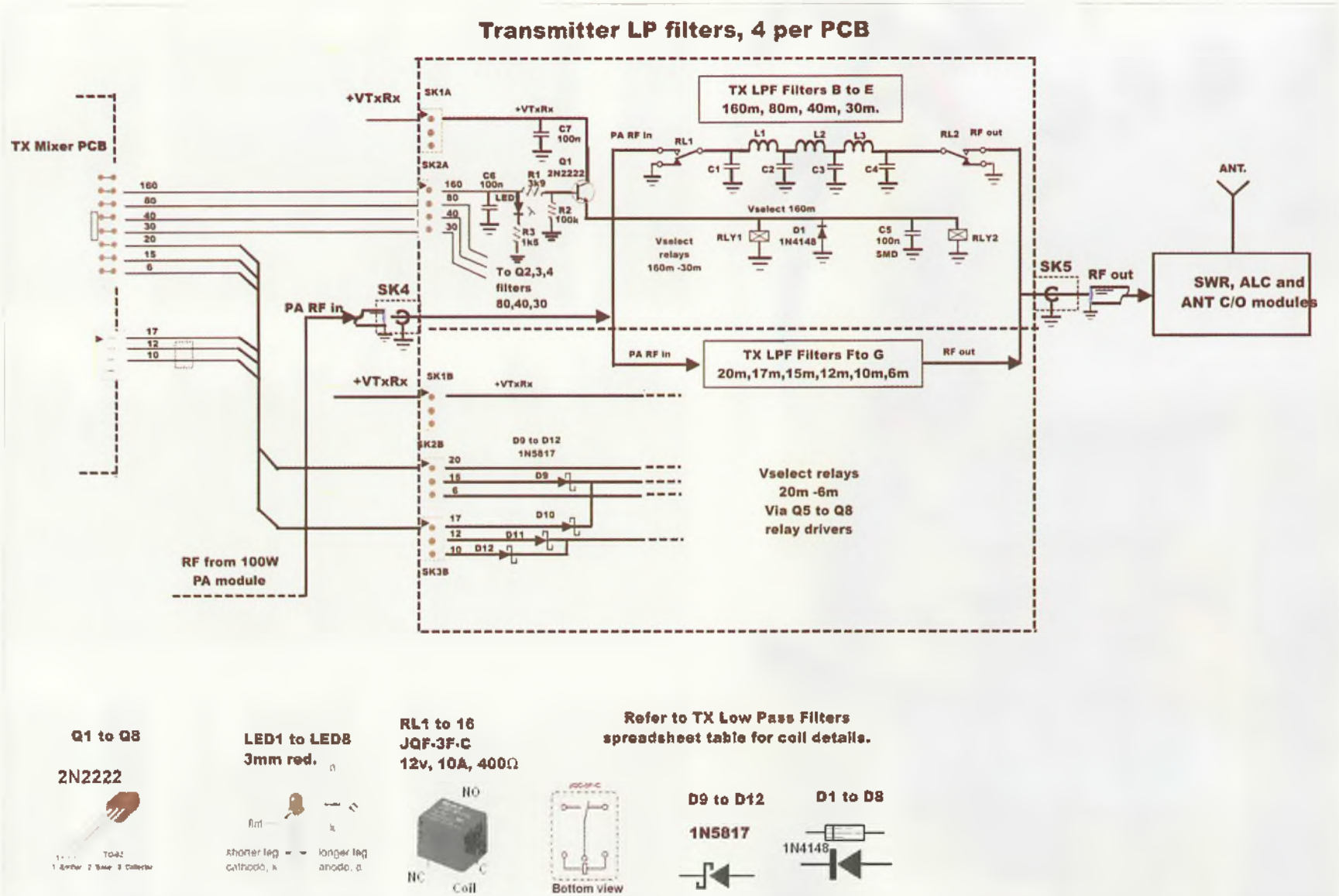


Figure 24: The transmitter low-pass filters are selected by relays, with individual relay drivers. The parts lists are at the end of this article, on page 23.

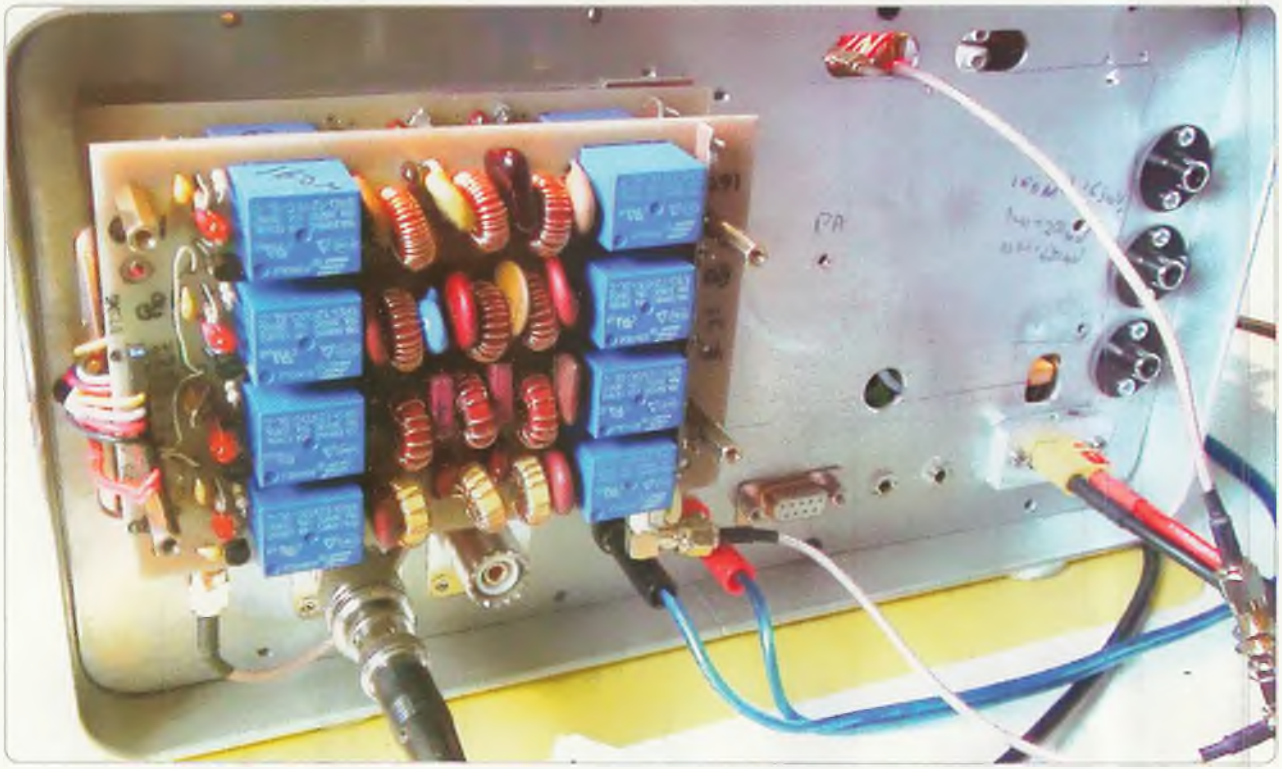


Photo 2H: The transmitter low-pass filter PC boards are stacked and mounted to a back panel at the transceiver's rear.

limited RF current carrying capacity.

A 100 W RF signal across 50 ohms has approximately 200 volts peak-to-peak across the load and drives a current of around 1.4 amps RMS through it. The peak current can reach 4 A. Some thin cables are only rated at around 2A. So, one needs to be mindful of the current carrying capacity of SMA connectors and associated thin coax cable when running 100 W of power.

The figures above are for a resistive 50 ohm load. Open or short circuits can produce considerably more voltage or current resulting in the SMA connectors and cable being damaged. **Photo 2H** shows the transmit low-pass filters mounted on the back panel prior to mounting the 100 W PA.

SWR, ALC, Antenna change over, and receive attenuator module

This module is placed between the antenna and the remainder of the transceiver. **Figure 25** shows the circuit. On receive, the antenna signal is passed onto the receiver tuned circuits via RLY1. On transmit, the 12 V transmit voltage activates the relay and connects the antenna to the output of the transmit low-pass filters. The module also contains a 20 dB pad in the receive path which can be switched in or out by RLY2 activated by the three-position 'Attn/Off/Preamp 1 on' switch. On transmit, RLY2 is also activated and switches the attenuator pad into the receiver feed to help reduce any remaining RF getting into the receiver front end.

Transmit RF power is sampled by a Stockton-type SWR bridge. The bridge is used to sense forward and reflected power. Frequency response is reasonably flat over most of the HF range. The forward power output is also used to generate an ALC voltage. The reflected power is used to reduce transmitter drive as the SWR increases. Both voltages are fed to the meter switch. **Photo 2I** shows the Stockton bridge. After this photo was taken, an XH 2 pin connector was added with FWD and REV power outputs feeding the ALC and SWR control unit.

ALC and SWR control unit

The SWR and forward power voltages feed the ALC and SWR control unit. The circuit is shown in **Figure 26**. It consists of an LM3900 quad Norton amp. The design is similar to one published in the RSGB handbook as part of the HF transceiver described by G3TSO. There are a few minor changes that were necessary to stop the unit oscillating under certain drive conditions. These included the addition of AC feedback for IC1a and IC1b using 100nF capacitors, as well as some changes in the overall loop gain, and some voltage limiting diodes.

The forward power detector output, labelled 'ALC forward voltage', feeds IC1b via R5 and C5, whose time constant provides a delay to prevent ALC pumping on SSB speech. IC1b has a reference

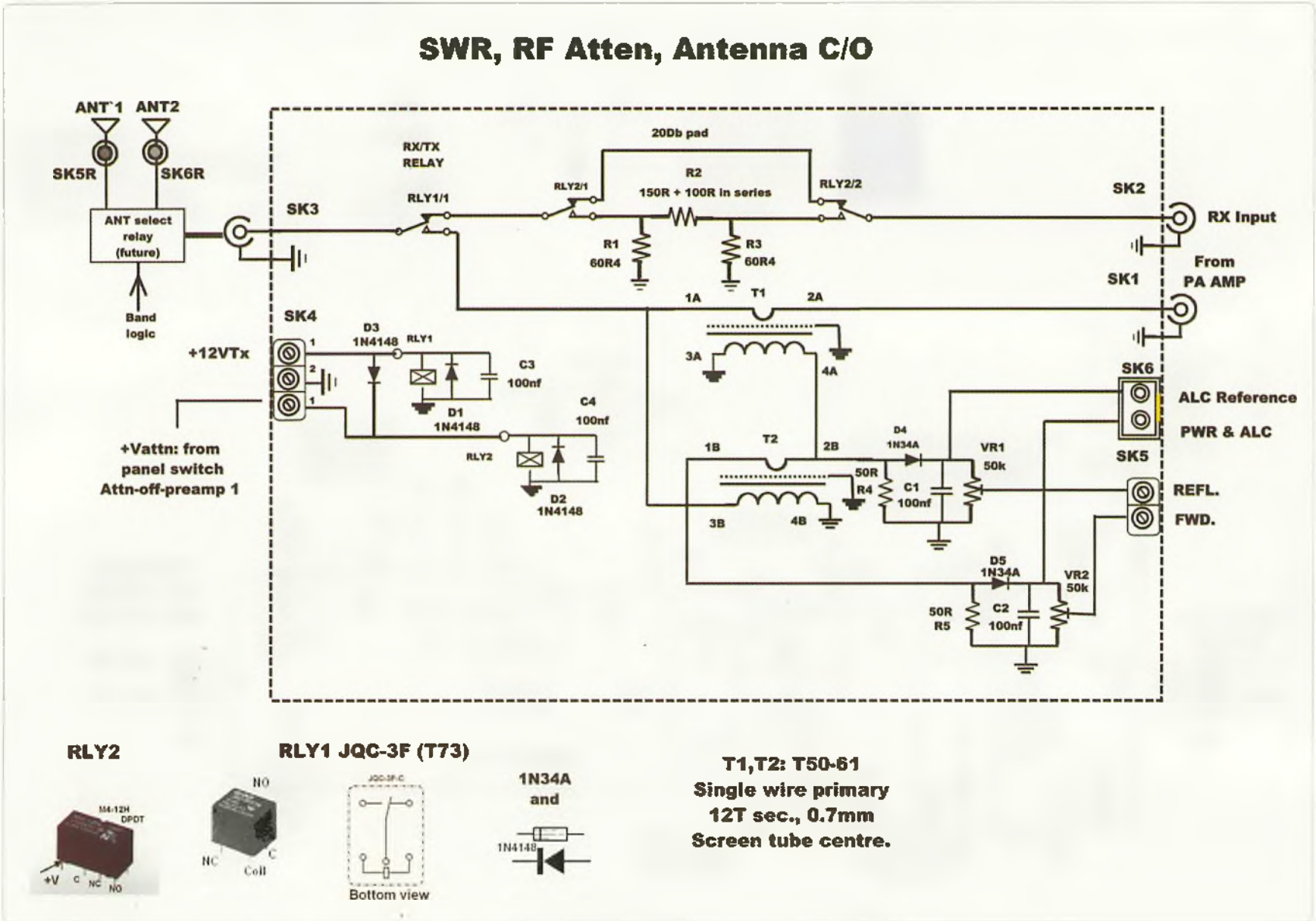


Figure 25: Transformers T1 and T2 are wideband toroidal assemblies that comprise the Stockton Bridge RF power and SWR sampling for metering and ALC operation. See Photo 2I on page 19 (overleaf). The parts list is at the end of this article, on page 23.

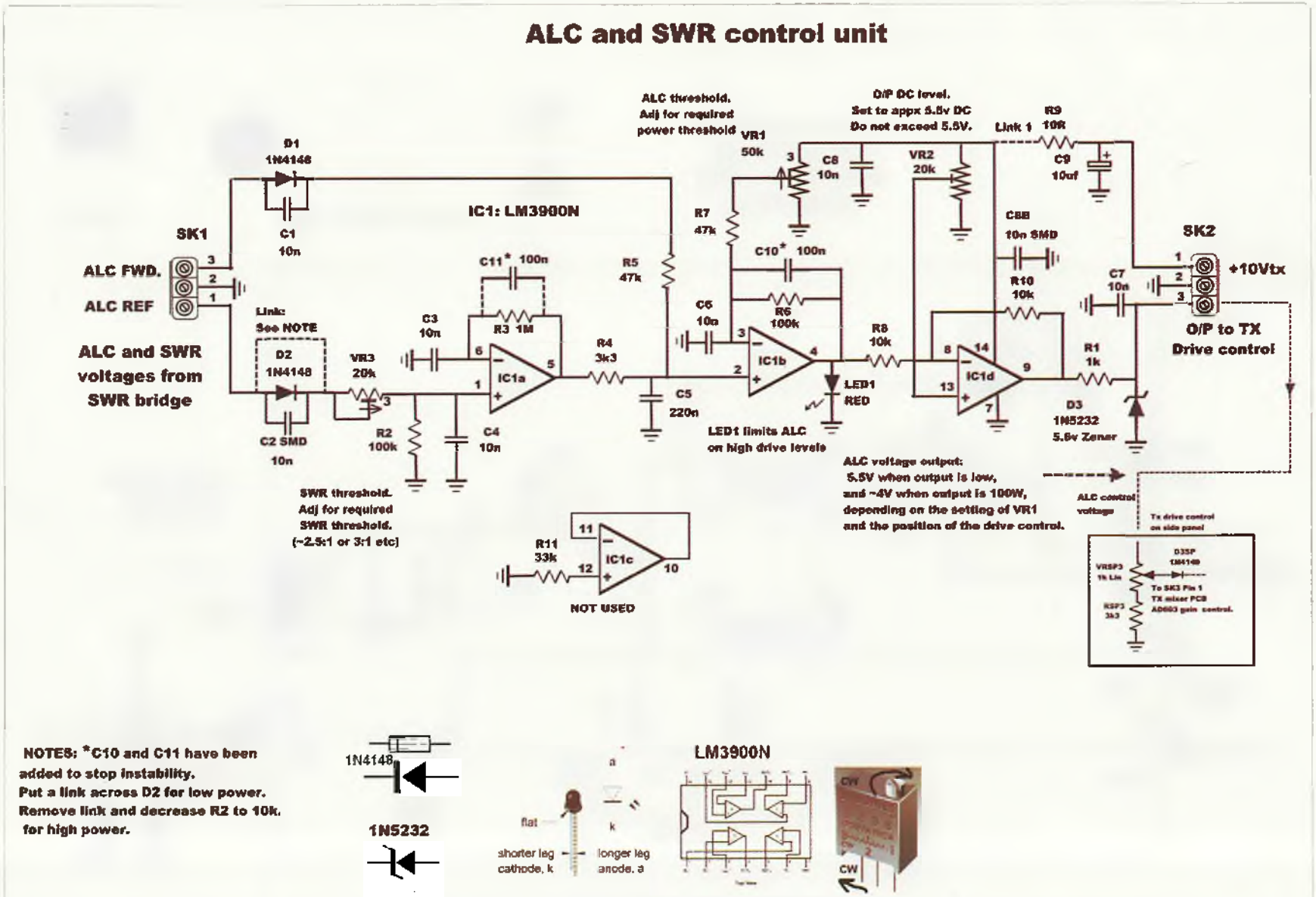


Figure 26: The quad op-amp IC1 (LM3900N) controls the transmitter PA via the ALC output, determined by both the RF drive and detected SWR of the load. See Photo 2J. The parts list is at the end of this article, on page 23.

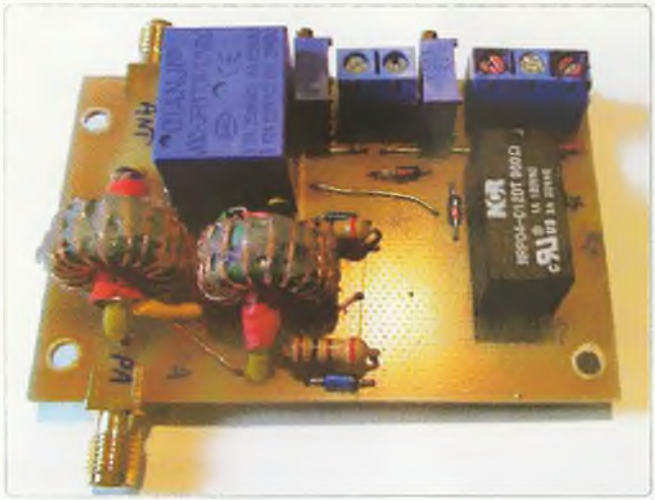


Photo 21: The Stockton Bridge components dominate the lower left of the SWR, RF attenuator and antenna changeover PC board; the circuit is Figure 25.

voltage on the inverting input, which is varied by VR1 and sets the threshold for the start of ALC action. If the forward power voltage exceeds the threshold, IC1d output acts on the AD603 in the transmitter chain to reduce the power and limit it to the value determined by the threshold adjustment. The output of the control unit actually goes to the top of the manual drive control. The amount of ALC feedback therefore varies with the setting of the drive control. The greater the setting of the drive control, the greater the ALC action. So the ALC control unit works in conjunction with the manual control.

When adjusting the ALC threshold, some degree of understanding of the action of the ALC loop is important. Note that the resulting feedback loop has the potential to oscillate, so the overall gain and time delays need to be such as to prevent this happening. Also, to prevent the AD603 going into the "hockey stick" mode, RSP3 in the bottom leg of the drive control, prevents the control voltage to the AD603 going too low, and causing the drive to increase, instead. Zener diode D3 limits the maximum positive voltage to just above 5.6 volts. A red LED across the output of IC1b limits the maximum voltage going to IC1d to around 2 V. This, in turn, keeps the ALC control voltage going to the AD603 from going down to near zero.

This was necessary to overcome some unusual behaviour of IC1d, which caused its output to suddenly fall to near zero sending the RF drive to maximum. It seems to be something to do with the current-driven mode of operation of Norton amplifiers. A quick lash up with a voltage-driven operational amplifier did not suffer this problem. Adding LED1 fixed the problem, but I am not 100% sure what the real cause of the problem was.

This unit also controls the RF drive when the SWR exceeds a preset amount. The output of the SWR detector feeds IC1b via amplifier IC1a. The time constant in this case is faster, and if the voltage exceeds the threshold, the power will be reduced fast enough to protect the power amplifier.

The SWR level at which the drive is reduced is adjusted with VR3. This can be set by feeding the transmitter into a load which is not 50 ohms. One way of producing an SWR of 2:1, is to put two 50 ohm dummy loads in parallel. However that may stress the power amplifier. You can also use an antenna tuning unit, which is adjusted using an in-line power meter to produce a known SWR. And you can also cause an SWR by putting a load higher than 50 ohms across the transmitter output, which might cause less stress to the PA. One further method is to feed a DC voltage to the SWR input terminal of the control unit, which is identical to that produced by the SWR detector with a real SWR amount. For example, I measured the bridge output voltage at 0.73 volts for an SWR of 2:1 with a forward transmit power of 50 W.

Table 5 and **Table 6** list my measured detector voltages for different power levels, and also the SWR voltages with a fixed SWR of 2:1, at three power levels. You may not see these same voltages as it depends on the construction and number of turns of the RF transformers, and the diode types used in the Stockton bridge. The measured response of the Stockton bridge was pretty flat from 1.8 MHz to 54 MHz. As an example, at a power level of 4 W, the output at 1.8 MHz was 380 mV, at 21.25 MHz is

At input to the ALC, SWR control circuit

Power output W	ALC FWD voltage	SWR 2:1 voltage
5	1.8	
10	2.37	0.3
20	3	
40	4	
50	4.9	0.73
80	5.2	
100	5.7	
120	6.2	0.8

Table 5: ALC and SWR detector voltage readings.

Pin	No RF out	100W out
ALC FWD	0v	6.2v
Pin 2	0.57v	0.626v
PIN 3	0.631v	0.572v
Pin 4	0.132v	1.3v
Pin 9	5.5v	4.34v

Table 6: LM3900 IC1b voltages.

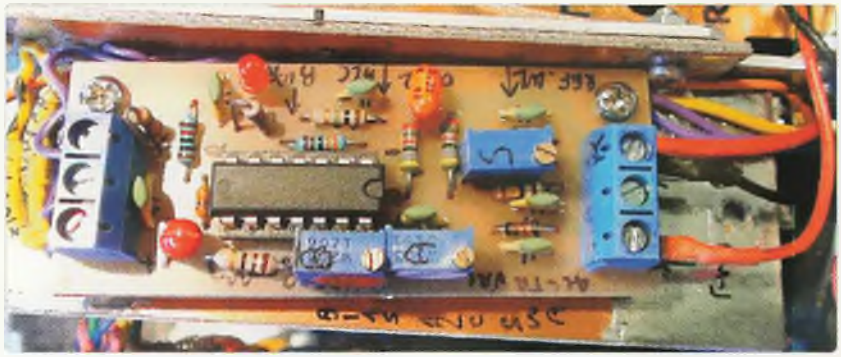


Photo 2J: The ALC and SWR control unit PC board (Figure 26) is small and crowded, but does a big job!

was at its minimum of 340 mV, and at 51.1 MHz it was 400 mV. A similar frequency response was obtained at other power levels. **Photo 2J** shows the ALC and SWR control board.

Part 2K The meter unit

The circuit of the meter unit is shown in **Figure 27**. I am using an analogue movement in this transceiver at present as it is quite straight forward to set up. The scale was taken from the web and most of it is okay. The S meter scale really needs to be calibrated for my rig using an accurate signal source. However, I intend to add an AD8307 log linear detector as a signal strength indicator.

The AD8307 has a wide range of around 90 dB, and can be programmed to provide signal strengths in dB. It would need to sample receive signal levels in some part of the radio that can be independent of the AGC action. Most likely, this would be part of a future frequency analyser and waterfall display section using the second VFO and additional receiver sections. That is a future project, so for now the analogue meter will be good enough.

The meter switch selects signal strength, ALC, forward and reverse power, and an indication of microphone audio compression. Each of these signals can be trimmed to suit the meter sensitivity. The signal strength is derived from the AGC line. Because the AGC line voltage does not reach zero with no signal, the negative terminal of the meter goes to a small adjustable regulator which provides an offset so the meter will read zero with no signal. On transmit, the negative terminal of the meter goes to earth.

On receive, the meter needle is set to S9 on the scale for an RF input signal strength of -73 dBm, which is 50 uVrms at the antenna terminal. For accuracy, the receiver input impedance should be 50 ohm non-reactive. This would be measured with all preamps turned on if that is the most often configuration used. Otherwise, maybe with just one preamp on. The rest of the scale depends very much on the overall closed loop transfer function of the AGC and receiver stage gains.

On transmit, the meter can be switched to measure RF power or any of the other signals. If the meter is switched to the S meter position, a reduced sample of the RF forward power is fed to the meter via diode D3 when transmit is initiated. One could pick any of the other signals but the RF power gives an indication that there is RF going out with the meter in the S meter position. Without this sample, the meter would read zero on transmit unless it was switched to the RF power position. If the meter is switched to any of the other positions, it will always read signal strength on receive due to RLY1.

The meter panel also has a number of LED indicators above the meter. There are three orange LEDS for receive illumination, a red LED for incorrect DC input polarity, a green LED for correct input DC polarity, and a blue LED which lights up on transmit. There is also a spare red LED that is there in case I need some other function monitored (i.e. maybe a fault condition).

The ALC, and compression signals are further processed on the meter PCB. The circuit of the two stages is shown in **Figure 28**, and as an inset in **Figure 27**. The audio signal from the compressor IC is amplified by IC1a and rectified by D4 and stored on C5. The average level of audio is fed to the meter. With more compression, the average level of the signal increases, and the meter reads higher. The ALC voltage feeds IC1b and can be adjusted with VR3. The ALC voltage can be several volts, so a blue LED is used to drop the level. Using an LED has the added advantage that it lights up when there is a high level of ALC action.

Figure 28 also has the circuit of the meter buffer amplifiers for forward and reverse power. It was found that switching the meter across the forward or reverse outputs of the Stockton bridge, caused a change in the signals going to the ALC and SWR control circuit. The loading effect of the meter was significant, so these buffer stages were added. This also allowed the forward and reflected voltage levels to match the meter sensitivity using the trimpot on the buffer amplifier outputs. These two buffers are mounted inside the case at the rear, and not far from the Stockton bridge, with the trimpots accessible through some holes on the rear panel.

References

These are listed in-full at the end of the 2nd article, on p.16 of Issue 1, 2020.

8. The transmitter low-pass filters were designed using SVC Filter Design, by James L. Tonne, W4ENE. See: *www.tonnesoftware.com/*

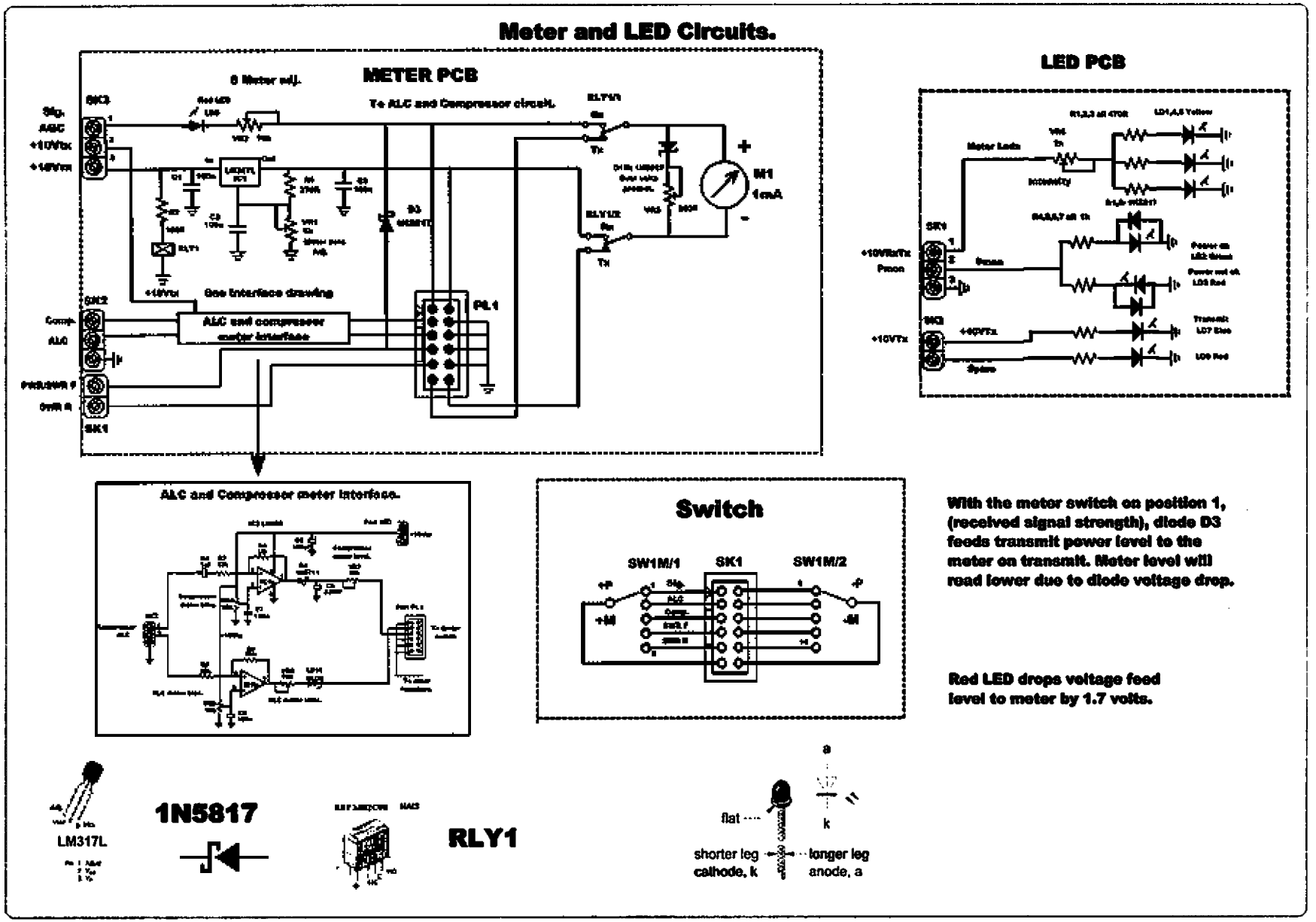


Figure 27: This wraps-up some of the adjunct circuitry, in conjunction with Figure 28. The parts list is on page 23.

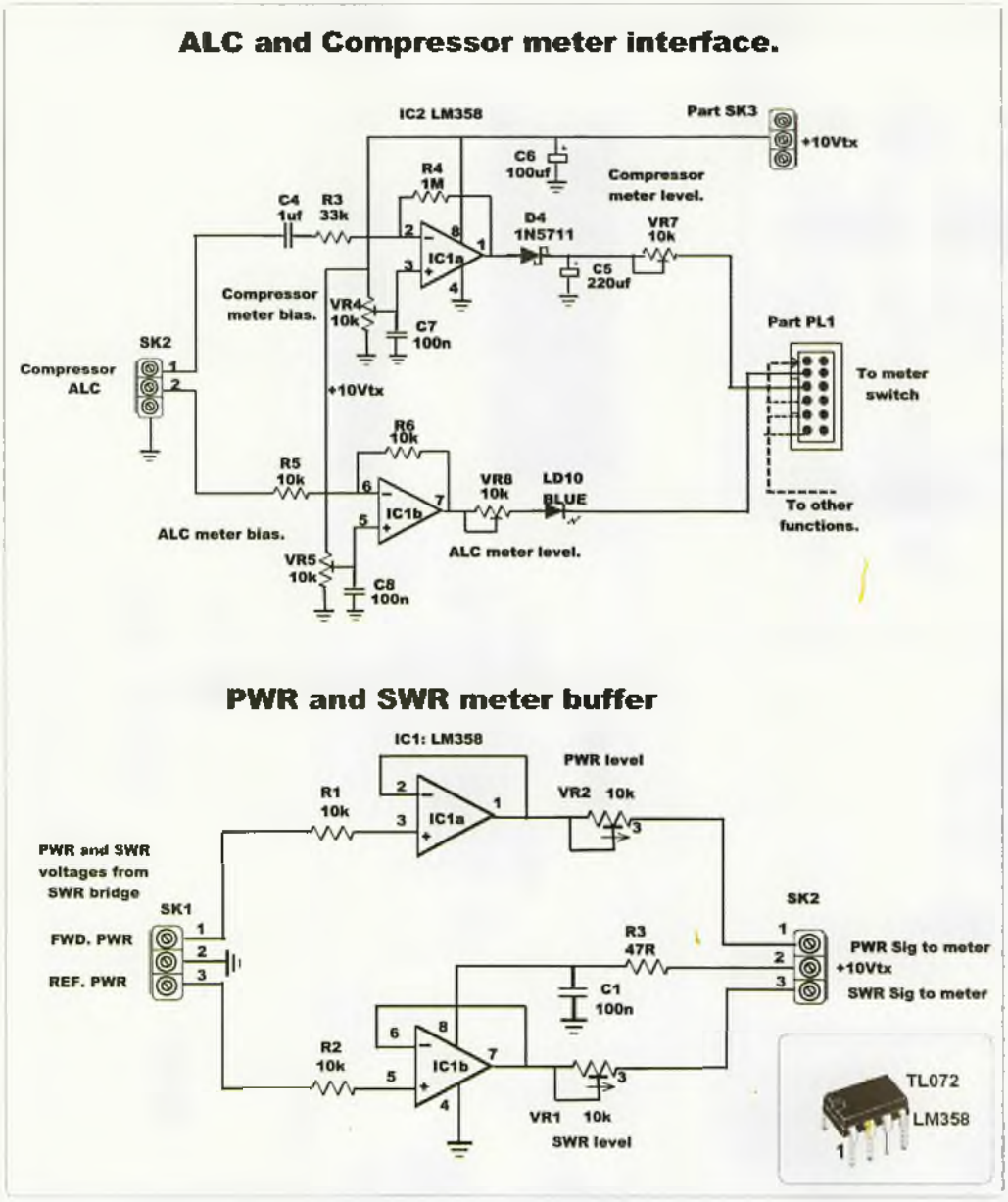


Figure 28: These two circuits work in conjunction with the Figure 27 circuit.

Reference.	Value	Notes.
C4	1uf	
C5	220uF	Electrolytic
C6	100uF	Electrolytic
C7,8	100nF	Monolithic
D4	1N5711	Schottky diode
IC1	LM358	
LD10	3mm blue LED	
R3	33k 5% 0.6W	
R4	1M 5% 0.6W	
R5,6	10k 5% 0.6W	
SK2,3	3 way 5.08mm	Screw block terminals
VR4,5,7,8	10k trimpot	

Figure 28: ALC and Compressor meter interface components.

Reference.	Value	Notes.
C1	100nF	Monolithic
IC1	LM358	
R1,2	10k 5% 0.6W	
R3	47R 5% 0.6W	
SK1,2	3 way 5.08mm	Screw block terminals
VR1,2	10k trimpot	

Figure 28: PWR and SWR meter buffer components.

Reference.	Value	Notes.
Filter C and L	See Table 4	
NOTE: There are 2 PCBs with 4 filters on each. PCB A and PCB B		
C5,6,7	100nF each per filter	Monolithic
R1	3k9 1% 0.6W one per filter	
R2	100k 1% 0.6W one per filter	
R3	1k5 1% 0.6W one per filter	
Q1	2N2222 one per filter	
D1 to D8	1N4148 one per filter across relays	
LED1	3mm Red LED one per filter	
Relays	JQF-3F-C 12V 10A, 2 per filter	

Figure 24: Transmitter Low Pass Filters circuit components.

Reference.	Value	Notes.
C1,2,3,4	100nF	Monolithic
D1,2,3	1N4148	
D4,5	1N34A	Germanium diode
R1,3	60R4 1%	1206 SMD
R2	150R+100R 1% in series	1206 SMD
R4,5	50R 1%	1206 SMD
RLY1	JQC-3F (T73)	10A relay SPDT 12v
RLY2	M4-12H	DPDT 12v mini relay
SK1,2,3	SMA Panel mount female(external thread)	
SK4	3 way 5.08mm	Screw block terminals
SK5	2 way 5.08mm	Screw block terminals
SK6	2 pin male XH PCB mount	Screw block terminals
T1,2 0.7mm	1 turn primary, 12 turn secondary, T50-6 core	
	Earth screen over wire primary through core.	
VR1,2	50k trim pot 20turn	

Figure 25: ALC and SWR detector circuit components.

D9,10,11,12	1N5817	Schottky diodes on PCB B
SK1A	3 pin male PCB header on PCB A.	
SK2A	4 pin male PCB header on PCB A	
SK1B,2B,3B	3 pin male PCB header on PCB B	
SK4,5	SMA panel mount female external thread.	
	Mounted on small brass or copper subpanels.	

Figure 24: Items above not replicated for each filter.

Reference.	Value	Notes.
C1,2,3,4,6,7,8,8B	10nF	Disk ceramic and SMD
C5	220nF	Monolithic
C9	10uF 25v	Electrolytic Low ESR or Tantalum
C10,11	100nF	Monolithic
D1,2	1N4148	
D3	1N5231	5.1 volt Zener
IC1	LM3900	
LED1	Red LED	
R1	1k 5% 0.6W	
R2,6	100k 5% 0.6W	
R3	1M 5% 0.6W	
R4	3k3 5% 0.6W	
R5,7	47k 5% 0.6W	
R8,10	10k 5% 0.6W	
R9	10R 5% 0.6W	
R11	33k 5% 0.6W	
SK1,2	3 way 5.08mm	Screw block terminals
VR1	50k trim pot 20turn	
VR2,3	20k trim pot 20turn	

Figure 26: ALC and SWR control circuit components.

Reference.	Value	Notes.
C1,2,3	100nF	Monolithic
D1M, D3	1N5817	
IC1	LM317L	
LD9	3mm Red LED	
M1	Moving coil meter to suit, 0 - 1mA	
PL1	2x8 pin boxed IDC male PCB header	
R1	270R 5% 0.6W	
R2	100R 5% 0.6W	
RLY1	Relay Mini NAIS 9v DPDT	
SK1	2 way 5.08mm	Screw block terminals
SK2,3	3 way 5.08mm	Screw block terminals
VR1	5k	trimpot
VR2	10k	trimpot
VR3	200R	trimpot

Figure 27: Meter circuit components.

Reference.	Value	Notes.
D1,2	1N5817	Schottky diode
LD1,4,5	3mm Yellow	
LD2	3mm Green	
LD3,8	3mm Red	
LD7	3mm Blue	
R1,2,3	470R 5% 0.6W	
R4,5,6,7	1k 5% 0.6W	
VR6	2k	trimpot
SK1	3 way 5.08mm	Screw block terminals
SK2	2 way 5.08mm	Screw block terminals

Figure 27: Meter LED PCB circuit.

SK1	2x8 pin IDC female cable mount straight plug.
SW1	2 Pole, 6 position, mini rotary switch

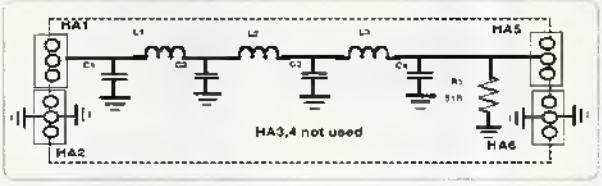
Figure 27: Meter switch.

Errors & Omissions

This is **Table 1**, which was omitted from **Part 1**, published in Volume 87, No.6, 2019.
It relates to *Figure 4*, on page 11 – the receiver input tuned circuits.

Ant. Input RF Filter	Filter Range	RF input tuned circuits	Coil	Tap/sec.	Core	Varicap range	Additional Cpar	Varicaps	Top coupling trimmer
	MHz		Turns	Turns		Cpf	pf		pf
A	0.1-1.0	Low pass filter. Fcutoff = 1MHz. See details below.						AOT	
B	1.0 -2.0	84uH	69	7	T50-3	68 to 268	68	1SV149	30
C	2.0-4.0	24uH	65	6	T68-2	56 to 256	56	1SV149	30
D	4.0-8.0	6.5uH	40	4	T50-6	120 to 320	120	1SV149	20
E	8.0-14	1.3uH	21	4	T37-6	120 to 320	120	1SV149	20
F	14-21	431nH	12	3.5	T37-6	100 to 300	100	1SV149	20
G	21-30	0.5uH	14	4	T37-10	50-120	25	BB201	10
H	30-54	0.3uH	6	2.5	T37-12/17	25-95		2xBB201	10

FILTER A: L1,L3 = 10.9uH = 25T on T50-3 C1,C4 = 4368pf
L2 = 11.4uH = 26T on T50-3 C2,C3 = 7243pf



FILTER H: Uses 2 off BB201 varicaps in parallel to cover range for each diode shown in circuit.
NOTE: BB201 range appx 25pf to 90pf 1SV149 range appx 30pf to 500pf

Table 1: Receiver RF input tuned circuits.

This is **Table 3**, which was omitted from **Part 2**, Third article, published in Volume 88, No.2, 2020. It relates to *Figure 19*, on page 18, the **Transmitter Band mixer**.

The Publications Committee apologises for these omissions.

That delightful character from The Goon Shows of yesteryear, Mad Dan Eccles, said it all when he uttered, vicariously: "*Nobody's perfect!*"

Software relay	Tx Mixer coils	BAND	HAM	Mixer tuned circuit	Coils	Core	Tap	Cpar	Ccoupl.	wire size
			MHz	uH	Turns			pf	pf	mm
1	A	NO TX	<1MHz							
2	B	160m	1.8	15	55	T50-2 Red	15t	470	30pf trimer	0.3
3	C	80m	3.5	9	43	T50-2 Red	8t	220	30pf trimer	0.3
4	D	40m	7	5	32	T50-2 Red	5t	100	10pf trimer	0.5
5	E	30m	10.1	5	35	T50-6 Yellow	5t	47	3.3	0.5
6A	F1	20m	14	3.8	30	T50-6 Yellow	5t	33	1pf	0.5
6B	F2	17m	18.068	2.37	26	T50-6 Yellow	5t	33	1pf	0.5
7A	G1	15m	21	1.71	22	T50-6 Yellow	4t	33	7pf trimmer	0.5
7B	G2	12m	24.89	1.33	21	T37-6 Yellow	4t	33	1pf	0.5
7C	G3	10m	28-30	1.37	21	T37-6 Yellow	4t	22	7pf trimmer	0.5
8	H	6m	50	0.78	12	T37-6 Yellow	3t	12	1pf	0.5

Table 3: Transmiter mixer filter details.

Software relay letters refer to the band logic designations in the Arduino software

Raspberry Pi savior

Robert Campiciano VK2ACR/VK2YMU

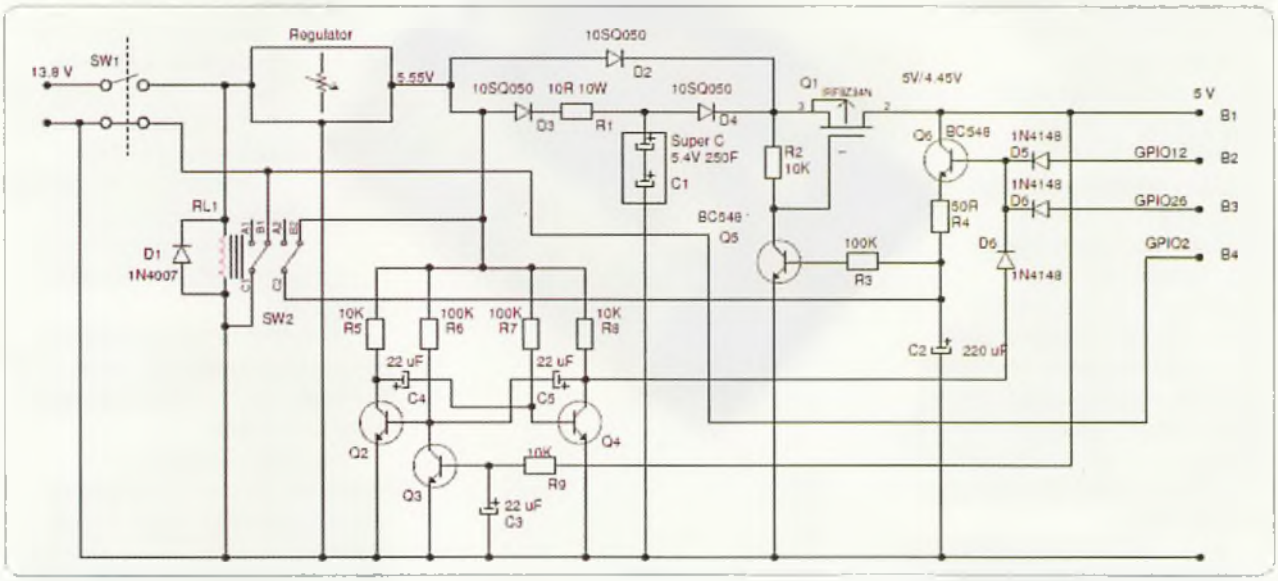


Photo 1: This straightforward circuit takes care of power control or failure conditions, shutting down the Raspberry Pi in a safe manner, as well as rebooting if power is present but the Raspberry Pi is shutdown.

An issue confronting Raspberry Pi users is SD card corruption due to improper system shutdown.

Ordinarily, before removing power from the Raspberry Pi, one should execute the "**sudo shutdown -h**" routine. This simple routine can be incorporated into the system, sensing either an operator shutdown or a power failure.

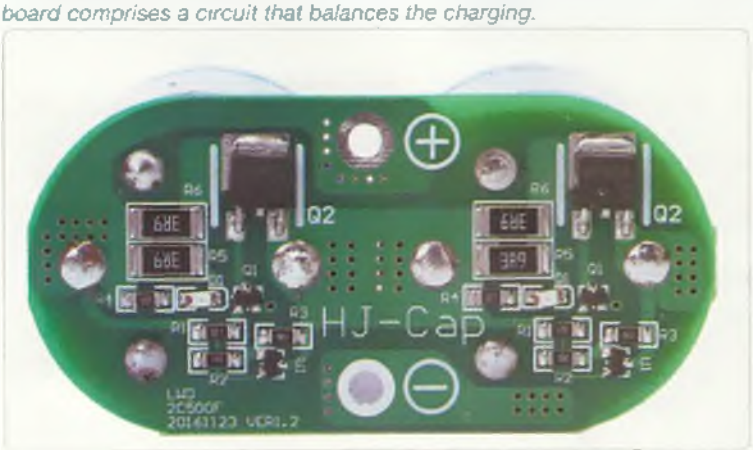
In the case of a power failure, we need some reserve of energy, keeping the Raspberry Pi alive long enough to perform the shutdown procedure.

In designing a power supply for a Raspberry Pi project, I gave consideration as to what kind of energy source would be most suitable. If a rechargeable battery is used, the need to charge it adds complexity to the circuit. I needed something else.

Enter the super capacitor

One device that provides a very simple charging method is a 'super capacitor', which only requires a current limiting resistor. The size of the super capacitor in my application was largely driven by economics, it had to have sufficient capacity and include a 'charge balancing' board. The cheapest one I could find was a 250 Farad 5.4 volts device, providing an energy

Photo 2 and 3: These two cans, and the board that holds them together, make up a 'super capacitor' of 250 Farads. The board comprises a circuit that balances the charging.



store of 1350 Coulombs; enough energy to power the Raspberry Pi during the shutdown.

The general power supply for my application – and very typical for many projects – provides 13.8 Vdc. So, to charge my super capacitor, I needed to drop that down to around 5.5 V. A good solution is to use a 'buck inverter' – a step-down dc-dc converter to provide a lower voltage from a higher input voltage with high efficiency. In my case, such a buck inverter needed to have high current capability and good regulation. Many modules are on offer. However, whatever was to be selected from the raft of products on-off had to meet the following specific criteria:

a/ have sufficient current ability to charge the super capacitor,
b/ have the lowest possible ripple noise on the output.

Having tested several inverter modules, I chose one from eBay. Costing less than $10, my chosen module provides a regulated, adjustable output of 5.0 volts from a source of 13.8 volts or less, with a maximum current ability of 12 Amps. At this point, I must issue a **warning** – before using this device, the output voltage must be set to 5 volts.

Code to be installed into the Raspberry Pi for power supply control includes:

1/ A 'Power Fail' routine (signal to power-down);
2/ A 'Heart Tick' routine (maintain power to the Raspberry Pi);
3/ Modification to the boot/config.txt (provide an 'SD card activity' signal).

Mod to config.txt

```
# Use external LED as SD ACT LED
dtoverlay=pi3-act-led,gpio=12
```

Signals required for the power supply operation are:

a/ Power On/Off/Fail (B4)
b/ Heart Tick indicating normal running (B3)
c/ SD card activity normal running (B2)

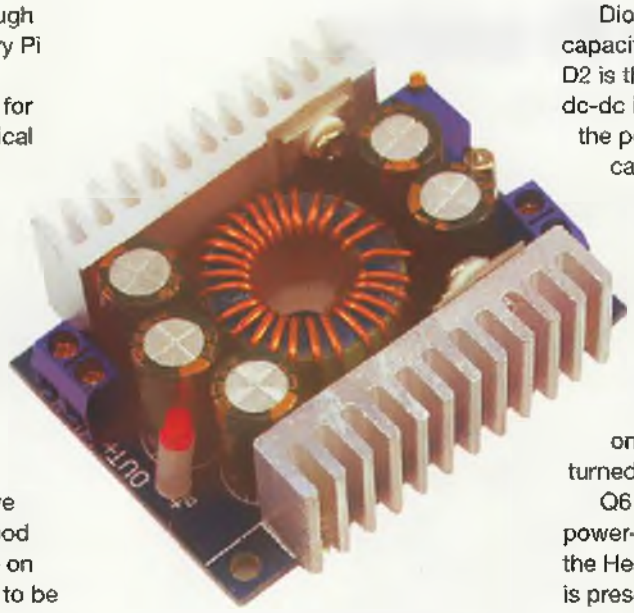


Photo 4: The dc-dc buck inverter module I chose can deliver up to 12 A at 5 Vdc from a 13.8 Vdc source supply. All for only $10!

Look at the circuit – the 500 mS Heart Tick signal of 3.3 volts is applied to B3, on the right hand side (GPIO26). This keeps the power supply turned on, delivering 5 Vdc to the Raspberry Pi. Power on/off timing is achieved by the action of C2 and C3 in the circuit.

Shutdown process

When a logic zero is applied to B4 GPIO2), this means Power Off/Fail is happening. The Raspberry Pi starts the shutdown process. During this process, the SD card activity signal is used to extend the ON time of the power supply. When the Heart Tick and SD card activity ceases, the timing capacitor – C2 – fully discharges, only then is the power to the Raspberry Pi turned off.

How it works

The power switching (on/off) is performed by Q1, a P-channel FET. Diode D1 Absorbs back-EMF from the relay to protect any devices sharing the 13.8 volt rail.

Diode D3 and R1 form the super capacitor charging circuit. Diode D2 is the power source from the dc-dc inverter. Diode D4 provides the power source from the super capacitor.

Transistors Q5 and Q6 are used to control the FET, Q1. If Q5 is turned off, Q1 is pinched off (i.e. the power-off condition).

Transistors Q2 and Q4 form an astable switch, controlled by Q3. If Q3 is on (saturated), the astable is turned off.

Q6 is the charge controller to power-up and keep the power on if the Heart Tick or SD activity signal is present (at B3).

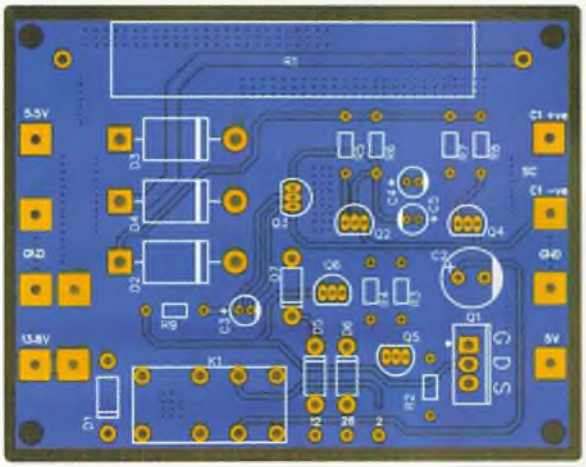
The Relay serves as a power-fail detector; choosing an electromechanical device solves problems when there may be slow decay of the power supply's input voltages, providing a solid signal that clearly indicates power failure.

Note that the buck inverter (labelled "Regulator" on the circuit) has a wide range of input voltage to maintain a regulated 5.5 Volt output. Thus, only when the voltage at the relay armature falls below the holding voltage, a power-fail signal is sent to the Raspberry Pi. Voltage variations taking place on the input of the Regulator above the holding voltage of the relay will have no consequence to the regulated output or the functionality of the Raspberry Pi.

The circuit has to meet three conditions:

a/ Operator Power on/off
b/ Power fail
c/ Auto-reboot if power is available but the Raspberry Pi is dormant, requiring a power cycle to boot.

Note that, if a shutdown command was issued, the inbuilt Raspberry Pi watchdog is disabled, so this can't be used to detect a dormant device to restart the Raspberry Pi; the power must be cycled, initiating a boot process.



Overlay for my project's printed circuit board.

Circuit operation

With SW1 in the OFF condition, a ground is applied to B4, indicating that power is turned off by the Operator (also initiating a power-down if the Raspberry Pi was running).

When SW1 is turned ON, the regulated 5.55 Vdc from the buck inverter, is applied to C2, charging C2 instantaneously. This is possible because of the lag in the relay armature at the same time the ground on B4 is removed. The charge in C2 drives current into the base of Q5 via R3, causing Q5 to saturates, thus turning on the FET Q1; 5 Vdc is now applied to the Raspberry Pi via B1. The source of this voltage is via D2, making the cathode of D4 more positive than the anode, hence D4 is turned off. So, D3 and R1 are now charging the super capacitor.
The initial charge in C2 allows 20 seconds of operation, the activity signal of the SD card during the boot process further adds to this charge, extending the time and ensuring a proper boot-up.

Once the Raspberry Pi has booted, the Heart Tick signal via B3 keeps charging C2 every second for 500 mS, sustaining the power to the Raspberry Pi.

Now, let's consider a power-off situation. When SW1 is turned off, the super capacitor is now supplying energy via D4, the ground applied to B4 initiates the Raspberry Pi shutdown procedure. The SD card activity is high during the shutdown process. This pulses B2, topping-up the charge in C2 via Q6, extending the power-on time. When the Raspberry Pi goes dormant, the Heart Tick and SD card activity ceases, C2 discharges fully, Q5 turns off and the FET also turns off and the 5 V is now removed from the Raspberry Pi.

Now we consider the operation of the circuit during a power-fail. If the circuit's input voltage falls below the holding voltage of the relay, the normally-closed (NC) contact is made, which applies a ground to B4, signalling the Raspberry Pi to commence the shutdown procedure.

As long as the input power remains off, the system will shutdown as if the operator had turned SW1 off.

Auto-boot

The auto-boot takes place when power is interrupted, initiating the shutdown procedure, but power returns, resulting in a dormant Raspberry Pi. In this condition, C2 is discharging, which takes approximately one minute. Once the 5 V supply to the Raspberry Pi falls to zero, C3 discharges, taking approximately 200 mS to turn off Q3 The astable switch – Q2 and Q4 – is now allowed to cycle, pulsing a charge into C2. This action causes the 5 V supply to the Raspberry Pi to be turned off and then back on again after 200 mS, thus initiating the boot process.

Action Times

Reboot: 1 minute 30seconds
Off to on: 1 minute 10 seconds
Switch Off: 5 seconds

Times will vary according to the services and task been performed by the Raspberry Pi.

Conclusion

This power supply takes care of power control or failure conditions, shutting down the Raspberry Pi in a safe manner, as well as rebooting if power is present but the Raspberry Pi is shutdown.

I can provide the C code for the control features of this power supply upon request.

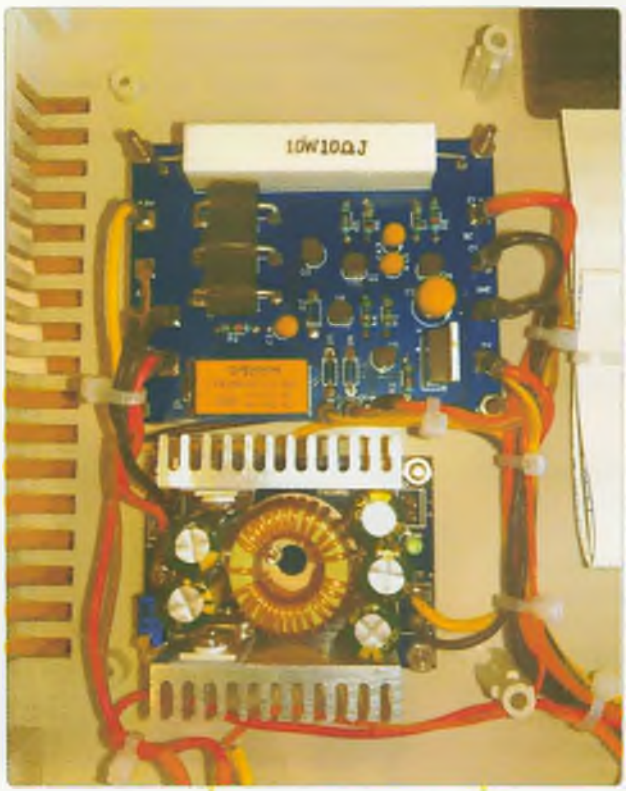


Photo 6: My power supply printed circuit board and the buck inverter were tucked away in a vacant area of a project box.

The 'gentle persuader' turns 90

Peter Wolfenden VK3RV, WIA Historian

Over the years, many individuals have contributed to the administration of amateur radio; some more so than others. One who has contributed significantly over many years, and well known to most old timers, is Dr David Wardlaw VK3ADW, who has now reached 90 years. This summary provides an insight to his dedication.

David has admirably served amateur radio for over five decades through his Wireless Institute of Australia (WIA), and International Amateur Radio Union (IARU) activities. His quiet approach in encouraging individuals, in working on resolving issues together with the ability to 'look ahead, saw David attending many conferences, both local and international over those decades. It can be truly said that he fought for hams and the hams won!

He is a 'gentle persuader', a dedicated and skilled man to whom amateurs owe so much. He played a significant role in gained new spectrum for the global amateur radio fraternity and, in Australia, helped to see-off a disastrous hike in licence fees by the legislative authority in the mid-1990s.

The early years

David was born in November 1929. He obtained his licence in 1948 and joined the WIA. In 1956 he was elected to the Council of the WIA Victorian Division and, until 1958, held the position of Federal Councillor, representing the state at Federal Conventions and the person who handled most of the day-to-day communications with the Federal Executive (directors of the company WIA Federal), the then-national administrative arm of the WIA.

Photo 1: The gentle persuader who achieved so much for the amateur radio fraternity.

From 1958 to 1963, David served as President of the Victorian Division but had to resign as he was transferring overseas for some years. David held both UK and Canadian callsigns while he was away from Australia.

On return from overseas in 1966, he was co-opted to the Federal Executive and subsequently became Federal President, which position he held from 1973 until 1979. David had a second term as President from 1984 to 1988.

The busy years

He has a great interest in international amateur radio affairs and when the IARU Region 3 was formed during 1968 in Sydney, David was present and became a member of the first Secretariat of R3. From 1988 to1994 and again from 1997 to 1999, David was a Region 3 Director after which he became IARU Vice President until 2004.

During 1979, David was a member of the Australian delegation to the World Administrative Radio Conference. At the Special Preparatory Meeting for WARC79 in Geneva, he presented the significant Australian delegation

Photo 2: David (centre) takes receipt of the IARU's Michael J Owen Award. At left is Tim Ellam VE6SH/G4HUA, IARU President, while at right is Gopal Madhavan VU2GMN, Chair of Region 3 IARU.

paper that helped obtain the new high frequency bands – the so-called 'WARC bands' at 10, 18 and 24 MHz. He was also a member of the Australian delegations to WARC 92, 95, 97, 2000 and 2003.

Acknowledgement

A life member of the Institute, David has also received the WIA's Ron Wilkinson Achievement Award (in 1979), and the G. A. Taylor Medal in 1992. That's the 'hat trick' of the Institute's highest awards (see: *www.wia.org.au/members/wiaawards/about/*).

On retirement from the IARU, David was appropriately honoured for his substantial contributions to the amateur radio service and amateur satellite service, by being awarded the IARU's inaugural *Michael J Owen Award*. An Award established in memory of his dear friend and 'co-conspirator' over many years in things IARU, WIA, and amateur radio, generally. The Award was formally presented to David in June 2014, by Tim Ellam VE6SH/G4HUA, President of the IARU.

David is a talented man who has contributed so much to amateur radio in Australia and Internationally. He is still contributing by being a member of the WIA's History and Archive Committee, his long association with amateur radio and the WIA is invaluable in helping to identify important documentation from the past.

VHF/UHF - An Expanding World

David K Minchin VK5KK

This edition of the column is a bit of a departure from the usual mix to try out a few new things.

Some news from Germany of a contact in the sub-terahertz range, as well as the first of the 'VHF and Above Construction Series' kicks off with a dc power supply design for surplus microwave amplifiers. And for a bit of nostalgia, a flash back from my column of 20 years ago!

What do you do when you have worked it all on all bands up to 241 GHz?

Michael DB6NT and Andreas DB2NP made the first ever QSO on 725 GHz on 20 July 2020. The third harmonic of 241 MHz was used to produce a signal in the Region 2 amateur band of 711730 MHz! The total distance covered was 42.0 metres. The internal waveguide diameter is 0.5 mm!

From DB6NT: *"Andreas DB2NP and I set up the stations about 20 m apart and let the OCXO's warm up. The signal was heard immediately but weak. The signal strength could only be optimized through exact antenna alignment. The direction setting was found to be just as critical as a QSO with laser light. This would not have been possible without setting the direction with micrometer screws. The radiation angle of the antennas is far less than one degree. Andreas DB2NP and I had already experienced this in 2004 during our record QSO over 106 km at 660 nm (red light). After everything was optimized, we exchanged the 529 reports. We noted the time 12:30 UTC on 20/7/2020. A further distance than 42.0 metres could not be bridged on this day. The air temperature was 25 ° C, the relative humidity 51% and the dew point was 13.7 °C"*

Photo 1: The DB6NT (left) and DB2NP (right) 725 GHz systems.

"The path attenuation on the day in the prevailing weather conditions was 288 dB per km! At these high frequencies, the humidity, air pressure and temperature have a strong effect on the path attenuation. In cold and clear winter weather, the achievable distance should be significantly higher. 725 GHz is not a really good band for DX, but it is a technical challenge to operate on this band"

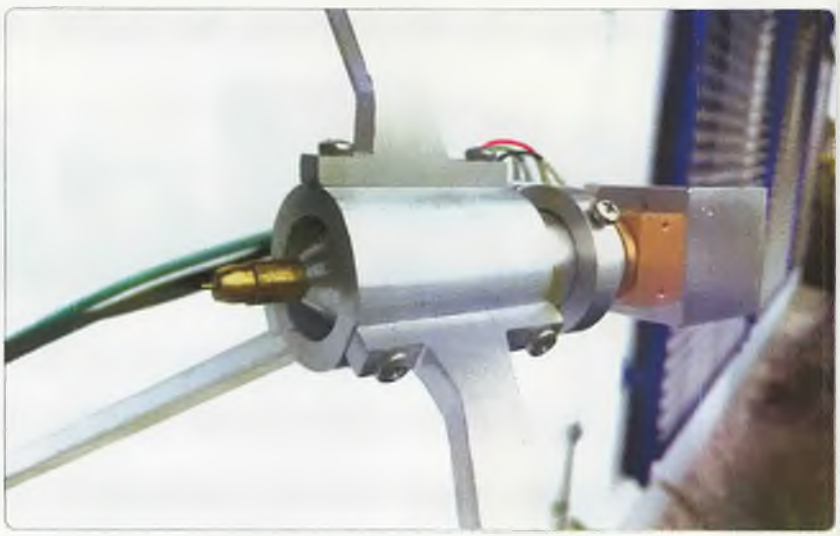


Photo 2: DB6NT's multiplier-waveguide feed on 725 GHz.

While not evident in the photos, the IF set at one end was a (vintage!) Yaesu FT290R Mk1, and at the other end, an (ancient) Icom IC 202 (why not?!). DB6NT used an OE5VRL 400 mm machined aluminium dish, while DB2NP used a former medical laser reflector. Video of the contact can be found online, here: *https://youtu.be/iXSuJN0LVwQ*

Construction Series, Part 1: Microwave amplifier power supply

This will be the first of several construction-type articles related to VHF and above activity.

'Homebrewing' has long been associated with the hobby. However, there has been a bit of a renaissance in recent times as available ready-made equipment sharply declines (or gets very expensive) the higher you go in frequency. Even if you buy a 'gold-plated' readymade and tested module, you still need to add some electronic or mechanical trickery to be able to use it.

Previously, I published a 24-part Microwave Primer series that ran in this column from 2000 to 2002 and, more recently, the smaller SDR and PLL technology series. We will revisit some of these series' with projects, based on interest and demand. I'll feature some original designs, some borrowed and, in some cases, kits that are readily available.

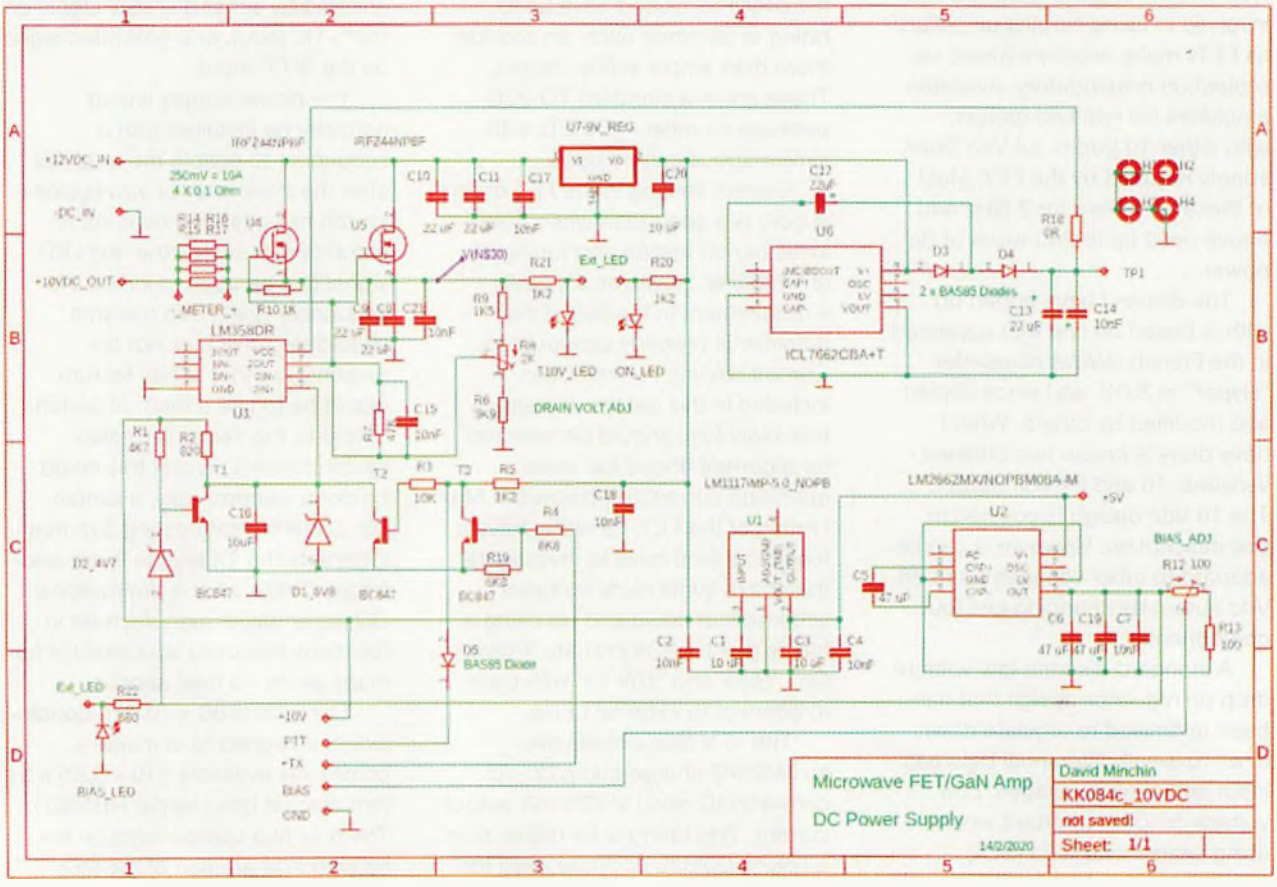
For this part, I will look at a simple power supply that can be used with 10-to-24 Vdc FET or GaN (gallium arsenide) amplifiers.

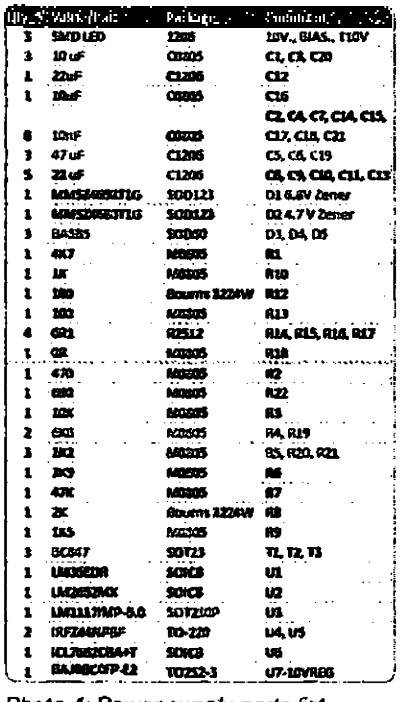
Every now and then, amplifier modules appear on eBay (or a local recycler!) that have been used previously on uWave frequencies in point-to-point or early satellite links. Discrete FET technology was widely used in the sub-5 W levels from the late 1980s till the 2000s, when power MMICs (monolithic microwave integrated circuits) became popular.

Above 5 W, discrete devices continue to be used today, along with newer GaN types. These amplifiers almost always use internally matched FETs, so are relatively easy to tweak for narrow band use, even if the band we are using is slightly higher or lower in frequency than the device was intended for.

Often, all that is available is the amplifier module, so a dc power supply needs to be added. Sometimes, there may be a power supply, but it has been designed to run from an ac supply with a non-standard dc voltage over 13.8 Vdc and so can't be used with a battery while portable.

Photo 3: Microwave amplifier power supply circuit (10 Vdc version).





1	SMD LED	1206	10V., BIAS., T10V
3	10 uF	C0805	C1, C3, C20
1	22uF	C1206	C12
1	100uF	C0805	C16
			C2, C4, C7, C14, C15,
8	10nF	C0805	C17, C18, C22
3	47 uF	C1206	C5, C6, C19
5	22 uF	C1206	C8, C9, C10, C11, C13
1	MMSZ4689ET1G	SOD123	D1 6.8V Zener
1	MMSZ4689ET1G	SOD123	D2 4.7 V Zener
3	BAS85	SOD80	D3, D4, D5
1	4K7	M0805	R1
1	1R	M0805	R10
1	1R0	Bourns 3224W	R12
1	10R	M0805	R13
4	6R1	R2512	R14, R15, R16, R17
1	0R	M0805	R18
1	47R	M0805	R2
1	68R	M0805	R22
1	10K	M0805	R3
2	6K8	M0805	R4, R19
3	1K2	M0805	R5, R20, R21
1	3K9	M0805	R6
1	47K	M0805	R7
1	2K	Bourns 3224W	R8
1	1K5	M0805	R9
3	BC847	SOT23	T1, T2, T3
1	LM2662M	SOIC8	U1
1	LM2662MX	SOIC8	U2
1	LM1117MP-5.0	SOT223P	U3
2	IRFZ44NPBF	TO-220	U4, U5
1	ICL7662CBA+T	SOIC8	U6
1	BA78BC07P-E2	TO252-3	U7-10VREG

Photo 4: Power supply parts list.

All FET devices need a negative bias voltage along with a positive dc supply that has protection from loss of bias. There is always a risk involved in using surplus amplifiers as FETs make excellent fuses, so protection is mandatory. Available amplifiers fall into two groups, with either 10 Vdc or 24 Vdc Drain supply required by the FET. Most of these amplifiers for 2 GHz and above need up to 240 watts of dc power.

The design I have ended up with is based on one that appeared in the French uWave newsletter "Hyper" in 2012, and since copied and modified by others. What I have done is create two different versions, 10 and 24 Vdc output. The 10 Vdc design is covered in this description. However, it can be adapted to other voltages up to 28 Vdc output by changing just four components.

A standard discrete low voltage drop dc regulator design that has been optimised to regulate down to a ~ 0.3-volt differential between input and output voltages. Low voltage drop is important when using sealed lead-acid (SLA) batteries portable, to get anywhere near the rated capacity from them; 10.5 volts is usually the discharge end-point, so the ability to still have 10 Vdc regulated output is a bonus.

In a normal regulator, the op-amp used would be powered from the input dc; however, this at best translates to a 0.5 V differential at high current. The solution is to raise the op-amp's Vcc above the input dc voltage so the circuit can regulate close to the input voltage, minus resistive losses. In the design, a common 7662 charge pump dc-dc converter IC normally used to create the negative bias rail has been used with a voltage doubler rectifier. The op-amp then has a Vcc of around 18 volts, enabling the operating point to be set within 300 mV of the input voltage at 10 Amps.

Two P-channel HEXFETs in parallel are used as the variable element series-pass devices. Using FETs rather than bipolar transistors gets around the obvious bipolar voltage drop problem. The IRFZ44NPBFs used have an ID rating of 35 amps each, so provide more than ample safety margin. These are in a standard TO-220 package so other HEXFETs with similar specs can be used.

Current limiting in the FET drain supply is a good idea when doing initial bench testing and tuning of an amplifier. However, it's rarely a requirement in the field if the amplifier is properly constructed. Current limiting has not been included in this design. Instead, a fast-blow fuse should be selected for a current above the usual operating current but below the Max I rating of the FET. I'd rather have a fuse blow (and have to investigate) than have some more complex scheme that could end up being a failure point! LEDs indicate 'Power On', 'Bias' and '10V Tx' with pads to connect to external LEDs.

The -5 V bias circuit uses an LM2662 charge pump dc-dc converter IC rated at 200 mA output current. This rating is far higher than a 7662 (~20 mA) normally used for negative bias to help reduce misuse failures. Bias protection is achieved by using a modified version of a design that dates back nearly 30 years in DB6NT designs.

The cathode of a 4.7 V Zener diode is connected to the -5 Volt bias supply; should the bias supply drop below about -4 V, a BC847 NPN transistor turns on, shorting the 6.8 V Zener used as the reference for the op-amp in the main regulator. The output voltage then drops to < 100 mV. The bias protection can only detect loss of bias at the power supply and not at the FET itself. It is important to use good quality multi-turn trimmer pots (i.e. Bourns 3223W series) to adjust the bias and that wiring to the amplifier is solid. DO NOT use in-line plugs or cheap, 'no name' trimpots!

Switching of the regulator from receive to transmit is also achieved by another BC847 across the 6.8 V Zener. The negative rail runs full time; the positive rail supply is then enabled by either a > +5 V signal on the '+TX' input, or a grounded signal on the 'PTT' input.

The power supply would normally be installed with a sequencer to enable the amplifier after the coax relay or waveguide switch has changed over. As an extra level of safety, the 'ext LED' signal can be used to inhibit the sequencer going into transmit should negative bias not be present. Another safety feature would be to use a thermal switch bolted to the heatsink to also inhibit transmit. Whilst this could be done electronically, a simple 60° C thermostat costing $15 that interrupts the TX enable is set-and-forget. That's what a professional uWave amplifier manufacturer in Germany has used successfully for many years – a heat sensor.

The PCB is 86 x 70 mm double-sided, designed to fit inside a commonly available 119 x 93.5 x 34 mm diecast box (Jaycar HB5067). The only two components on the reverse side are two of the four

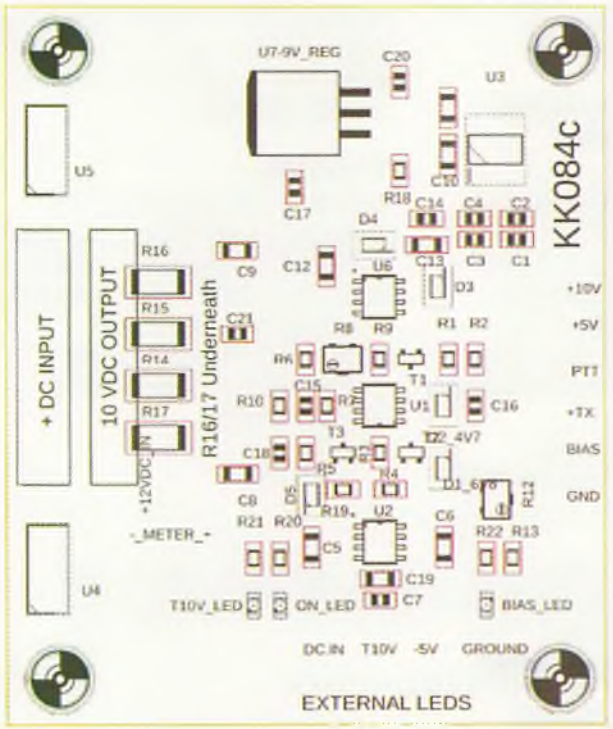


Photo 3: PCB overlay for the microwave amplifier power supply.

shunt resistors (R15 and R16). Any combination of 2 W SMD 2512 resistors could be used, the four 0.1 ohms shown can be used with a meter to show drain current (250 mV = 10 A). Both sides of the PCB are connected by multiple vias to dissipate any heat from the resistors and provide a solid mounting point for dc cables. SMD components are a mix of 0805 and 1206 SMD sizes.

The two HEXFETs are mounted under the PCB with full length leads and then bent up so the flange can be mounted against the inside of the diecast box (see the photo here). A small heatsink can be used to dissipate the 20-30 watts of heat. That said, the heat generated by the usual 50% duty cycle of WSJTX modes does not heat up the box very much when running from 12 Vdc.

The power supply should be thoroughly tested under load before connecting to an amplifier. Set up one or two vehicle headlamps to simulate an amplifier load and run the supply for 10-15 minutes to check there are no problems with heating, etc. Also check the specifications of the FET you will be using to see what bias voltage is required for a nominal idle current. You may need to adjust R13 (set for -2.5 V min) so it is not possible to lower the bias voltage below that point.

The R12 trimmer pot should be adjusted before connecting so that the voltage is just above the cutoff point according to the FET specs. Connect a 47 ohm ½ watt resistor (~90 mA) from the bias to ground and run for 10-15 minutes, then check the bias voltage is stable and that there is no over-heating.

Printed circuit boards are available, along with details of the changes for the 24 Vdc version of this design that has been specifically designed to be used with 5-24 GHz GaN amplifiers. Just email me, at david@vk5kk.com

Next issue, we will have a PLL-locked high frequency reference that uses commonly available 25-200 MHz VCXOs so a higher reference frequency can be used with microwave PLLs to reduce phase noise. The same design can also be used for 'rig locking' with some transceivers.

20 years ago

Headline from my September 2020 column: "Aurora Australis strikes in Southern Australia!", reporting on the biggest aurora event for years in VK: *"The 11th of August 2000 saw a significant Solar event resulting in Aurora's in both Northern & Southern hemispheres. While the Aurora was not as widespread as some (i.e. to more Northern areas) it certainly provided a number of contacts throughout lower VK2,3 & VK5."*

Russell VK3ZQB reports ... *"Worked a heap on 2mx Aurora 12/8 from 0750 to 0917 UTC. by then everyone had worked everyone else and it was down to taking turns calling CQ. Worked VK7JG 3-9 0750UTC, VK3XPD 3-9 0800UTC, VK5DK 4-9 0805UTC, VK3KEG 4-9 0819UTC, VK5DJ 4-5 0834UTC, VK3TLW 4-9 0839UTC, VK3YY 4-9 0840UTC, VK3ZLS 4-9 0913UTC, VK3AEF 4-9 0914UTC, VK5LP 4-7 0915UTC, VK3EK 4-9 0917UTC. Heard a VK2 in the dog pile at one stage but did not work him. There were many others there as well VK7ZPB is one I heard. 1200UTC all seems quiet, can't hear any signs even on the beacons... A good turn-up for an otherwise dull day."* ... VK3ZQB

Doug VK3UM (SK) reports on the Aurora, but also some of the more finer details of Auroral propagation, as well as some tips towards more effective operation. *" Thanks to Trevor VK3KEG I was able to get on and enjoy an extended Aurora opening commencing about 1800 hours EST 12/8/2000. It lasted to well after 2100 when I 'gave it away'. Given the length of the opening I was able to observe the Doppler shifts and relationships to distance and beam headings, something I had wished to do for ages.*

"Now to some observations. At 1800 the single peak (in the past I have noted multiple peaks) was about 160° and with time moved through 180° to about 195° and slowly returned to about 165° at 2100. It was interesting to watch the shift in Doppler by turning the beam. For example, listening to Russell VK3ZQB (who was 9+) from beam headings of 160-190°, the Doppler varied from 235- 375 Hz. Thus, beam heading (as has been known for ages) has a bearing on Doppler off set. On 144MHz this is not too

important but on 432 (3xf) it takes on more serious implications.

"As I mentioned above, I could further vary the Doppler shift by greater than 150 Hz by shifting the beam heading. One may postulate why this is so??? I have always used the analogy of 'looking up at a waterfall'. The moving water coming towards you relates to the positive Doppler shift and from where you are standing relates to its magnitude." . . VK3UM.

I have just extracted parts of Doug's text from the column, but his advice (as always) is still relevant today. We just need some Sunspots and flares. More next month!

Online path loss calculator for 24 GHz and above

As previously covered, Iain VK5ZD's website that displays the calculated path loss for 24, 47, 76, 134 and 241 GHz has become a well-used resource to quantify mmWave band conditions. The website can be found here: *http://weather.vk5microwave.net/Weather.aspx?State=H*

There is also a path loss calculator available on this link that allows live meteorological data to be entered for any site, anywhere in the world: *http://weather.vk5microwave.net/Calculate.aspx*

In closing

Feel free to drop me a line if you have something to report, especially on the VHF bands, as we currently do not have a VHF Editor! It doesn't take much to put a few lines together and helps the diversity of this column. Just email me, at *david@vk5kk.com*

73s
David VK5KK

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Website:
www.amsat-vk.org

Group site:
group.amsat-vk.org

About AMSAT-VK

AMSAT-VK is a group of Australian amateur radio operators who share a common interest in building, launching and communicating with each other through non-commercial amateur radio satellites. Many of our members also have an interest in other space based communications, including listening to and communicating with the International Space Station, Earth-Moon-Earth (EME), monitoring weather (WX) satellites and other spacecraft. AMSAT-VK is the primary point of contact for those interested in becoming involved in amateur radio satellite operations. If you are interested in learning more about satellite operations or just wish to become a member of AMSAT-Australia, please see our website.

AMSAT-VK monthly net

Australian National Satellite net

The Australian National Satellite Net is held on the second Tuesday of the month (except January) at 8.30 pm eastern, that's either 9.30 or 10.30Z depending on daylight saving. Please note we will be taking check-ins from 8.20pm-ish. Check-in starts 10 minutes prior to the start time. The AMSAT-VK net has been running for many years with the aim of allowing amateur radio operators who are operating or have an interest in working in the satellite mode, to make contact with others in order to share their experiences and to catch up on pertinent news. The format also facilitates other aspects like making 'skeds' and for a general 'off-bird' chat. Operators may join the net via EchoLink by connecting to either the "AMSAT" or "VK3JED" conferences. Past experience has shown that the VK3JED server offers clearer audio. The net is also available via IRLP reflector number 9558. In addition to the EchoLink conference, the net will also be available via RF on the following repeaters and links.

In New South Wales
VK2RBM Blue Mountains repeater on 147.050 MHz

In Queensland
VK4RRC Redcliffe 146.925 MHz -ve offset IRLP node 6404 EchoLink 44666

In South Australia
VK5TRM, Loxton on 147.175 MHz
VK5RSC, Mt Terrible on 439.825 MHz IRLP node 6278,
EchoLink node 399996

In Tasmania
VK7RTV 2 m. Repeater Stowport 146.775 MHz. IRLP 6616

In the Northern Territory
VK8MA, Katherine on 146.750, CTCSS 91.5, IRLP Node 6800

We are keen to have the net carried by other EchoLink or IRLP enabled repeaters and links in order to improve coverage. If you are interested in carrying our net on your system, please contact Paul via email. Frequencies and nodes can change without much notice. Details are put on the AMSAT-VK group site.

Become involved

Amateur satellite operating is one of the most interesting and rewarding modes in our hobby. The birds are relatively easy to access and require very little hardware investment to get started. You can gain access to the FM 'repeaters in the sky' with just a dual band handheld operating on 2 m and 70 cm. These easy-to-use and popular FM satellites will give hams national communications and handheld access into New Zealand at various times through the day and night. Currently only SO-50 is available.

Should you wish to join AMSAT VK, details are available on the web site or sign-up at our group site as above. Membership is free and you will be made very welcome.

Meteor Scatter Report

Dr Kevin Johnston VK4UH

VHF Meteor Scatter: an introduction to operating practice in VK **Part -1**

Photo 1: Photograph depicting a typical meteor trail or "Shooting Star".

Photo 2: Image of a meteor trail at 100 km altitude, as seen from the International Space Station which is itself orbiting at around 400 km altitude (NASA).

The purpose of this short series of articles is to provide answers to some simple questions about this fascinating aspect of amateur radio. Rather than being a 'master-class' for those already active on meteor scatter (MS), this short series is aimed towards those who have had zero or minimal exposure to this type of operating. Mathematics and complicated formulae have been deliberately kept to a minimum. So, with that in mind, let's go to the beginning: -

What is a meteor?

A meteor is a tiny fragment of matter originating from outer-space that is drawn into the gravitational field of our earth and is accelerated towards the ground. Reaching astronomical velocities, all extra-terrestrial meteors are, by definition, completely ablated (burned up) on entry to the upper levels of the earth atmosphere. This differentiates **meteors** from **meteorites.**

Meteorites are, by definition, sufficiently large to make it all the way to the ground without being wholly ablated. Small pieces of meteorite are frequently found on the ground, especially in desert areas, where they typically show entirely different structures and chemical composition from the local geology, clearly not originating from where they are found.

Meteors are the origin of the terms "shooting", "falling" or "wishing" stars, which have been seen to flash across the night sky since the earliest of times. The brilliant streaks of light, often much brighter than surrounding stars, are due to the 'ablation' (burn-up) of the meteors where their enormous kinetic energy is released to air molecules in the upper atmosphere, which become so compressed that they become 'incandescent' and the energy is released as a flash or track of light.

What have meteors got to do with radio propagation? When meteors are ablated, the released kinetic energy produces the bright, visible trail across the night sky. It also results in a long and persistent trail of ionisation in its wake. Ionisation is due to the release of free electrons from the air molecules as a result of the enormous temperatures achieved. This ionised trail is frequently able to reflect or refract VHF radio signals back to earth giving rise to the radio propagation phenomenon known as meteor scatter.

Ablation of meteors typically occurs at an altitude around 100 km above the ground since this is the first part of the atmosphere where the air is sufficiently dense to slow them down by air resistance. It is

the region where both the visual trail and meteor scatter occur. This, incidentally, is the same height as the E-region (aka E-layer) where most short-skip HF day-time propagation occurs. Indeed, the very existence of the E-region is in part due to the iron and nickel ions released from meteors at ablation.

Can meteor scatter be used for communication?

Although the brilliant visual meteor trails last for only a tiny fraction of a second, typically less than 1ms, the ionised trails remaining may persist for much longer. Meteors of interest for amateur communication lie mostly between the size and mass of a grain of sand and the size and mass of a dried pea (0.1-1.0 grams) and typically achieve velocities of 10–100 km/second as they accelerate towards the ground under the effect of gravity.

Ablation of these optimum-sized meteors leads to ionisation tracks persisting in the atmosphere for anything from a few milliseconds to, occasionally, hundreds of seconds. The majority, however, of meteors usable for amateur communication produce ionisation and radio returns (reflection) for 0.1s to five seconds at a time. Some, however, persist for much longer periods.

Why do meteors only come at night?

In fact, they don't. Meteors enter the earth's atmosphere at all hours of the day and night and across all seasons of the year. However, during daylight hours the visual meteor trails are overwhelmed by ambient light and are not seen by the naked eye; the same reason that stars are not seen during the day.

Even though meteors are always there 24/7, meteor scatter propagation, however, is not constant. There is a marked 'peak' in signal returns in the pre-dawn period and a corresponding minimum, or dip, in the afternoon each day. This daily cycle is superimposed on a much longer one with a peak in the Spring-Summer season in each hemisphere and a corresponding dip in the autumn/vernal-Winter season each year.

The astronomy and physics behind this recurring pattern of 'random meteor scatter' will be explained shortly. Before that explanation, however, is another dimension to this amazing aspect of our hobby – that being the phenomenon of 'meteor showers.

Photo 2: Engraved image depicting the Leonid meteor shower of 1833 (Volmey 1889).

Photo 3: Time-lapse photograph of the Orionid meteor shower. All meteors appear to be emanating from the centre of the easily recognised constellation of Orion 'The Hunter', with the three stars forming his belt.

What is a meteor shower?

Superimposed on the pattern of random or background meteor activity, as described above, are regular periods throughout the year when there is enormous enhancement of both visual meteors and meteor scatter propagation. These periods are called meteor showers, and again, the enhancement of visual meteor

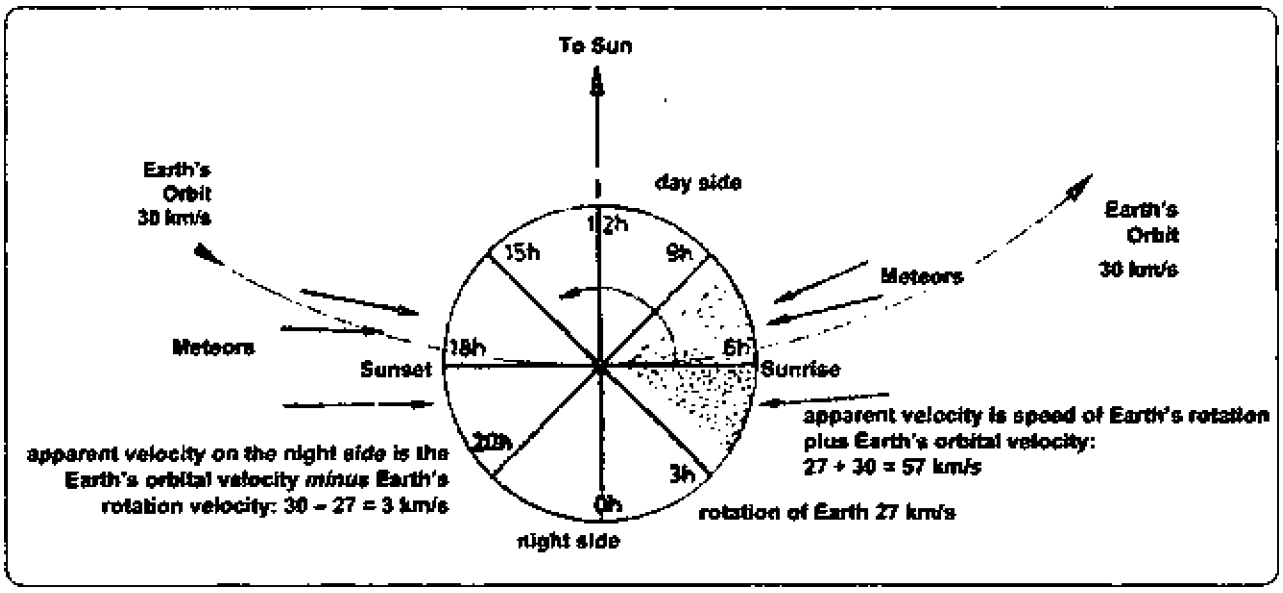

Figure 1: Relative velocities of a point on the Earth's surface comparing sunrise to sunset.

sightings at certain times of the year have been recognised for thousands of years.

Some showers present visual meteor sightings numbering tens or even hundreds every hour and some events in history have been described as the "sky falling". Some such events have been afforded magical significance in the past. These events occur regularly and there are at least eleven major and a host of minor meteor showers each year. Almost one a month. The peak of meteor showers occurs on regular and highly predictable dates each year. Enhancement of meteor scatter propagation parallels these peaks in visual sightings.

Meteor showers occur when the orbit of the earth around the sun takes it through bands of debris remaining from the earlier passage of comets or asteroids across our own solar system. Since these bands of 'cosmic detritus' are effectively stationary in relationship to our Sun, then we cross that path on the same date each year since it is our position in that orbit that actually defines the date and the seasons.

Also determined by that position in the orbit are the dominant star constellations as seen from Earth on that date. A unique feature of meteors in a shower, as distinct from random, background meteors, is that they all appear to be radiating from a single point in the sky – called the Zenith. Historically, meteor showers have been named according to which constellation or star they appear to be emanating from. Meteors apparently arising from the constellation of Leo in November each year are called the *Leonids* and occur as the Earth passes through the track remaining from Comet 55 P/Temple-Tuttle.

The *Orionid* shower in October, named after the constellation of Orion, is the aftermath of Halley's Comet, and the Geminids shower in December following the passage of asteroid 3200 Phaeton across the solar system. Clearly the meteors are not arising from the stars in those naming constellations, which are millions of light-years away from earth, they only appear to do so as a trick of the calendar and the orbit of the earth.

How rare are meteors?

Not rare at all. Conservative estimates put the mass of extra-terrestrial material entering the earth's atmosphere, from outer space, to be in the region of 100,000 tonnes per year. If you do a quick estimate of the number of grains of sand, each weighing one tenth of a gram, that are needed to make up 100,000 tonnes, then this will give some idea of just how common meteors actually are.

Why does MS propagation peak before dawn and in spring?

The answer to this is all down to some simple physics – illustrated in Figure 1. Like all the planets in the solar system, the earth is orbiting around the Sun. The Earth completes its orbit, by definition in one-year, or every 365.25 days, give or take. Determined by the physical distance it travels in that time, the length of the orbit (approximately 940 million km), this means that the Earth is actually traveling through space at a velocity (distance/time) of around 30 km/second. At the same time, the Earth itself is rotating, from west to east around its own axis and completes one complete revolution every 24 hours – the definition of one day.

Based on the circumference of the Earth itself (approx. 40,075 mm at the equator) this means that a point on the surface of the Earth at the equator is also moving through

space at a velocity of around 27 km/s by virtue of its own rotation. Seen from above the North Pole, looking down on the Earth, the rotation of the Earth appears to be anticlockwise. The day side is facing the Sun (towards the top of the diagram Figure 1). The night side facing away from the Sun, towards the bottom of the diagram.

From the perspective of a point on the Earth's surface moving into sunrise, then the equivalent velocity through space is the sum of those two velocities due to the orbit of the Earth around the Sun and from the Earth's own rotation – something approaching 67 km/s, since both motions are acting in the same direction. Meteors entering the atmosphere on the sunrise side of the Earth are meeting this rotational velocity head-on and achieve the optimum conditions for ablation - like bugs hitting the front windscreen of a car!

From the perspective of an equivalent point on the Earth's surface moving into sunset, then the opposite effect is occurring. Here, the two relative velocities are acting in opposite directions and the true velocity through space on the sunset side of the Earth is only 3 km/s, which enormously reduces the number of meteors achieving the optimum conditions for ablation on that side of the Earth. Not many bugs get stuck on the back window!

The seasonal variations with a peak in meteor scatter propagation in spring/summer, and corresponding trough during autumn/winter, are due to the fact that the axis of rotation of the Earth itself is inclined at around 23 degrees to the plane of the orbit around the sun. Summer occurs when that tilt faces the Earth towards the Sun, winter when the tilt faces it away. That same tilt towards the Sun in the summer season enhances optimum conditions for meteor ablation and meteor scatter.

Shower name	Peak date
Lyrids	22 April
Eta Aquarids	5-6 May
Southern Delta Aquarids	28-29 July
Orionids	21 October
Leonids	17-18 November
Geminids	13-14December

Table 1: The top six meteor showers each year.

The second part of this series will cover the mechanisms of reflection and refraction of VHF radio signals from ionised meteor trails and how these are used to achieve QSOs by meteor scatter over much larger distances than normally achievable on the VHF bands. The equipment required and the operating techniques involved in meteor scatter operation will also be covered.

VK2 news

Stuart Walker VK2BMX
e *office@arnsw.org.au*

With the recent passing of Tim Mills VK2ZTM, I have taken over the presentation of the VK2 News for inclusion in *Amateur Radio* magazine.

Amateur Radio NSW has temporarily suspended all events at VK2WI Dural. The Board is planning to resume in-person activities once it is reasonable, in accordance with the public health advice. The Dural site remains closed to visitors, with most work being carried out remotely, where practical. Enquiries can still be made via email, to *office@arnsw.org.au*, or by phone to 02 9651 1490; both of these are being monitored remotely.

VK2WI News Broadcasts continue on Sunday mornings, starting as usual at 10am local time with WIA National News, followed by VK2WI Local News and features.

The Evening bulletins have temporarily been suspended, but it is planned to resume them within the next couple of months.

VK2WI News continues to be relayed via many VHF and UHF repeaters. ARNSW would like to thank those clubs for their continued support of this local news service.

With the public health restrictions in place, many groups have moved activities from in-person to on-air. The Manly-Warringah Radio Society and the Hornsby Club (HADARC) are two examples of clubs that have transformed club meetings into additional nets on their respective club repeaters.

The two weekly nets of the Oxley Region Amateur Radio Club are receiving increased patronage. Special mention should be made of regional clubs, including the Central Coast Amateur Radio Club and the Amateur Radio Central West Group, who have instigated morning and afternoon "Cuppa Tea nets" in order to check-in and provide some general conversation for members that may be physically isolating or are simply looking for additional activities at the moment.

Visit the ARNSW website, at: *www.arnsw.org.au*

SOTA and Parks

Allen Harvie VK3ARH
e *vk3arh@wia.org.au*

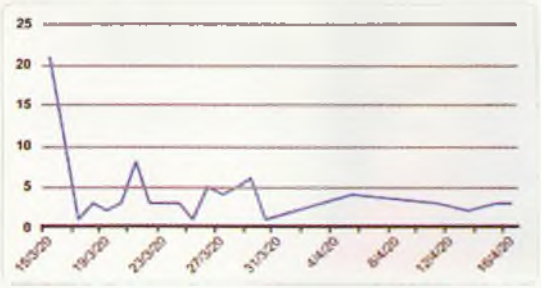

Figure 1. SOTA activations tracked over mid-January through mid-April.

Portable in a coronavirus pandemic

Owing to the COVID-19 world-wide situation, activations such as SOTA and WWFF have been canned or severely restricted due to localised travel constraints. While many national parks across Australia remain closed in the aftermath of bushfire devastation, COVID-19 is casting doubt over a range of recreational activities as new government guidelines point us towards our living rooms and away from the great outdoors. But, you have to leave your house to make contacts using portable radio.

Currently, the recommendations are to stay at home and isolate as much as possible. While currently not a recommendation in some states, getting out for 'playing radio' isn't one of the exceptions. As a result, most people are hunkered down at home due to the travel and activity restrictions.

Both SOTA and WWFF awards require the activators to ensure that they are abiding by the specific requirements for their relevant state or territory government. With many sites being on private property, the situation that, just because a site or location may be registered for SOTA or WWFF, does not ensure access.

Various government regulations control access to sites. This is why sites like VK3/VC-004, Mount Observation, or VK8/UL-043 Uluru, are off the agenda. The situation with COVID-19 is just another consideration, and restrictions differ from state to state in Australia.

I was able to work from home early in the piece during this pandemic, so was able to monitor daytime HF and noticed that the bands are quite active. Nets are becoming popular! There is still some US-based SOTA and POTA activity, and EU – both SOTA and WWF. Local activations, be they SOTA, VKFF, Shires or even QRP from anywhere, are few and far between.

Figure 1 is a chart of activations each day between the 15th of January and the 16th of April. You can see the 'spike' of the John Moyle Field Day at the left – the stated aim of the event is to encourage, and provide familiarisation with, portable and field operation, as well as to afford training for emergency situations. Otherwise, only those in the right spot for work, or with a summit where they can exercise, are able to activate.

ZL2AL Activity Marathon 2020

This is a COVID breaker, see: *http://zl3x.com/marathon/*. Four or more contacts on any mode on at least 90 days out of the many left in the calendar year. There tends to be activity around 1000 hrs VK / midday ZL, involving SOTA and WWFF operators. Also, keep your radio on for the new activity – Backyards on the Air (BOTA?)!

So, as it is, any expectations that travel restrictions will be lifted 'real soon now' are dashed. Keep in mind the seasonal access restrictions generally run from June (Queen's Birthday weekend) to November (Melbourne Cup day weekend), so there will be a window to pick up some favourites before the road closures. There is always activity in the background.

SOTA Watch API and site upgrade

The hard-working people behind SOTA (including our Andrew VK3ARR) have completed a mammoth upgrade of the SOTA sites and deployment of API. The sites now use HTTPS and 'Single Sign-On' across the sites. Ensure your links point to the correct addresses:
https://www.sota.org.uk/
https://sotawatch.sota.org.uk/
https://www.sotadata.org.uk/en/
https://summits.sota.org.uk/

And don't forget that these sites are run by volunteers, so go to the SOTA shop (https://sota-shop.co.uk/) and buy some bling (or simply make a donation) to help run the show.

The ParksnPeaks.org site, plus the PnP iOS app and VK port-a-logger, have all been upgraded to support the use of HTTPS and updated API.

New VK6 parks

VK6 received 84 new WWFF sites in late March. Whenever there are updates to the WWFF scheme, Marc VK3OHM works to process and supply site data that included accurate location and boundary files. This is never a trivial task with computers running overnight to process the known site and verify against Collaborative Australian Protected Areas Database (CAPAD) and SOTA site data. These files are available for PnP *(https://parksnpeaks.org/viewMaps.php)*.

If haven't done so already, then checkout Peter VK3YE's YouTube channel for all round great information for portable operators. Visit: *https://www.youtube.com/user/vk3ye*

So again, at this stage, assume that all activation weekends, UK/VK, JA evenings, Shires weekends et al, are postponed until travel restrictions are lifted. We are awaiting the post Corona season!

Allen VK3ARH

ALARA

Jenny Wardrop VK3WQ

Well, they say that no news is good news, but at the moment no news means no, or very little, ALARA Activity. Hopefully, you are all still well and haven't contracted the Corona virus. If you have, we trust that you are recovering satisfactorily.

ALARA 2020 AGM

Our Annual General Meeting was held on 4 May 2020m, with the following officers being elected for 2020-21.

President - Linda Luther Vk7qp

Vice President - Shirley Tregellas VK5YL

Secretary/Minute Sec. Tina Clogg VK5TMC

Treasurer, Membership & Souvenir Custodian – Catherine Hammond VK7GH

Sponsorship Officer – Tina Clogg VK5TMC

Publicity Officer - Jenny Wardrop VK3WQ

Editor – Tina Clogg VK5TMC

Award Custodian - Marilyn Syme VK5DMS

Historian/Librarian - Vacant

Contest Manager - Sue Southcott VK5AYL

Webmistress – Lyn Battle VK4SWE

State Reps: VK1/2DB Dot Bishop VK2DB; VK3 Jean Fisher VK3VIP; VK4 Lyn Battle VK4SWE; VK5/8 Jean Kopp VK5TSX; VK6 Bev Hebiton VK6DE; VK7 Linda Luther VK7QP.

WARO in Recess

We have been saddened to hear that our sister organisation WARO, the Women Amateur Radio Operators of New Zealand, has had to go into recess. Most of its Committee members are older and/or have health problems and, despite constant requests for newer members to "step-up", unfortunately no-one has offered.

WARO's AGM was canceled for this year, but they are hoping that when they meet face to face next year in Hastings at the NZART National Conference in June, they might get some new volunteers.

It is a very sad situation, considering the great and positive times they have had over 50-plus years. I guess it's a situation that many organisations fear these days. In the meantime, their Bulletin magazine will continue as articles come in, and their nets will continue, but the rest has just had to go by the wayside for the time being. We hope that they will be able to resolve the situation, and a letter has been sent to them expressing best wishes from ALARA.

Photo 1: The jury-rigged hex beam used by Rose-Marie KB4RM.

Greetings from Kulnura - VK2AKB

Karen VK2AKB relates: "my daily 'radio routine' is to check into the WICEN NSW Health and Welfare Net on the Chatswood Repeater VK2RWC at 9am, and then the CCARC Morning Tea/Are you OK Net on the 2M Somersby repeater VK2RAG at 10am."

She explained that, when writing to me, she was net controller for the Morning Tea/Are you OK Net, because the usual net controller, Bob VK2AOR, was going to see the doctor. He has been net controller for 45 consecutive days, but had to take a sickie for the 46th day.

Continuing, Karen says, *"I'm enjoying my new Motorola DM4601e, which I purchased through WICEN NSW at a discounted price. We have a very good VHF location to get into the Chatswood Repeater, which is about 70 km from our QTH."*

"Also, as a Level 3 Assessor for the AMC-AR, I can do remote assessments." Karen has now held her first assessment, which was for a Foundation and a practical.

"I don't have the spare time to sit and enjoy my radio like I used to", she says, *"due to the farm work and caring for my mother-in-law, who is approaching her 95th birthday. Keep well everyone, and stay safe.*

"33, Karen VK2AKB and the custodian of VK2YX (which I'm keeping for CW when life goes back to normal)."

From Dot VK2DB: "An item from one of my radio sisters (sponsors) Rose-Marie KB4RM who reports, "This is my Hex-beam in the bucket of concrete on the terrace of our rented house. We are not allowed to have antennas, but we put it up and it was four months before we were told to take it down. We asked if we could wait until after this isolation is over and we now have it 'til July. Then we hope we get to have it longer. We do DX on it with an amplifier, too. I do get Sweden so I am happy'."

Rose-Marie explained that "*... most of our stuff is packed away since 2016 when we moved to Texas three years ago and are now are back in Virginia – same place as before, Charlottesville, but not at old house we sold. We now rent a house and are looking to buy, so will not unpack more than what we need. After four years, you start to wonder if you need all the stuff that is packed away."*

Photo 3: The plaque in Victoria Harbour, Canada, commemorating the world-record round-the-globe voyage of Jeanne Socrates VE0JS.

News from our Founder

I know that we don't usually do baby photos, but this baby has a rather special 'Grandma'. Norma VK2YL instigated of the founding of ALARA (originally known as LARA) in 1975, along with several others, many of whom were university students.

A recent email from Norma included the news that daughter Christine VK2FIZI and husband Dan had a baby boy in April. They went to Sydney for the birth as they were living in Roxby Downs and, due to insufficient medical care there, they had to go to a bigger town; so, obviously Sydney, where Norma and OM Frank VK2AKG live, was their first choice. The baby, Charles, is Norma and Frank's first grandchild, and perhaps this is the start of a new generation of amateurs? Their other daughters, Lorraine VK2FICQ and Michelle VK2FMYL, are active and members of ALARA.


Photo 2: Norma VK2YL with grandson Charles.

Norma also commented, "The only other news is that as we are staying at home a lot now. I am more active on echolink and join the ALARA nets occasionally (when I remember). I also go on the scout nets regularly on Jota 365 on Saturday nights at 0800 utc, as does Michelle VK2FMYL. We have made friends with scout leaders in UK, Netherlands, Hong Kong, Denmark and USA."

And hot off the proverbial press comes this news from Jeanne Socrates VE0JS, in an email titled 'Feeling very honoured': "Just been informed of this plaque having been installed on Victoria (Canada) Harbour's Wall of History, overlooking the harbour (and Nereida) close to the Parliament building."

Nereida is Jeanne's boat in which she sailed solo, non-stop and unassisted, around the world from and to Victoria, Canada. At 77 years old, she was the oldest person to do so – a world record.

I believe that Jeanne may still in Western Australia, where she has been isolating with friends since the COVID-19 virus forced the closing of the WA borders and, sadly has been unable to continue on her around Australia holiday. Perhaps we may be able to claim her as an Australian soon!

Between verification and validation

Brian Clarke VK2GCE

In the editorial I wrote for Issue N0.1, 2020, I mentioned that I had attempted to contact amateur radio bodies like the WIA in other parts of the world. One of my early respondents was Mark Gooding ZL2UFI from the NZART. I am grateful to Mark for reminding me that what might appear to work in one place might not in another. Dale Hughes VK1DSH has reinforced this notion. Mark's and Dale's observations fit well with the 1980s contingency view of the design of organisations.

Who can recall the 'World's Best Practice' craze, with its notion of 'Benchmarking' that swept though parts of western civilisation in the 1990s – the notion that good ideas can be transplanted *ad eundum et ad infinitum*? (meaning: in the same way forever more). And who remembers the headlong rush, starting in 1987, to apply the ISO 9000 family of quality standards to everything? Both World's Best Practice and ISO 9000 were universalistic and ran counter to contingency theory.

They were about traceability; that is, does the product match what was in the deposited, documented specification? In engineering terms, this is **verification**. But if you are a good engineer, as are some IT software people, you know that the product must perform well in the real world; this is called **validation**. Visit any software engineer and you will find the V-diagram stretching between verification and validation.

Frederick Winslow Taylor (b. 1857) introduced Scientific Management to steel manufacturing at Bethlehem Steel in Philadelphia around 1880. His published work, 'The Principles of Scientific Management' (1911), was a forerunner to Industrial Engineering.

A transceiver powered by a pedal-operated generator was invented by Alfred Traeger in 1927. The technology became central to the success of the Royal Flying Doctor Service and, later, long-distance School of the Air education across the Australian outback.

It was all about **verification**. The Americans loved it because it gave more power to management over those pesky labour unions.

A near equivalent of **validation** started much later.

One W Edwards Deming (b1900), an electrical engineer, earned his PhD in 1928 from Yale University, supervised by Walter Shewhart. Who is he, you ask? He invented the Plan-Do-Check-Act cycle. Deming's statistical sampling ideas were employed by the US Department of the Census and the Bureau of Labour Statistics. After WWII, General Douglas MacArthur attempted to lift the quality of Japanese manufacturing. I recall in the 1940s, the Japanese toys my Mum and Dad bought me. Even as a 6-year old, I could see they were rubbish. MacArthur chose Deming to show the way. Deming chose to observe the realistic variation in people's production methods. He chose contextualised reality (validation) to management fiat (verification).

The Jaguar impact

After graduating from university, I owned a string of Jaguar cars. I read about William Lyons, who followed Harry Weslake's engine design using overhead valves and a hemispherical combustion chamber; I thought, 'What a marvel', because it produced more power per cubic centimetre of engine displacement than the side-valve engines of Ford and Morris. I stripped and rebuilt several Jaguar engines when they failed, usually at no more than 150,000 km.

Then, I met a fellow who owned several Toyota cars. He had not changed the engine oil in over 300,000 km and there was no sign or sound of engine failure; the oil on the dipstick looked brand new. On one of his engines, he wanted to change from carburetion to direct injection. He and I stripped the engine. As soon as I saw the designs of the crankshaft, pistons, connecting rods, oil-ways and the bearings, I knew exactly what Deming had started – the Kaizen way.

Deming's approach to improving manufacturing quality has almost become a religion in Japanese factories. The effect has been that Japanese products now command such a premium that most Japanese people cannot afford them and must buy Chinese. The philosophy

has now become 'Total Quality Management' (TQM), also known as 'Kaizen' in Japanese manufacturing, and the statistical analytic ideas have become enshrined in '6-sigma'.

When I was teaching Electrotechnology at TAFE in the early 1990s, a head-office person called us to a meeting to introduce us to the wonderful benefits of ISO 9000. The mandate was that all our documentation had to be traceable back to where it originated. I thought, "What a wonderful way to waste tax-payers' money." So, when she finished her spiel, I got up and presented TQM. We didn't hear of ISO 9000 again.

Focus

Late in WWII, Akio Morita – the founder of Sony – started designing and building Japanese RADAR equipment. To get tighter target resolution, it was necessary to use higher frequencies than the British Chain Home Service, which operated around 50 MHz. This is where he taught himself miniaturisation, later producing the first transistor portable radio in 1955. Sony never ventured into amateur radio, instead focussing on premium-quality professional audio and video equipment.

The move to miniaturisation and the use of transistors was soon taken up by other Japanese manufacturers. So now, on the one hand we have Icom and Kenwood (Japanese) amateur radio products, and on the other we are inundated with cheap, tiny Baofeng and Baojie (Chinese) products, whose unwanted spectrum spurious emission products go unchallenged, and whose multi-function user-interface buttons fall apart through continued menu scrabbling. AWA, Barrett, Codan, and Tait could have given the Japanese and Chinese amateur radio products the broom.

AWA produced the A-510 in 1954, a radio that was half the weight and superior in performance to the English WS No. 68 infantry radios and the American PRC-8 family, where it was validated in the jungles of Malaya and South Vietnam. Subsequently, AWA produced the PRC-F1, an HF marvel with a synthesised VFO. Then it chose to worship Mammon via gaming machines and went belly-up. Barrett, Codan, and Tait have focussed on the First Responder market, ignoring the amateur radio market. To these manufacturers, validation of their products in their specific world-wide markets has been a continuing success story.

Where is this going?

Why am I telling you all this? It is to validate what Mark Gooding and Dale Hughes said. While I will relay what I have uncovered in nine other countries' amateur radio organisations about how they attract and retain their members, I will urge caution that we choose what will work in our economic, political, cultural, legislative and technical world. In the meantime, get yourself an all-HF Codan or Barret radio to enjoy a product that will meet stringent spectrum spurious emission specifications, or start modifying a Tait VHF set for the amateur bands. You do have and know how to use a surface-mount soldering iron, don't you?

Following in Akio Morita's footsteps, we have all seen the miniaturisation of communication devices – phones, tablets, transceivers. They all require powering. How do you choose a specific battery chemistry for your device? Use the existing LeClanché cell, or try the latest lithium compound? Perhaps use your body?

In 1912, John Flynn started providing medical services by air. In 1927 he got Alfraed Traeger to develop a pedal-powered radio. During WWII, many wireless sets were issued with a hand or pedal operated generator, including AWA's A-510. The human body emits about 75 W of heat continuously, but at very high entropy. A fit person can operate a hand or pedal generator at a maximum of about 200 W, but only for a short period; the efficiency of the human body in converting food into mechanical energy is about as good as an internal combustion engine, no more than 26%; where does the rest go? Sugar, fat and muscle build-up, and heat.

There have been attempts to use piezo-style generators built into shoes; the energy produced is just about enough to power a digital watch, but certainly not enough for a cochlear implant, let alone a heart pace-maker, particularly one with an automatic defibrillator. What can you come up with that could power say an HT or small tablet from your body?

OK, now you have an impetus to produce something new. The next step is write up your design, its prototyping, the photographic trail, initial testing and what you have learned that will go into Version 2. Or perhaps you have written some new software that can be used to control an antenna rotator or an SDR. Now is the time to submit it to this magazines' Editor. We have guidelines on how to write your article – just ask via email: *armag@wia.org.au*

DX Talk

Steve Barr VK3KTT
e *vk3ktt@gmail.com*

With Melbourne locked down, on the surface it certainly appears grim times in DXing if you are well on your way. For others, with more time at home and respectively more time for the hobby, the wonders of the DX World are just beginning to emerge.

It is with a heavy heart that I have little in the way of DX news to report, given that most major and minor dxpeditions have been cancelled due to the COVID-19 Pandemic. As such, we are left with resident operators. However, you would be quite surprised to discover resident operators in many exotic DX locations.

Around the bands

First, on a sad note, the Italian dxpedition group has cancelled its dxpedition to Chad this year after last year's dxpedition there was cancelled. They are hoping for a better 2021.

6O1OO, Ali, has left Somalia and is scheduled to return in mid-November

5Z – Kenya – 5Z4/G3AB, Andy, has a new resident callsign: 5Z4VJ

Also, **5Z4/ZS5J** is now 5Z4J. QSL manager is M0URX.

E51WL has returned to the North Cook Islands and should catch up on his QSL cards in-situ. Keep an ear out for Warwick on 6m over the summer; I have worked him on 6m.

New Op: ZL7STU joins Chris ZL7DX on the Chatham Islands.

XW2DX, Mike, operating out of Vientiane, Laos, does LoTW. However, QSL is via RM0L.

8J1RL, the Japanese Antarctica Research Expedition (JARE) – IOTA AN-015 – "Taka" (JA1AGS) and "Hiro" (JH7JCX) are both operating, mainly FT8. QSL through the Bureau to "8J1RL", or SASE to JARL (no LoTW and PayPal).

A reminder that **TR8CA**, Gabon – Alain, always loves to work VK, mainly on FT8 these days, but SSB, RTTY and CW are possibilities.

ZD7MY, Barrie, on St. Helena Island, was worked here in June on 30m using FT8, the final mode and a new band for me. Noting from my log, I have worked ZD7 in October and November, also.

D2EB, Gab, is still in Angola working the radio, mainly in our morning on most bands.

No 'one' is an island

Now for many of you who have been hitting the bands hard and filling-in all those FT8 slots, you are very likely feeling a bit jaded with the same operators on the same bands at the same time etc, so you all need something new and exciting.

One opportunity that I quickly found and enjoyed was IOTA chasing. This is where one can chase all the islands in the world, of which there are more than 1000 to be sought. This will certainly keep you busy, so I recommend next time you work someone on an island, do check out his IOTA number at QRZ.com and be sure to make the appropriate entries in your logs.

More info on this can be found online, here: *www.iota-world.org/*

What's old is new, again

Last but not least, have you thought about using CW to make dx contacts? I can hear you grumbling and then dismissing me.

Like you, myself and many of my ham friends, back "in the day", all thought it was too much hassle and we were too old to learn. That was until we found the magic buttons on our radios with the CW memory key and a program called a CW decoder.

Back when I was clawing my way up the DXCC ladder, I reached 220 - 240 DXCCs worked. In those humble beginnings there was no FT8, only RTTY, PSK31 and a few souls who did JT65.

After reading lots of DX info I realized a lot of dxpeditions had a heavy focus on CW and not so much on SSB, which was my mode of choice. So I decided to have a go.

If you want decode CW, there are programs that can do this for you. You just need to plug in your USB cable to your rig and find the correct USB audio port: *www.dxsoft.com/en/products/cwget/* Remember press the Auto GTM (Go To Max).

One of the better decoders is MRP40. Get it here: *www.polar-electric.com/Morse/MRP40-EN/*

Hopefully, there will be more to report next month! Lastly, don't forget the VK DX Chasers Facebook page for all your DX Spots and info: *www.facebook.com/groups/vkdxchasers*

VK3news Geelong Amateur Radio Club

Tony Collis VK3JGC

Update on the GARC Internet Radio Linked Project 6572

The GARC IRLP Node project was started back in early 2017 by Lou VK3ALB and other club members. During its early development stages, the system has had many temporary homes ending up at the QTH of Dennis VK3BQZ in late 2018; eventually it will be relocated at Mount Anakie Repeater Hut when NBN access has been installed at the repeater site, replacing the need for the current Tait800 link.

The system incorporates the use of an IPEX Thin Office desktop mini-computer with LINUX operating system, a DTMF control board based on the K0KN design, and software by David VK7ETD.

The node can be accessed via VK3ATL on 147.00 MHz, using the appropriate DTMF tones.

Development of an automatic Broadcast mp3 file retrieval and replay system by VK2YD has facilitated the regular Evening Broadcast on GARC Net, which links VK3ATL at Mount Anakie, VK3ROW at Beach Forest, and VK3RWL Warrnambool.

Daily Playback time is 9:00 pm Local (AEST). Prelude Announcement is by Craig Meddings VK3CRG every night, followed by regular Amateur Radio News Broadcasts.

The Repeater Team is planning to introduce an additional service to the above weekly table, by preceding the nightly news service re-broadcast with the current month's GARC Syllabus managed by Alan VK3LCD, which can also be found at: www.vk3atl.org.

The syllabus broadcast will also be available 'on-demand', by sending: DTMF –GARC.

Weekday	Broadcast Source	
Sunday	VK6.	(News West)
Monday	ARNL.	(Amateur Radio News Line)
Tuesday	RAOTC.	(Radio Amateur Old Timers Club. VK3OTN)
Wednesday	WIA.	(Wireless Institute of Australia. VK1WIA)
Thursday	NZART.	(New Zealand Association of Radio Transmitters.)
Friday	ARRL.	(Amateur Radio Relay League.)
Saturday	SARL	(South African Radio League. ZS6C)
Alternate Saturday	RSGB.	(Radio Society of Great Britain)

The GARC IRLP and Repeater Team. left to right: Bert VK3TU, Peter VK3WK and Dennis VK3BQZ.

VK3 news Amateur Radio Victoria

Tony Hambling VK3XV
e *arv@amateurradio.com.au*
w *www.amateurradio.com.au*

Amateur radio was on-show at the annual Train and Hobby show, staged by husband and wife team, Julie VK3FOWL and Joe VK3YSP. A great success!

Amateur radio "On Show"

At the kind invitation of Richard VK3VRS, Amateur Radio Victoria members, Julie VK3FOWL and Joe VK3YSP, provided their School Amateur Radio Club Network exhibition at Melbourne's Train and Hobby Show. This well-organised show is held every year at Sandown Racecourse, attracting many thousands of visitors each day over the long weekend in March.

This year, the exhibition included a large presentation area for children, including a parent's gallery, set aside for electronics, soldering and Morse code workshops, complete with slide-shows, take-home kits and free catalogues, kindly provided by Jaycar and Altronics. There were four public workshops scheduled each day over the three-day event.

Julie VK3FOWL said, "The response from members of the public to amateur radio is always very positive, particularly when it is directed at engaging youngsters in electronics and radio technologies, but what always surprises me is their interest in Morse code.

"We ran Morse code workshops and provided many Morse code practice sets to both adults and children. The sound of CW seems to work like a magnet".

The husband and wife team said they also had a lot of interest from school teachers and parents responding to Julie's School Amateur Radio Club display, featuring many photos of primary school students happily engaged in Amateur Radio activities.

"Teachers often need assistance promoting science, technology, engineering and mathematics to students and amateur radio is a great resource. We often go to schools and run free STEM workshops using amateur radio. But we can only do so much ourselves. We are always trying to encourage other Amateur Radio clubs and individuals to do the same," they said.

Well done Julie and Joe for promoting our hobby at this high-profile event.

The ARV Homebrew Group 2020

At the March meeting of the ARV Homebrew Group, seventeen members participated in an interesting and informative talk by Dieter Pelz, VK3FFB. The subject was 'Comparison of Yagi Antenna Matching Methods'.

Using a well-prepared Power Point presentation, Dieter began his talk by covering the historical development of the Yagi antenna and the various methods of matching available to us. The presentation expanded on 3D Electromagnetic Modelling, including the use of Smith Charts and actual comparisons of Hair Pin and Gamma Matching.

Dieter's presentation was concluded by a discussion regarding various antenna analysers, including several recommendations on brands currently available. The talk was followed by the usual Homebrew discussions.

ARV thanks Dieter for his professional presentation to the Homebrew group.

At the time of writing, the Homebrew Group is not meeting due to COVID-19 restrictions. However, we suggest Members subscribe to the ARV Homebrew Group newsletter for updates regarding recommencement.

Meetings are normally held in the ARV rooms, located at 40g Victory Blvd., Ashburton, on the first Saturday of each month (excluding January), at 2.00 pm.

2020 meeting dates remaining:
3 October, 7 November,
5 December. Contact Rob via:
vk3mq@ammateurradio.com.au

Keith Roget Award activation period 2020

The tenth annual activation period for the Keith Roget Memorial National Parks Award (KRMNPA) will now take place across two days in 2020 – Saturday 7 November 7 and Sunday 8 November.

Two Special Operating Awards will be available this year for the 10th Anniversary of this popular award. More details will be made available later in the year. All members are encouraged to participate in the Activation event. For more information, please contact Tony via:
vk3xv@amateurradio.com.au

Contest Notes

Marc Hillman VK3OHM
e *vk3ohm@wia.org.au*

Oceania DX Contest 2020

This will be the 75th running of the event. New for 2020 – the start time is 0600 UTC and finish 0600 UTC. Martin VK7GN provided a history and rules rundown in AR No.2 for 2020, pages 56-57.

Contest Period

Phone

Contest: 0600 UTC **Saturday 3 October** to 0600 UTC **Sunday 4 October** 2020.

CW

Contest: 0600 UTC **Saturday 10 October** to 06:00 UTC **Sunday 11 October** 2020.

Exchange

RS(T) report, plus a progressive contact serial number starting at 001. M2 and MM entries are to use a separate serial number for each band.

Rules

Full Rules are online, at *www.oceaniadxcontest.com*

Aim

The aim of the contest is to promote HF contacts with stations in the Oceania region.

The Object

The object is for:

- Oceania transmitting stations to contact stations both inside and outside Oceania.
- Non-Oceania transmitting stations to contact stations inside Oceania.
- Oceania receiving (SWL) stations to copy contest stations inside and outside Oceania.
- Non-Oceania receiving (SWL) stations to copy contest stations inside the Oceania region.

Contact Points

Each QSO is credited twenty points on 160m; ten points on 80m; five points on 40m; one point on 20m; two points on 15m; and three points on 10m.

Multiplier

The multiplier is the number of different valid prefixes worked. Note that the same prefix may be counted once on each band for multiplier credit.

The Final Score

The final score is the sum of the Contact Points multiplied by the Multiplier.

Logs

Electronic logs are preferred, and are mandatory for stations logging more than 50 contacts. Electronic logs are to be submitted in Cabrillo format. Submit your Cabrillo log file using the on-line submission form on the web site, at: *www.oceaniadxcontest.com*

Over to you

AR mag No. 2 for 2020

Worth the wait! Better than QST and Radcom.

Thanks.

Stephen VK2ASC

Congratulations to you and your team on the excellent 2nd edition of *AR* Mag for 2020. I enjoyed it immensely, especially so the articles on receiver restoration, the Callbook history and the Oceania DX contest, not to mention the review of Radio Girl by David Dufty, the recipient of the President's Commendation.

We are all indeed most fortunate that *AR* Magazine is now back in production for us to enjoy.

Keep up the great work you are all doing in this regard.

Cheers & 73

Mike Charteris VK4QS

Just thought I would say well done on the publishing of the 2020 issue 2 *AR* Magazine under these trying times we are in.

Look forward to future editions.

73, Peter VK4GIS

Silent Key

Rusty (John) McGrath VK4JM

Rusty, a founding member of the Bundaberg Amateur Radio Club, an active member and official for over 50 years, and a respected member of the Bundaberg community, passed away peacefully at Canossa Private Hospital, Brisbane, on 23 June 2020, aged 90 years.

While in the Merchant Navy, the Irishman became ill while in the port of Bundaberg. He was nursed by Jocelyn (now VK4JJ), who became his wife and life-long amateur radio partner. They raised a family of three sons and two daughters in their home at Elliot Heads. He was loving grandfather to seven and great grandfather to eight.

Rusty was a keen HF and VHF operator but his main interest was introducing others to the hobby, providing a training environment, and ensuring the Bundaberg Amateur Radio Club (BARC) was established and operated successfully for more than 50 years.

He was one of a group of amateur operators who met in September 1961 to form the Club. Rusty was president in 1964 and 1965, Secretary continuously from 1975 through 2008, before taking up

President again in 2008 and 2009. His only break from being an official of the Club were the years 1965-75 while he worked tirelessly for local Scouts when his children were involved. He retired from active club duties in 2014, but remained ever watchful and involved in Club activities.

Rusty was involved in the training of new operators from the inception of the Club util recently. He was an WIA assessor leading a local team conducting examinations and assessment for all levels of Amateur Radio licences. He was facilitator with the Radio & Electronics School, training candidates to Advanced standard. The Club's classes saw many Bundaberg youth get good jobs in Commonwealth and state government departments and industry, in addition to enabling their interesting hobby.

Rusty was an electrician with the Bundaberg City Council and, before his retirement, a Workplace Health and Safety and Training Officer.

Involved in WICEN activities, Rusty was WICEN Controller for the Bundaberg Region as well as Group Leader and Trainer for WICEN Bundaberg.

Rusty and his wife Joscelyn, VK4JJ supported radio club activities Australia-wide and brought back what they learned at conventions. He never stopped learning and sharing that knowledge with the club.

At the 2010 Australian Day celebration, Rusty was awarded Bundaberg Senior Citizen of the Year. In presenting the major Awards at the ceremony, the Mayor of Bundaberg made mention of the personal sacrifice and years of voluntary service by the award recipients.

'Forever In Our Hearts'

Submitted by George McLucas VK4AMG BARC AOCP Class 1964

Silent Key

Bob Whalley VK3BWZ

It is with great sadness I advise that Bob Whalley VK3BWZ passed away peacefully in his sleep on Saturday 14 March 2020 after his two-year fight with cancer. He was less than a month short of his 94th birthday.

Bob was originally licenced as VK3ZWZ, but later upgraded with Morse code to VK3BWZ. His father was a founding member of the WIA, then licenced as VK3WZ. Bob learned the science of radio in his teens as a radio fitter in the RAAF. After WW2, he spent the rest of his working life in PMG-Telstra.

He spent his first 20 years with PMG servicing teleprinters and facsimile machines around Melbourne and during the 1956 Olympic games. For his last 20 years in Telstra, he was an instructor at the Tooronga training school and finally retired as Vice Principal at the South Melbourne training school, now the site of the MTC.

He once famously said he had ". . spent more of his life retired than working", and during that time he was an active member of the Eastern and Mountain District Radio Club (EMDRC) and WICEN. Bob had a long association with EMDRC and I understand the club provided him a lot of joy in ham radio, which was more than a hobby to him.

In recent times, Bob was a regular at our Thursday clubroom meetings, where he would often bring a trinket from days gone by to discuss with members. Certainly, he was a popular member of the club and a very handy resource to discuss wartime military radio equipment.

Like me, some might have worked Bob during his frequent trips to the Merino Hotel in western Victoria, owned at the time by his son, Ian. I have several of these contacts recorded in my logbook. Clearly, radio is in the Whalley blood. Bobs father was licensed as VK3WZ, Bob as VK3BWZ, and his son Bruce (Wal), now proudly holding VK3WZ.

David VK3RU

Silent Key — Barry Fraser VK7FR

Amateurs and friends were saddened to hear of the passing of Barry Fraser VK7FR on 30 November 2019. Barry has had a lifetime of working in radio and television.

Barry started working for Radio Station 7LA in Launceston and then, in 1955, he started employment with the ABC, spending the first two years in Port Morseby.

In 1960, Barry was chosen as the opening presenter when ABC commenced TV broadcasts in 1960. Barry was dubbed "the golden voice" and the "most recognisable voice on ABC". Barry also did voiceover work and announcements for the TT Line that were used on the MS Spirit of Tasmania, and was a volunteer at HFC Christian radio.

Tony VK7AX became associated with Barry when they teamed up to produce a program called "Spectrum Tasmania", a news broadcast based on happenings in amateur radio within VK7, and small snippets from other world-wide amateur radio news. It aired once a week on the voice repeaters in the North of VK7 and on HF on 80m.

Barry, of course, was the announcer, while Tony handled the technical side, transmissions, etc.

Unfortunately, Barry suffered a Stroke in 2009, which affected his voice for several weeks. Not to be deterred, he worked hard to get his voice back to almost normal so he could continue with Spectrum broadcasts as well as programs for community FM Stations statewide, which he produced from his studio in Ulverstone.

Tony is very grateful to Barry for passing on his knowledge, particularly the art of proofreading dialogue to remove unnecessary wording and phrases. Unfortunately, as a result of his stroke, Barry's health deteriorated, spending the last 18 months in the Mt St Vincent Nursing home at Ulverstone, where he passed away peacefully with wife Mary (VK7NBL) by his side. Condolences to Mary and family. Vale Barry Fraser VK7FR, Final 73.

From Eric VK7EV and Tony VK7AX

Silent Key — John Coulston VK2TUV

It is with sadness that we inform readers that John Coulston VK2TUV became silent key in hospital on 8 February 2020 at 1215 pm. John was an active amateur radio operator and member of the Amateur Radio Central West Group (ARCWG). His life was celebrated at St Joseph's Catholic Church, Orange NSW, attended by a large congregation of family and friends to whom we extend sincere condolences. Vale John.

John VK2EJM, President ARCWG

Silent Key — Douglas Charlton VK7DK 29-09-1927 – 6-01-2020

Licensed in the 1940s, Doug loved amateur radio. During the Second World War, he served as an officer in the Royal Australian Navy. His expertise was as a mechanical engineer and, because of a shortage of men with his technical ability in England, he was loaned to the Royal Navy for two years. He also had a grounding in civil engineering and, after leaving the RAN, he travelled the world working on large projects. While living in America building skyscrapers in Las Vegas, he made lifelong friends with other radio amateurs.

Doug's passion was building RF amplifiers and large antenna systems, even a Sterba Curtain antenna between two large gum trees on his property near Perth, Tasmania. His expertise in engineering was reflected in the quality of his home-brew equipment, with separate RF amps for each of the bands he was interested in – everything finished in 'battleship grey'! This equipment, with a pair of phased HF Yagis pointing to the States, enabled him to keep in touch with friends in the USA on a daily basis, regardless of conditions!

Doug was an inveterate builder, and even in the couple of weeks before his passing aged 92, he had built and erected a six-element six metre beam onto the top of his 15m steel tower.

He passed away peacefully at the Launceston General Hospital. Loved husband of Marion (dec.), father of Keith, Russell and Nicola. Sadly missed by all his friends and family and his beloved border collie, Murphy. Vale Doug VK7DK.

Nic VK7BEE and Trevor VK7TB

John Moyle Memorial National Field Day 2020

Denis Johnstone VK4AE -
Contest Manager, JMMFD 2020

24 Hour Portable Operation – Multiple Operator

Call Sign	Operators	Mode	Band	Contacts	Score	Locator	Place / Award	Cert.
VK2WG	Multi	All	All	213	1,676	QF34RR	1 /*	1
VK6NC	Multi	All	All	221	559	OF88BH	2 /*	2
VK6ARG	Multi	All	All	77	517	OF87AB	3 /*	3
VK5WAT	Multi	All	All	84	203	QF21NW	4 /*	4
VK4LKB	Multi	Phone	All	233	486	QG62DA	1 /*	5
VK4WIT	Multi	Phone	All	157	377	QG39EX	2 /*	6
VK6WR	Multi	Phone	All	71	261	OF87AX	3 /*	7
VK4WIG	Multi	Phone	All	38	254	QG62OB	4 /*	8
VK3III	Multi	Phone	All	62	132	QF13CH	5 /*	9
VK2SRC	Multi	Phone	VHF	174	1,953	QF69JV	1 /**	10
VK2AMW	Multi	Phone	HF	442	882	QF55CH	1 /*	11
VK2MB	Multi	Phone	HF	229	458	QF58SB	2 /*	12
VK2NJP	Multi	Phone	HF	149	298	QF44WO	3 /*	13
VK5FAAH	Multi	Phone	HF	114	228	PF95IA	4 /*	14
VK2SRA	Multi	Phone	HF	23	46	QF45JS	5 /*	15

/* *Certificate Awarded*
** *President's Plaque*

Six Hour Portable Operation – Multiple Operator

Call Sign	Operators	Mode	Band	Contacts	Score	Locator	Place / Award	Cert.
VK6SVB	Multi	All	All	77	258	OF88CD	1 /*	16
VK4BAR	Multi	Phone	All	128	302	QG62PL	1 /*	17
VK7TAZ	Multi	Phone	All	33	284	QE38PL	2 /*	18
VK2CLR	Multi	Phone	All	104	240	QG60LE	3 /*	19
VK5LZ	Multi	Phone	All	25	85	PF95JG	4 /*	20
VK2FRE	Multi	Phone	All	33	81	QF67EX	5 /*	21
VK4QD	Multi	Phone	HF	265	530	QG62KU	1 /*	22
VK4NBX	Multi	Phone	HF	132	264	QG63HW	2 /*	23
VK3BEZ	Multi	Phone	HF	94	188	QF31IS	3 /*	24
VK2WRC	Multi	Phone	HF	33	66	QF68IL	4 /*	25

/* *Certificate Awarded*

Comments on John Moyle Memorial National Field Day 2020

Firstly, I must congratulate the portable stations who went to considerable extra effort to take part after many of the locations used in the past were destroyed by the horrendous summertime fires this year, and the government rules in some states effectively banned club stations from operating in the field.

24 Hour Portable Operation – Single Operator

Call Sign	Operators	Mode	Band	Contacts	Score	Locator	Place / Award	Cert.
VK4BZ	Single	All	HF	317	662	QG62KO	1 /*	26
VK4ARW	Single	All	HF	217	436	QG51XW	2 /*	27
VK6GD	Single	Phone	All	66	281	OF88BH	1 /*	28
VK7KPC	Single	Phone	All	22	54	QE37RX	2 /*	29
VK2KCM	Single	Phone	VHF	67	664	QF69MS	1 /*	30
VK1JP	Single	Phone	HF	342	684	QF44MS	1 /*	31
VK3KK	Single	Phone	HF	240	480	QF12SH	2 /*	32
VK2AWJ	Single	Phone	HF	75	150	QF15CT	3 /*	33
VK8RR	Single	Phone	HF	66	132	PH57EF	4 /*	34
VK4JSS	Single	Phone	HF	41	82	QG61AJ	5 /*	35
VK2AEJ	Single	Phone	HF	16	32	QG56NC	6 /*	36

Six Hour Portable Operation – Single Operator

Call Sign	Operators	Mode	Band	Contacts	Score	Locator	Award	Cert.
VK2IO	Single	All	HF	158	326	QF56KH	1 /*	37
VK4SN	Single	All	HF	97	206	QG62JG	2 /*	38
VK2MG	Single	All	HF	70	144	QF56QL	3 /*	39
ZL3VZ	Single	All	HF	69	142	RE58XL	4 /*	40
VK3ZPF	Single	Phone	All	111	341	QF22TG	1 /*	41
VK5GR	Single	Phone	All	101	221	PF95JF	2 /*	42
VK7TW	Single	Phone	All	71	168	QE37PD	3 /*	43
VK2NH	Single	Phone	All	14	123	QF57RV	4 /*	44
VK5FBAA	Single	Phone	All	15	39	PF95ND	5 /*	45
VK3CWF	Single	Phone	VHF	43	415	QF22FB	1 /*	46
VK7WN	Single	Phone	VHF	3	12	QE36PV	2 /*	47
VK6FANG	Single	Phone	VHF	1	4	OF77VV	3 /*	48
VK5PAS	Single	Phone	HF	239	478	PF94NT	1 /*	49
VK4FOMP	Single	Phone	HF	99	198	QG62NR	2 /*	50
VK2DEK	Single	Phone	HF	79	156	QF55FQ	3 /*	51
VK2BBQ	Single	Phone	HF	77	154	QF45QT	4 /*	52
VK2EMU	Single	Phone	HF	75	150	QF56MB	5 /*	53
VK7QP	Single	Phone	HF	75	150	QF42UK	6 /*	54
VK2GZ	Single	Phone	HF	70	140	QF56QF	7 /*	55
VK3OAK	Single	Phone	HF	63	126	QF22FH	8 /*	56
VK2YK	Single	Phone	HF	59	118	PF95IE	9 /*	57
VK2XLJ	Single	Phone	HF	52	104	QF46MP	10 /*	58
VK2FMYL	Single	Phone	HF	25	50	QF56LF	11 /*	59
VK3DPW	Single	Phone	HF	24	48	QF21MQ	12 /*	60
VK2WS	Single	Phone	HF	12	24	QF55FM	13 /*	61
VK5AR	Single	Phone	HF	9	18	PF94HX	14 /*	62
VK2XSE	Single	Phone	HF	8	16	Mobile	15 /*	63
VK8DA	Single	Phone	HF	8	16	PH57IM	15 /*	64

/* *Certificate Awarded*
/* *Participation Certificate*

Home Station – 24 Hour (Part 1)

Call Sign	Operators	Mode	Band	Contacts	Score	Locator	Award	Cert.
VK6ZMS	Home	All	All	124	313	OF78WC	1 /*	65
VK6CF	Home	All	All	80	198	OF77WX	2	
VK2AZ	Home	All	All	93	149	QF56IF	3	
VK5UE	Home	All	All	11	15	PF95IG	4	
VK6CX	Home	All	VHF	24	77	OF77TI	1 /*	66
VK5LJ	Home	All	HF	396	560	PF95LN	1 /*	67
VK2YI	Home	All	HF	268	317	QF56LB	2	
VK2EIK	Home	All	HF	177	183	QF69AL	3	
VK3DN	Home	All	HF	66	96	QF22OD	4	
VK2JDR	Home	All	HF	27	57	QF55LQ	5	
VK3DRH	Home	All	HF	9	13	QF22LF	6	
VK2XAX	Home	Phone	All	217	370	QF56IF	1 /*	68
VK3GRK	Home	Phone	All	248	351	QF23DF	2 /*	69
VK3AVV	Home	Phone	All	205	277	QF22MF	3	
VK6ZRW	Home	Phone	All	98	244	OF77VV	4	
VK6DW	Home	Phone	All	142	237	OF88AA	5	
VK5KBJ	Home	Phone	All	106	176	PF94GQ	6	
VK3ND	Home	Phone	All	75	129	QF22PC	7	
VK3HGB	Home	Phone	All	82	117	QF33KV	8	
VK3CTM	Home	Phone	All	79	106	QF23EE	9	
VK4EA	Home	Phone	All	15	103	QG62MO	10	
VK6MIL	Home	Phone	All	46	88	OF78UF	11	
VK6GC	Home	Phone	All	39	86	OF77WX	12	
VK6FMTG	Home	Phone	All	36	80	OF78VF	13 /$	70
VK5FD	Home	Phone	All	48	70	PF95IH	14	
VK6XL	Home	Phone	All	28	45	OF78VC	15	
VK3CHI	Home	Phone	All	31	45	QF22MF	16	
VK3FLID	Home	Phone	All	23	33	QF21KP	17 /$	71
VK6TU	Home	Phone	All	5	25	OF76MI	18	
VK7AN	Home	Phone	All	9	21	QE38NN	19	
VK6WE	Home	Phone	All	7	7	OF78VA	20	
VK2ELH	Home	Phone	VHF	115	583	QG61JC	1 /*	72
VK2VL	Home	Phone	VHF	97	436	QG60LE	2	
VK2PMG	Home	Phone	VHF	73	317	QG61PW	3	
VK2ACD	Home	Phone	VHF	64	288	QG60QU	4	
VK2DLR	Home	Phone	VHF	54	272	QG61RF	5	
VK6ZKO	Home	Phone	VHF	111	253	OF88AA	6	
VK3FIX	Home	Phone	VHF	40	89	QF21PW	7	
VK3WWW	Home	Phone	VHF	37	78	QF22OD	8	
VK6PCB	Home	Phone	VHF	36	72	OF78WB	9	
VK6ZIC	Home	Phone	VHF	24	54	OF78VC	10	
VK6HM	Home	Phone	VHF	8	38	OF77UR	11	

/* *Certificate Awarded*

/* *Participation Certificate*

This year's entries came from each of the Australian call areas (except VK0 and VK9), with several from New Zealand. The total number of eligible logs submitted was 178. This was an increase (11.3%) from the 160 logs received last year.

Well done to all who took part and took the effort to submit a log.

Home Station – 24 Hour (Part 2)

Call Sign	Operators	Mode	Band	Contacts	Score	Locator	Award	Cert.
VK3JX	Home	Phone	HF	367	454	QF22PB	1 /*	73
VK4ZD	Home	Phone	HF	177	216	QG62DK	2 /*	74
VK4D1	Home	Phone	HF	183	215	QG62EM	3 /*	75
VK4TAA	Home	Phone	HF	121	169	QG62MQ	4	
VK2RT	Home	Phone	HF	100	159	QG60OM	5	
VK5PX	Home	Phone	HF	105	148	PF95JG	6	
VK8ZWM	Home	Phone	HF	99	138	PF96CF	7	
VK2LEE	Home	Phone	HF	102	131	QF57KW	8	
VK4HDY	Home	Phone	HF	83	112	QG62MS	9	
VK4GDW	Home	Phone	HF	83	106	QG26DN	10	
VK3FDLL	Home	Phone	HF	61	89	QF22NE	11 /$	76
VK2LDW	Home	Phone	HF	58	88	QF55HC	12	
VK3FNQS	Home	Phone	HF	60	80	QF23ON	13 /$	77
VK3SIM	Home	Phone	HF	60	72	QF22NJ	14	
VK5IR	Home	Phone	HF	52	70	PF95GD	15	
VK5DT	Home	Phone	HF	52	69	PF95IK	16	
VK2MTM	Home	Phone	HF	61	61	QF46BC	17	
VK4NP	Home	Phone	HF	33	58	QG64IR	18	
VK4FEMO	Home	Phone	HF	34	52	QG56OC	19 /$	78
VK3PR	Home	Phone	HF	25	40	QF23EF	20	
VK2MK	Home	Phone	HF	28	35	QF54FP	21	
VK4PQ	Home	Phone	HF	22	35	QH30IP	22	
VK5VC	Home	Phone	HF	26	32	PF95HC	23	
VK4FNQT	Home	Phone	HF	21	31	QH30IR	24 /$	79
VK5DC	Home	Phone	HF	21	30	PF94KW	25	
VK3PWG	Home	Phone	HF	19	29	QF12WK	26	
VK3TNL	Home	Phone	HF	20	27	QF31AU	27	
VK3HFZ	Home	Phone	HF	18	26	QF23DG	28	
VK4AK	Home	Phone	HF	16	25	QG62LJ	28	
VK2TG	Home	Phone	HF	20	24	QF55JW	29	
VK3DEK	Home	Phone	HF	13	20	QF12JQ	30	
VK4BRT	Home	Phone	HF	10	16	QG62MQ	31	
VK4AKH	Home	Phone	HF	9	10	QG62MS	32	

/* *Certificate Awarded*

/* *Participation Certificate*

I have included in the results all of the logs that I received and if any are missing, they are completely lost. I can only offer my apologies to anyone so affected. If your log is missing, it did not get it to me.

Based upon submitted logs, there were some 13,679 contacts, (a 2.2% decrease from 2019), accumulating some 31,161 points claimed (a 25.9% decrease from 2019). This was successful contesting for an Australian field day contest resulting from 178 logs received. More than 1320 Australian individual call signs were logged during the contest.

Unfortunately, the number of Club Stations was considerably fewer that in the past, but the COVID-19 restrictions prohibited the multiple operator stations. Well done to those Multi-operator stations who were able to work around the restrictions.

Activity was carried out on all bands permitted under the rules. There was a big decrease in activity on HF, and there was less activity on the all HF frequencies,

Home Station – 6 Hour

Call Sign	Operators	Mode	Band	Contacts	Score	Locator	Award	Cert.
VK5KI	Home	All	HF	40	55	PF95ID	1 /*	80
VK2GR	Home	All	HF	14	22	QF54EQ	2	
VK4ADC	Home	Phone	All	140	414	QG62LG	1 /*	81
VK7EV	Home	Phone	All	23	121	QE38BT	2	
VK7ZBX	Home	Phone	All	45	98	QE37PH	3	
VK6NAD	Home	Phone	All	52	93	OF87AV	4	
VK3FOWL	Home	Phone	All	50	88	QF22NC	5 /$	82
VK3YSP	Home	Phone	All	50	88	QF22NC	5	
VK2TTL	Home	Phone	All	45	78	QG60NR	7	
VK3XFX	Home	Phone	All	58	76	QF23DF	8	
VK5NI	Home	Phone	All	31	59	PF95HF	9	
VK2FFLL	Home	Phone	All	9	22	QF34QU	10 /$	83
VK6ATX	Home	Phone	VHF	67	149	OF77WW	1 /*	84
VK5ACE	Home	Phone	VHF	25	49	PF95IE	2	
VK7HH	Home	Phone	VHF	6	39	QE37LD	3	
VK7PD	Home	Phone	VHF	13	35	QE38NN	4	
VK3DIP	Home	Phone	VHF	3	31	QF11SI	5	
VK5KIK	Home	Phone	VHF	10	25	PF95IE	6	
VK7BEN	Home	Phone	VHF	11	25	QE37QD	6	
VK7DW	Home	Phone	VHF	4	8	QE38NO	8	
VK2PR	Home	Phone	HF	252	303	QF55JS	1 /*	85
VK2ND	Home	Phone	HF	198	272	QF56JX	2	
VK2XJM	Home	Phone	HF	154	184	QF56LB	3	
VK3CO	Home	Phone	HF	66	93	QF22OI	4	
VK7JGD	Home	Phone	HF	43	58	QE36PW	5	
VK2STG	Home	Phone	HF	32	54	QF43LJ	6	
VK2GLJ	Home	Phone	HF	30	44	QF46SO	7	
VK4TFN	Home	Phone	HF	29	39	QG62MO	8	
VK2FAAU	Home	Phone	HF	22	33	QF56MC	9 /$	86
VK2VV	Home	Phone	HF	18	25	QF58JB	10	
ZL1WL	Home	Phone	HF	21	25	RF72OB	10	
VK4IAA	Home	Phone	HF	15	22	QG62ML	12	
VK4JAZ	Home	Phone	HF	18	18	QG62LL	13	
VK4QH	Home	Phone	HF	11	18	QG62DK	13	
VK4TMZ	Home	Phone	HF	14	18	QG62LQ	13	
VK6GOM	Home	Phone	HF	10	15	OF76PI	16	
VK8VWA	Home	Phone	HF	8	15	PH57KP	16	
VK2EY	Home	Phone	HF	2	3	QF56OC	18	
VK3FADN	Home	Phone	HF	1	2	QF31AU	19/$	87

/* *Certificate Awarded*

/* *Participation Certificate*

as would be expected by the decreasing Solar Cycle, which is going through a minimum at the moment, and conditions on some bands did appear to reflect this.

The lower bands seemed to be only marginally affected by QRM.

In the higher UHF and Microwave bands, there was a huge decrease in activity; since the absence of club stations virtually eliminated activity? Activity overall was somewhat decreased as many fewer portable stations were out in the field.

The scoring in the VHF range was much reduced compared to last year, though the scoring as a ratio of contacts per station was down from 2019. The absence of many club stations, because of the miserable weather and the COVID-19 restrictions that were introduced certainly reduced activity, with most stations making such comments.

The participation across the various call areas was patchy. There was a decrease in portable stations in most areas. Home Station logs were increased from last year in most call areas.

All of the portable stations that went to the effort to send in a log will get a certificate. The WIA believes that those who make the effort to set up and operate a portable station should be acknowledged. In line with previous years, the Foundation Licence logs who did not achieve a placing were instead awarded a Participation Certificate for encouragement.

There were thirteen Foundation Licensed operators who submitted a log, two from VK2, four from VK3, three from VK4, two from VK5 and two from VK6. There were more Foundation stations operating who were logged during the contest, but chose not to submit a log. All logs submitted by Foundation operators were awarded a participation certificate. Logs from club stations did also show that some 'F' Calls also took part as part of the club station effort, well done.

This year, the rules again stated that EXCEL is the preferred submission format. A sample linked EXCEL logging report was prepared and was available on the WIA Contest website. (Contact me at vk4ae@wia.org.au if you would like a copy of my linked spreadsheet in EXCEL for next year.) Other suitable file submission formats are WORD, or LogToSubmit.txt output file from VKCL (VK Contest Log).

PDF format is not acceptable, nor are JPG and TIFF or any other image type, as though a picture might be worth 1,000 words to me or you, an image file of your log contains no more information than a picture of a flower and the data is not readable by a computer, thus the file is unreadable and unusable for the contest. Hence the contest manager has to manually enter your file into the database. Indeed, a scanned copy of the signed front page of the log is perfectly acceptable, but the rest of the log has to be electronically readable.

The majority of other logs submitted in an electronic form this year were usually fully readable. There were 98.7% of logs submitted electronically this year, similar to last year. This has been due largely to the excellent work by Mike Subocz (VK3AVV) and his worthy program VKCL (VK Contest Log). Those that submitted a log in the VKCL export format were as usual very easy to work with.

It is interesting that the number of logs submitted in the latest version 4.10 of VKCL was only 113 logs. There were 49 logs submitted using an older version of VKCL. It must be stressed that older versions of

VKCL do not always follow the latest version of the contest rules and so logs submitted using the older versions can and do contain significant scoring errors. You are strongly encouraged to ALWAYS use the latest version of VKCL as you might be missing out on some score. In addition, there were only 10 logs that were submitted using EXCEL.

Paper logs may continue to be used. A small log from an individual operator is, and will remain, completely acceptable. Large paper logs require a very considerable manual work on the part the contest manager to input the data into the contest database and hence are not permitted. It is so much better to forward the computer files used to print the paper log, as part of an e-mail, for the data can then be most easily extracted and used for checking purposes.

A note for all HF Stations: All HF contacts are valid HF scoring contacts, whether they are from VK ZL or P2 stations, or stations from overseas.

Overseas stations cannot submit a log to the contest but can exchange numbers with stations participating in the Field Day Contest. They are to be scored as a Portable station contact.

Comments Regarding this Year's Contest

1. The comparative difference in score and scoring between HF and VHF/UHF contacts

In fact, within the John Moyle Contest, the rules allow for some 60 possible alternative categories as shown here. Each category is actually completely independent from every other category and so there are in fact 60 parallel contests. In this way, it is completely different from any other contest presently in Australia. This year, only 28 of the different categories were contested.

For this reason, it is not possible to have overall winner in this contest, as scores from any category, especially between different bands and different modes are not directly comparable. Only scores within the same category are correctly comparable. To reduce the costs to the WIA the number of certificates awarded to Home Stations – the contest is a Field Day after all – only 1 certificate for every 10 logs received in each category will be awarded again this year.

The award of the Presidents Cup is a further parallel contest. It is awarded to the highest score from a Club Station, affiliated with the WIA, in any category. This year will be awarded to VK2SRC.

2. The number of logs submitted to the contest is up compared with last year

The number of logs entered in this year's contest has increased compared to last year. The number individual stations taking part in the contest and the number of their contacts seems to be down compared to last few years. The additional logs increased the percentage of verified contacts during the contest, making the contest manager's task of checking the logs just a little bit easier.

In 2020, a total of 178 logs were submitted from 64 portable stations and 114 home stations.

In 2019, a total of 160 logs were submitted from 76 portable stations and 84 home stations.

In 2018, a total of 171 logs were submitted from 81 portable stations and 90 home stations.

In 2017, a total of 160 logs were submitted from 79 portable stations and 81 home stations.

In 2016, a total of 154 logs were submitted from 82 portable stations and 72 home stations.

In 2015, a total of 184 logs were submitted from 94 portable stations and 90 home stations.

In 2014, a total of 179 logs were submitted from 88 portable stations and 91 home stations.

In 2013, a total of 111 logs were submitted from 67 portable stations and 44 home stations.

In 2012, a total of 140 logs were submitted from 77 portable stations and 63 home stations.

In 2011, a total of 129 logs were submitted from 83 portable stations and 46 home stations.

In 2010, a total of 122 logs were submitted from 73 portable stations and 49 home stations.

In 2009, a total of 124 logs were submitted from 63 portable stations and 61 home stations.

In 2008, a total of 104 logs were submitted from 59 portable stations and 45 home stations.

In 2007, a total of 76 logs were submitted from 48 portable stations and 18 home stations.

3. The issue of scoring for CW contacts

The number of All Mode contacts was significantly higher than in the recent past. A good sign!

While CW is no longer a precondition for obtaining an Amateur licence, it is a skill that is still widely distributed among existing operators and a skill that should be nurtured among the newer licence holders as communications is still possible under very trying conditions.

However, the use of computer generated/decoded CW is prevalent and it is felt that hand-generated code that is decoded by ear alone should only qualify as true CW. This has caused some concern among the contest aficionados, but as this is a field day contest and so the emphasis on hand sent and ear decoded CW is seen to be preferred and computer sent and decoded CW is not endorsed. This is hard to police however, and it requires the cooperation of the operator to indicate in their log if the CW is hand keyed or not.

Any computer method is simply just another digital mode, and so should not score the same as hand CW, but only the same as any of the other many digital modes.

4. The number of people who submitted logs claiming 'All Modes' and only logging contacts using SSB or FM

The Modes allowed in the rules are PHONE (SSB or FM), Morse (CW) (Manual) and DIGITAL (Computer) Mode.

The PHONE (Voice) only Modes are SSB, DSB, FM, PM or AM. That is, the modulation is an audio signal derived in the first instance from a microphone.

The alternative is hand CW Mode, which is one where the operator simply turns the carrier on and off according to the Morse code.

DIGITAL mode is one which uses a computer to control the transmitter and to decode the information to allow the operator to complete the contact. The total number of digital contacts this year was only 4. ALL MODE, is any combination of the above modes.

5. Club Stations

Club Stations were well operated and made some very big scores as a result of their combined efforts. Well done.

The absence of a more than 53 club Stations (75%) was noted for this year. This is largely because of the COVID-19 restrictions that were introduced – notably in VK3 – which precluded any activity by a multi-operator of club station .

One issue that occurred prior to the contest was that a couple of Club Stations said that they could not find sufficient people to man their portable station. However, these stations wanted to operate as Multi-Operator Home stations. The rules do not allow this.

Once in the past, Multi-Operator Home Stations were permitted, but there were so many complaints made by others about the very predatory and aggressive operating practices of these stations. In addition, there was the very obvious advantages of permanent antennas high powered amplifiers and mains power and hence this practice is no longer allowed.

James VK7JAM (left) and Peter VK7PD operating portable in the John Moyle Memorial Field Day. (Photo courtesy of Peter VK7PD)

A Home station is only permitted to have a single operator. Of course, a Club Station can operate with a single transmitter and a single operator at any time, this is encouraged, as it provides very good training for the newer operators as they can be readily helped and supervised during the contest.

The purpose of the Field Day is to promote field operation and the Home Station is encouraged to provide contacts for portable stations. There are plenty of all singing and dancing Multi-Operator and Multi-station contests during the year, so it is not felt to be in the spirit of the JMMFD contest to have club stations with Multi-operators and multiple High-Power transmitters dominating the contest in a Portable Station contest.

6. The Future

Now it is over to you. There are always ways to improve anything, but scrapping something because it does not suit you is not possible. But, if benefits are shown to be available, further changes can be made to the contest to better serve the amateur community. But changes to force the majority to follow what suits a small minority is definitely not a good idea.

If you have any contribution to these topics, the Rules for this contest are available at the WIA web site, at www.wia.org.au/members/contests/johnmoyle/, which already contains my contact information and please feel free to contact me with your submission for further consideration.

Well done to all of those stations that participated in the contest, and well done those who bothered to submit a log. It is hoped that the number of logs to be submitted next year will continue its increase from this year's log numbers.

I wish to thank those who did send in photographs of their equipment set-up and personnel involved-for inclusion in the *AR* magazine.

Denis Johnstone VK4AE

https://www.wia.org.au/members/contests/johnmoyle/

WIA Awards

Marc Hillman VK3OHM/VK3IP

New awards

Antarctic

#	Call	Name	Mode
116	VK3AWG	Christopher Bellmont	Open
117	VK3QI	Peter Forbes	Open

DXCC Multi-band (7)

#	Call	Name	Mode	Band	Count
44	YL2CA	Arnolds Preiss	Open	40-30-20-17-15-12-10m	1266
45	YL2CA	Arnolds Preiss	Digital	40-30-20-17-15-12-10m	952
46	VK5BC	Brian Cleland	Digital	80-40-30-20-17-15-12m	1127
47	YL2CZ	Visvaldis Sedolins	Open	80-40-20-17-15-12-10m	1196
48	YL2CZ	Visvaldis Sedolins	CW	40-30-20-17-15-12-10m	917
49	VK2DX	Nikola Hacko	Open	80-40-30-20-17-15-10m	1108
50	VK3QI	Peter Forbes	Phone	80-40-20-17-15-12-10m	1437
51	VK4CAG	Graeme Dowse	Digital	80-40-30-20-17-15-12m	1046

Changes afoot

From this month there are a few changes to this column. With the introduction of the DXCC Single-band award, the size of the Awards listing has grown significantly. A decision has been taken to, in future, only publish new awards. DXCC Updates will no longer be published, but you can always see the current Standings. This decision has been taken to save valuable space in the magazine.

For editorial reasons, the Awards column was not published in Issue 2. In order to catch up, this issue (No. 3 for 2020) includes the Awards column data for the 4 month period 21 Dec 2019 to 14 Apr 2020. The next issue (4) will include awards data for 15 Apr 2020 – 14 Aug 2020. At that point we will be all caught up. From then on, 2 months of data will be published in each issue as normal.

Try before you buy

In general awards news, DX users have been given full access to the awards system on registration, except that they cannot apply for awards unless they subscribe, or join the WIA. This will allow users to establish which awards they qualify for, before having to pay the subscription fee. See the details on the WIA website, at: www.wia.org.au/newsevents/news/2020/20200812-1/index.php

Listed here are all New awards issued from 15 December 2019 to 14 April 2020.

To use the online award system, visit: *www.wia.org.au/members/wiadxawards/about/*

DXCC Multi-band (3)

#	Call	Name	Mode	Band	Count
147	JA3DBD	Souichi Miyamoto	Open	30-20-17m	369
148	JA3DBD	Souichi Miyamoto	Digital	30-20-17m	369
149	VK3EY	Robert Puise	Open	20-17-10m	398
150	VK2QV	Rasika Liyanage	Open	40-20-17m	414
151	YL2CA	Arnolds Preiss	Open	20-15-12m	614
152	YL2CA	Arnolds Preiss	CW	20-15-12m	462
153	YL2CA	Arnolds Preiss	Digital	20-17-15m	452
154	VK3SIM	Simon Keane	CW	40-30-20m	396
155	YL2CZ	Visvaldis Sedolins	Open	20-15-10m	571
156	YL2CZ	Visvaldis Sedolins	CW	40-20-15m	438
157	VK2QV	Rasika Liyanage	Digital	40-20-17m	359
158	OM2GM	Tibor Fuzik	Open	20-17-15m	422
159	VK3KTT	Steven Barr	Digital	40-30-20m	382
160	VK2PW	Adam McCarthy	Open	40-30-20m	431
161	VK2PW	Adam McCarthy	Digital	40-30-20m	386
162	VK2BY	Bradley Devon	Open	40-20-17m	474
163	VK2BY	Bradley Devon	Digital	40-30-20m	422
164	VK3QI	Peter Forbes	Phone	20-15-10m	822

DXCC Multi-band (5)

#	Call	Name	Mode	Band	Count
107	YL2CA	Arnolds Preiss	Open	20-17-15-12-10m	962
108	YL2CA	Arnolds Preiss	CW	40-20-15-12-10m	713
109	YL2CA	Arnolds Preiss	Digital	40-20-17-15-12m	710
110	VK3KTT	Steven Barr	Open	40-30-20-15-10m	934
111	YL2CZ	Visvaldis Sedolins	Open	40-20-17-15-10m	918
112	YL2CZ	Visvaldis Sedolins	CW	40-20-17-15-10m	698
113	VK3OHM	Marc Hillman	Digital	40-30-20-17-15m	671
114	VK2QV	Rasika Liyanage	Open	40-30-20-17-15m	679
115	VK3MH	Brendan Bryant	Open	40-30-20-17-15m	728
116	VK3QI	Peter Forbes	Phone	40-20-17-15-10m	1169
117	VK2QV	Rasika Liyanage	Digital	40-30-20-17-15m	640

DXCC Multi-band (8)

#	Call	Name	Mode	Band	Count
2	VK3TZ	Tony Burt	Open	80-40-30-20-17-15-12-10m	1645
3	VK3EW	David McAulay	Open	80-40-30-20-17-15-12-10m	2621
4	VK3EW	David McAulay	CW	160-80-40-30-20-17-15-12m	2018
5	VK6IR	Stephen Chamberlain	Open	80-40-30-20-17-15-12-10m	1966
6	VK6IR	Stephen Chamberlain	CW	80-40-30-20-17-15-12-10m	1363
7	VK6IR	Stephen Chamberlain	Digital	80-40-30-20-17-15-12-10m	1186
8	VK4KEE	Robert Hollis	Open	80-40-30-20-17-15-12-10m	1628
9	VK7CW	Steven Salvia	Open	80-40-30-20-17-15-12-10m	1768
10	VK7CW	Steven Salvia	CW	80-40-30-20-17-15-12-10m	1682
11	VK5BC	Brian Cleland	Open	80-40-30-20-17-15-12-10m	1804
12	VK4CAG	Graeme Dowse	Open	80-40-30-20-17-15-12-10m	1714
13	YL2CA	Arnolds Preiss	Open	80-40-30-20-17-15-12-10m	1371
14	YL2CZ	Visvaldis Sedolins	Open	80-40-30-20-17-15-12-10m	1312
15	VK6DU	Lance Martin	Open	80-40-30-20-17-15-12-10m	1957
16	VK3QI	Peter Forbes	Open	80-40-30-20-17-15-12-10m	2502
17	VK3QI	Peter Forbes	CW	80-40-30-20-17-15-12-10m	1973

DXCC Multi-band (9)

#	Call	Name	Mode	Band	Count
23	YL2CZ	Visvaldis Sedolins	Open	160-80-40-30-20-17-15-12-10m	1413

DXCC Multi-mode (Digital)

#	Call	Name	Count
101	JA3DBD	Souichi Miyamoto	202
102	VK2QV	Rasika Liyanage	199
103	VK1DC	Emma Cuthbert	100
104	YL2CA	Arnolds Preiss	195
105	YL2CZ	Visvaldis Sedolins	157
106	VK2RZ	Alexander Taverner	105
107	OM2GM	Tibor Fuzik	153
108	VK3TX	Oscar Reyes	116
109	VK3WE	Rhett Donnan	100

DXCC Multi-mode (Open)

#	Call	Name	Count
484	VK2QV	Rasika Liyanage	216
485	JA3DBD	Souichi Miyamoto	202
486	VK1DC	Emma Cuthbert	101
487	YL2CA	Arnolds Preiss	264
488	YL2CZ	Visvaldis Sedolins	276
489	VK2RZ	Alexander Taverner	106
490	OM2GM	Tibor Fuzik	192
491	VK3TX	Oscar Reyes	116
492	VA3CQG	Terry Hursh	101
493	VK2GZ	Laurie Gordon	104

DXCC Multi-mode (Phone)

#	Call	Name	Count
632	YL2CA	Arnolds Preiss	143
633	YL2CZ	Visvaldis Sedolins	203
634	OM2GM	Tibor Fuzik	143
635	VA3CQG	Terry Hursh	101
636	VK2BY	Bradley Devon	135
637	VK2KS	Martin Hutchings	100

DXCC Single-band

#	Call	Name	Mode	Band	Count
236	VK2QV	Rasika Liyanage	Open	20m	166
237	VK2QV	Rasika Liyanage	Phone	20m	117
238	JA3DBD	Souichi Miyamoto	Open	20m	158
239	JA3DBD	Souichi Miyamoto	Digital	20m	158
240	VK2QV	Rasika Liyanage	Digital	20m	142
241	VK3EY	Robert Puise	Phone	20m	134
242	VK3EY	Robert Puise	Digital	20m	111
243	YL2CA	Arnolds Preiss	Open	20m	210
244	YL2CA	Arnolds Preiss	CW	20m	166
245	YL2CA	Arnolds Preiss	Digital	20m	170
246	YL2CA	Arnolds Preiss	Phone	20m	102
247	VK3OHM	Marc Hillman	Open	40m	167
248	VK3OHM	Marc Hillman	Open	30m	128
249	VK3OHM	Marc Hillman	Open	15m	181
250	VK3OHM	Marc Hillman	Open	10m	110
251	VK3OHM	Marc Hillman	Phone	15m	131
252	VK3OHM	Marc Hillman	Digital	40m	135
253	VK3OHM	Marc Hillman	Digital	30m	126
254	VK3OHM	Marc Hillman	Digital	15m	122
255	VK7CW	Steven Salvia	Open	80m	130
256	VK7CW	Steven Salvia	Open	40m	208
257	VK7CW	Steven Salvia	Open	30m	243
258	VK7CW	Steven Salvia	Open	17m	259
259	VK7CW	Steven Salvia	Open	15m	230
260	VK7CW	Steven Salvia	Open	10m	194
261	VK7CW	Steven Salvia	Open	12m	191
262	VK7CW	Steven Salvia	Phone	15m	139
263	VK7CW	Steven Salvia	Phone	10m	103
264	VK7CW	Steven Salvia	CW	80m	128
265	VK7CW	Steven Salvia	CW	10m	176
266	VK7CW	Steven Salvia	CW	12m	185
267	VK7CW	Steven Salvia	CW	40m	206
268	VK7CW	Steven Salvia	CW	30m	241
269	VK7CW	Steven Salvia	CW	17m	253
270	VK7CW	Steven Salvia	CW	15m	209
271	VK3EW	David McAulay	Open	160m	201
272	VK3EW	David McAulay	Open	80m	313
273	VK3EW	David McAulay	Open	40m	336
274	VK3EW	David McAulay	Open	30m	327
275	VK3EW	David McAulay	Open	17m	335
276	VK3EW	David McAulay	Open	15m	331
277	VK3EW	David McAulay	Open	12m	321
278	VK3EW	David McAulay	Open	10m	318
279	VK3EW	David McAulay	Phone	80m	293
280	VK3EW	David McAulay	Phone	40m	322
281	VK3EW	David McAulay	Phone	17m	319
282	VK3EW	David McAulay	Phone	15m	326
283	VK3EW	David McAulay	Phone	12m	281
284	VK3EW	David McAulay	Phone	10m	305
285	VK3EW	David McAulay	Digital	15m	183
286	VK3EW	David McAulay	Digital	17m	188

DXCC Single-band

#	Call	Name	Mode	Band	Count
287	VK3EW	David McAulay	Digital	30m	240
288	VK3EW	David McAulay	Digital	40m	200
289	VK3EW	David McAulay	Digital	80m	139
290	VK3EW	David McAulay	CW	10m	167
291	VK3EW	David McAulay	CW	12m	232
292	VK3EW	David McAulay	CW	15m	238
293	VK3EW	David McAulay	CW	17m	299
294	VK3EW	David McAulay	CW	20m	288
295	VK3EW	David McAulay	CW	40m	284
296	VK3EW	David McAulay	CW	80m	180
297	VK3EW	David McAulay	CW	160m	172
298	VK3GA	Graham Alston	Open	80m	152
299	VK3GA	Graham Alston	Open	40m	226
300	VK3GA	Graham Alston	Open	30m	250
301	VK3GA	Graham Alston	Open	17m	227
302	VK3GA	Graham Alston	Open	15m	225
303	VK3GA	Graham Alston	Open	10m	133
304	VK3GA	Graham Alston	Phone	15m	155
305	VK3GA	Graham Alston	Phone	10m	108
306	VK3GA	Graham Alston	CW	40m	126
307	VK3GA	Graham Alston	CW	30m	108
308	VK3GA	Graham Alston	CW	17m	137
309	VK3GA	Graham Alston	CW	15m	104
310	VK3GA	Graham Alston	Digital	80m	125
311	VK3GA	Graham Alston	Digital	40m	200
312	VK3GA	Graham Alston	Digital	30m	201
313	VK3GA	Graham Alston	Digital	17m	175
314	VK3GA	Graham Alston	Digital	15m	153
315	VK3FZ	Roger Stafford	Phone	10m	176
316	VK3FZ	Roger Stafford	Phone	15m	126
317	VK3FZ	Roger Stafford	Open	10m	212
318	VK3FZ	Roger Stafford	Open	12m	157
319	VK3FZ	Roger Stafford	Open	15m	185
320	VK3FZ	Roger Stafford	Open	17m	156
321	VK3FZ	Roger Stafford	Open	30m	151
322	VK3FZ	Roger Stafford	Open	40m	132
323	VK3KTT	Steven Barr	Open	10m	181
324	VK3KTT	Steven Barr	Phone	10m	173
325	VK3KTT	Steven Barr	Open	40m	182
326	VK3KTT	Steven Barr	Open	30m	132
327	VK3KTT	Steven Barr	Open	15m	181
328	VK3KTT	Steven Barr	Phone	15m	133
329	VK3KTT	Steven Barr	Digital	40m	126
330	VK6IR	Stephen Chamberlain	Open	160m	117
331	VK6IR	Stephen Chamberlain	Open	40m	297
332	VK6IR	Stephen Chamberlain	Open	10m	265
333	VK6IR	Stephen Chamberlain	Digital	80m	159
334	VK6IR	Stephen Chamberlain	Digital	40m	192
335	VK6IR	Stephen Chamberlain	Phone	40m	263
336	VK6IR	Stephen Chamberlain	Phone	15m	260
337	VK6IR	Stephen Chamberlain	Phone	10m	244

DXCC Single-band

#	Call	Name	Mode	Band	Count
338	VK6IR	Stephen Chamberlain	Open	15m	284
339	VK6IR	Stephen Chamberlain	Phone	12m	116
340	VK6IR	Stephen Chamberlain	Phone	17m	109
341	VK6IR	Stephen Chamberlain	Phone	80m	138
342	VK3FN	Peter Demikos	Open	20m	132
343	VK3BDX	David Burden	Open	80m	162
344	VK3BDX	David Burden	Open	40m	244
345	VK3BDX	David Burden	Open	30m	236
346	VK3BDX	David Burden	Open	17m	192
347	VK3BDX	David Burden	Open	15m	162
348	VK3BDX	David Burden	Digital	80m	159
349	VK3BDX	David Burden	Digital	40m	237
350	VK3BDX	David Burden	Digital	30m	227
351	VK3BDX	David Burden	Digital	17m	185
352	VK3BDX	David Burden	Digital	15m	154
353	VK2QV	Rasika Liyanage	Open	40m	119
354	VK2QV	Rasika Liyanage	Open	17m	121
355	VK3AWG	Christopher Bellmont	Open	40m	131
356	VK3AWG	Christopher Bellmont	Open	30m	125
357	VK3AWG	Christopher Bellmont	Open	17m	162
358	VK3AWG	Christopher Bellmont	Open	15m	167
359	VK3AWG	Christopher Bellmont	Digital	40m	107
360	VK3AWG	Christopher Bellmont	Digital	30m	110
361	VK3AWG	Christopher Bellmont	Digital	17m	140
362	VK3AWG	Christopher Bellmont	Digital	15m	115
363	VK6APK	Aleksandar Petkovic	Open	80m	126
364	VK6APK	Aleksandar Petkovic	Open	40m	253
365	VK6APK	Aleksandar Petkovic	Open	30m	234
366	VK6APK	Aleksandar Petkovic	Open	17m	185
367	VK6APK	Aleksandar Petkovic	Open	15m	194
368	VK6APK	Aleksandar Petkovic	Phone	40m	180
369	VK6APK	Aleksandar Petkovic	Phone	15m	151
370	VK6APK	Aleksandar Petkovic	Phone	10m	111
371	VK6APK	Aleksandar Petkovic	CW	40m	184
372	VK6APK	Aleksandar Petkovic	CW	20m	120
373	VK2NN	Peter Garoufalis	Open	15m	130
374	VK2NN	Peter Garoufalis	Phone	15m	103
375	VK6WX	Wesley Beck	Open	40m	189
376	VK6WX	Wesley Beck	Open	30m	142
377	VK6WX	Wesley Beck	Open	17m	135
378	VK6WX	Wesley Beck	Open	15m	158
379	VK6WX	Wesley Beck	CW	40m	133
380	VK6WX	Wesley Beck	Phone	15m	106
381	VK6APK	Aleksandar Petkovic	Open	10m	123
382	VK6IR	Stephen Chamberlain	CW	80m	108
383	VK6IR	Stephen Chamberlain	Open	80m	215
384	VK6IR	Stephen Chamberlain	Open	30m	200
385	VK6IR	Stephen Chamberlain	Open	17m	193
386	VK6IR	Stephen Chamberlain	Open	12m	200
387	VK6IR	Stephen Chamberlain	CW	40m	207
388	VK6IR	Stephen Chamberlain	CW	30m	170

DXCC Single-band

#	Call	Name	Mode	Band	Count
389	VK6IR	Stephen Chamberlain	CW	20m	199
390	VK6IR	Stephen Chamberlain	CW	17m	124
391	VK6IR	Stephen Chamberlain	CW	12m	161
392	VK6IR	Stephen Chamberlain	CW	10m	183
393	VK6IR	Stephen Chamberlain	Digital	30m	139
394	VK6IR	Stephen Chamberlain	Digital	17m	114
395	VK6IR	Stephen Chamberlain	Digital	15m	153
396	VK6IR	Stephen Chamberlain	Digital	12m	106
397	VK6IR	Stephen Chamberlain	Digital	10m	128
398	VK3TZ	Tony Burt	Phone	10m	200
399	VK3TZ	Tony Burt	Phone	15m	211
400	VK3TZ	Tony Burt	Phone	17m	109
401	VK3TZ	Tony Burt	Phone	40m	187
402	VK3TZ	Tony Burt	Open	80m	128
403	VK3TZ	Tony Burt	Open	40m	226
404	VK3TZ	Tony Burt	Open	30m	187
405	VK3TZ	Tony Burt	Open	17m	176
406	VK3TZ	Tony Burt	Open	15m	243
407	VK3TZ	Tony Burt	Open	12m	164
408	VK3TZ	Tony Burt	Open	10m	227
409	VK3TZ	Tony Burt	CW	20m	130
410	VK3TZ	Tony Burt	CW	17m	104
411	VK3TZ	Tony Burt	CW	15m	137
412	VK3TZ	Tony Burt	CW	12m	110
413	VK3TZ	Tony Burt	CW	40m	153
414	VK3SIM	Simon Keane	Open	40m	234
415	VK3SIM	Simon Keane	Open	30m	212
416	VK3SIM	Simon Keane	Open	17m	205
417	VK3SIM	Simon Keane	Open	15m	196
418	VK3SIM	Simon Keane	Open	12m	115
419	VK3SIM	Simon Keane	Open	10m	144
420	VK3SIM	Simon Keane	Phone	15m	111
421	VK3SIM	Simon Keane	Phone	10m	103
422	VK3SIM	Simon Keane	CW	40m	128
423	VK3SIM	Simon Keane	CW	30m	101
424	VK3SIM	Simon Keane	Digital	40m	206
425	VK3SIM	Simon Keane	Digital	30m	186
426	VK3SIM	Simon Keane	Digital	17m	156
427	VK3SIM	Simon Keane	Digital	15m	153
428	VK5GR	Grant Willis	Open	40m	217
429	VK5GR	Grant Willis	Open	30m	179
430	VK5GR	Grant Willis	Open	17m	148
431	VK5GR	Grant Willis	Open	15m	134
432	VK5GR	Grant Willis	CW	40m	113
433	VK5GR	Grant Willis	Digital	40m	190
434	VK5GR	Grant Willis	Digital	30m	163
435	VK5GR	Grant Willis	Digital	17m	130
436	VK5GR	Grant Willis	Digital	15m	113
437	VK5BC	Brian Cleland	Phone	10m	205
438	VK5BC	Brian Cleland	Open	10m	221
439	VK5BC	Brian Cleland	Open	80m	137

DXCC Single-band

#	Call	Name	Mode	Band	Count
440	VK5BC	Brian Cleland	Digital	80m	105
441	VK5BC	Brian Cleland	Open	40m	239
442	VK5BC	Brian Cleland	Phone	40m	142
443	VK5BC	Brian Cleland	Digital	40m	181
444	VK4CC	Colin Clark	Open	17m	126
445	VK4CC	Colin Clark	Open	15m	162
446	VK2HV	Paul Hanna	CW	10m	143
447	VK2HV	Paul Hanna	Phone	10m	208
448	VK2HV	Paul Hanna	Open	17m	141
449	VK2HV	Paul Hanna	Phone	15m	135
450	VK2HV	Paul Hanna	Open	15m	150
451	VK2HV	Paul Hanna	Open	40m	148
452	VK2HV	Paul Hanna	Open	20m	196
453	YL2CZ	Visvaldis Sedolins	Open	160m	101
454	YL2CZ	Visvaldis Sedolins	Open	80m	124
455	YL2CZ	Visvaldis Sedolins	Open	40m	175
456	YL2CZ	Visvaldis Sedolins	Open	30m	116
457	YL2CZ	Visvaldis Sedolins	Open	20m	199
458	YL2CZ	Visvaldis Sedolins	Open	17m	172
459	YL2CZ	Visvaldis Sedolins	Open	15m	191
460	YL2CZ	Visvaldis Sedolins	Open	12m	154
461	YL2CZ	Visvaldis Sedolins	Open	10m	181
462	YL2CZ	Visvaldis Sedolins	Phone	20m	110
463	YL2CZ	Visvaldis Sedolins	Phone	10m	103
464	YL2CZ	Visvaldis Sedolins	CW	40m	141
465	YL2CZ	Visvaldis Sedolins	CW	30m	105
466	YL2CZ	Visvaldis Sedolins	CW	20m	145
467	YL2CZ	Visvaldis Sedolins	CW	17m	125
468	YL2CZ	Visvaldis Sedolins	CW	15m	152
469	YL2CZ	Visvaldis Sedolins	CW	12m	114
470	YL2CZ	Visvaldis Sedolins	CW	10m	135
471	YL2CZ	Visvaldis Sedolins	Digital	20m	107
472	YL2CA	Arnolds Preiss	Open	80m	105
473	YL2CA	Arnolds Preiss	Open	40m	164
474	YL2CA	Arnolds Preiss	Open	30m	140
475	YL2CA	Arnolds Preiss	Open	17m	176
476	YL2CA	Arnolds Preiss	Open	15m	208
477	YL2CA	Arnolds Preiss	Open	12m	196
478	YL2CA	Arnolds Preiss	Open	10m	172
479	YL2CA	Arnolds Preiss	CW	40m	123
480	YL2CA	Arnolds Preiss	CW	15m	159
481	YL2CA	Arnolds Preiss	CW	12m	137
482	YL2CA	Arnolds Preiss	CW	10m	128
483	YL2CA	Arnolds Preiss	Digital	40m	128
484	YL2CA	Arnolds Preiss	Digital	30m	119
485	YL2CA	Arnolds Preiss	Digital	17m	140
486	YL2CA	Arnolds Preiss	Digital	15m	142
487	YL2CA	Arnolds Preiss	Digital	12m	130
488	YL2CA	Arnolds Preiss	Digital	10m	123
489	VK2QV	Rasika Liyanage	Digital	17m	105
490	VK2QV	Rasika Liyanage	Digital	40m	100

DXCC Single-band

#	Call	Name	Mode	Band	Count
491	VK3JLS	John Seamons	Open	17m	108
492	VK3JLS	John Seamons	Open	15m	110
493	VK3JLS	John Seamons	Phone	15m	104
494	VK3OHM	Marc Hillman	Open	17m	109
495	VK4CAG	Graeme Dowse	Open	160m	115
496	VK4CAG	Graeme Dowse	Open	80m	151
497	OM2GM	Tibor Fuzik	Open	20m	153
498	OM2GM	Tibor Fuzik	Open	17m	150
499	OM2GM	Tibor Fuzik	Open	15m	119
500	OM2GM	Tibor Fuzik	Digital	20m	117
501	OM2GM	Tibor Fuzik	Digital	17m	109
502	VK3MB	Philip White	Open	20m	133
503	VK3MB	Philip White	Digital	20m	129
504	VK3MB	Philip White	Open	40m	114
505	VK3MB	Philip White	Digital	40m	106
506	VK2KS	Martin Hutchings	Phone	20m	100
507	VK3KTT	Steven Barr	Digital	30m	120
508	VK2QV	Rasika Liyanage	Open	15m	102
509	VK3BDX	David Burden	Phone	20m	114
510	VK5BC	Brian Cleland	Open	30m	219
511	VK5BC	Brian Cleland	Open	17m	238
512	VK5BC	Brian Cleland	Open	15m	238
513	VK5BC	Brian Cleland	Open	12m	205
514	VK5BC	Brian Cleland	Phone	17m	190
515	VK5BC	Brian Cleland	Phone	15m	192
516	VK5BC	Brian Cleland	Phone	12m	153
517	VK5BC	Brian Cleland	CW	17m	103
518	VK5BC	Brian Cleland	Digital	30m	175
519	VK5BC	Brian Cleland	Digital	17m	159
520	VK5BC	Brian Cleland	Digital	15m	156
521	VK5BC	Brian Cleland	Digital	12m	104
522	VK2ZQ	Michael Ramsay	Open	40m	161
523	VK2ZQ	Michael Ramsay	Open	30m	130
524	VK2ZQ	Michael Ramsay	Open	15m	151
525	VK2ZQ	Michael Ramsay	Open	10m	154

Ed. DXCC Single-band list will continue on AR Number 4 - 2020

VHF Century Club

#	Call	Name	Mode	Band
147	YL2CA	Arnolds Preiss	Open	6m
148	YL2CA	Arnolds Preiss	Phone	6m
149	YL2CA	Arnolds Preiss	CW	6m
150	YL2CA	Arnolds Preiss	Digital	6m
151	YL2CZ	Visvaldis Sedolins	Open	6m
152	YL2CZ	Visvaldis Sedolins	Phone	6m
153	YL2CZ	Visvaldis Sedolins	CW	6m
154	YL2CZ	Visvaldis Sedolins	Digital	6m
155	VK5UR	Andrew Hodges	Open	6m
156	VK5UR	Andrew Hodges	Phone	6m

Grid Square

#	Call	Name	Mode	Band	Count
435	VK6WX	Wesley Beck	CW	HF	349
436	VK2QV	Rasika Liyanage	Open	HF	1462
437	VK2QV	Rasika Liyanage	Phone	HF	695
438	VK2QV	Rasika Liyanage	Digital	HF	1255
439	VK3EY	Robert Pulse	Open	HF	524
440	VK3EY	Robert Pulse	Digital	HF	524
441	YL2CA	Arnolds Preiss	Open	HF	1523
442	YL2CA	Arnolds Preiss	Open	6m	412
443	YL2CA	Arnolds Preiss	Phone	HF	400
444	YL2CA	Arnolds Preiss	Phone	6m	232
445	YL2CA	Arnolds Preiss	CW	HF	726
446	YL2CA	Arnolds Preiss	CW	6m	279
447	YL2CA	Arnolds Preiss	Digital	HF	1335
448	YL2CA	Arnolds Preiss	Digital	6m	313
449	DK3UA	Reinhard Michaelis	Open	HF	1003
450	VK3FZ	Roger Stafford	Digital	6m	56
451	JA3DBD	Souichi Miyamoto	Open	HF	923
452	JA3DBD	Souichi Miyamoto	Open	6m	80
453	JA3DBD	Souichi Miyamoto	Digital	HF	923
454	JA3DBD	Souichi Miyamoto	Digital	6m	80
455	YL2CZ	Visvaldis Sedolins	Open	HF	457
456	YL2CZ	Visvaldis Sedolins	Open	6m	372
457	YL2CZ	Visvaldis Sedolins	Open	2m	75
458	YL2CZ	Visvaldis Sedolins	Phone	6m	132
459	YL2CZ	Visvaldis Sedolins	CW	6m	193
460	YL2CZ	Visvaldis Sedolins	CW	2m	46
461	YL2CZ	Visvaldis Sedolins	Digital	HF	457
462	YL2CZ	Visvaldis Sedolins	Digital	6m	199
463	YL2CZ	Visvaldis Sedolins	Digital	2m	39
464	VK3DRH	David Heathcote	Open	HF	500
465	VK5SA	Chris Levingston	Open	HF	570
466	VK5SA	Chris Levingston	Phone	HF	103
467	VK5SA	Chris Levingston	Digital	HF	505
468	VK2RZ	Alexander Tavemer	Open	HF	536
469	VK2RZ	Alexander Tavemer	Digital	HF	530
470	VK3MB	Philip White	Phone	HF	120
471	OM2GM	Tibor Fuzik	Open	HF	815
472	OM2GM	Tibor Fuzik	Open	6m	105
473	OM2GM	Tibor Fuzik	Digital	HF	806
474	VK2ZQ	Michael Ramsay	Digital	6m	67
475	VK2DX	Nikola Hacko	CW	HF	1174
476	VK2DX	Nikola Hacko	Phone	HF	720
477	VK5UR	Andrew Hodges	Open	6m	101
478	VK5UR	Andrew Hodges	Phone	6m	85
479	VK3QI	Peter Forbes	Open	HF	793
480	VK3QI	Peter Forbes	Phone	HF	468
481	VK3QI	Peter Forbes	CW	HF	600

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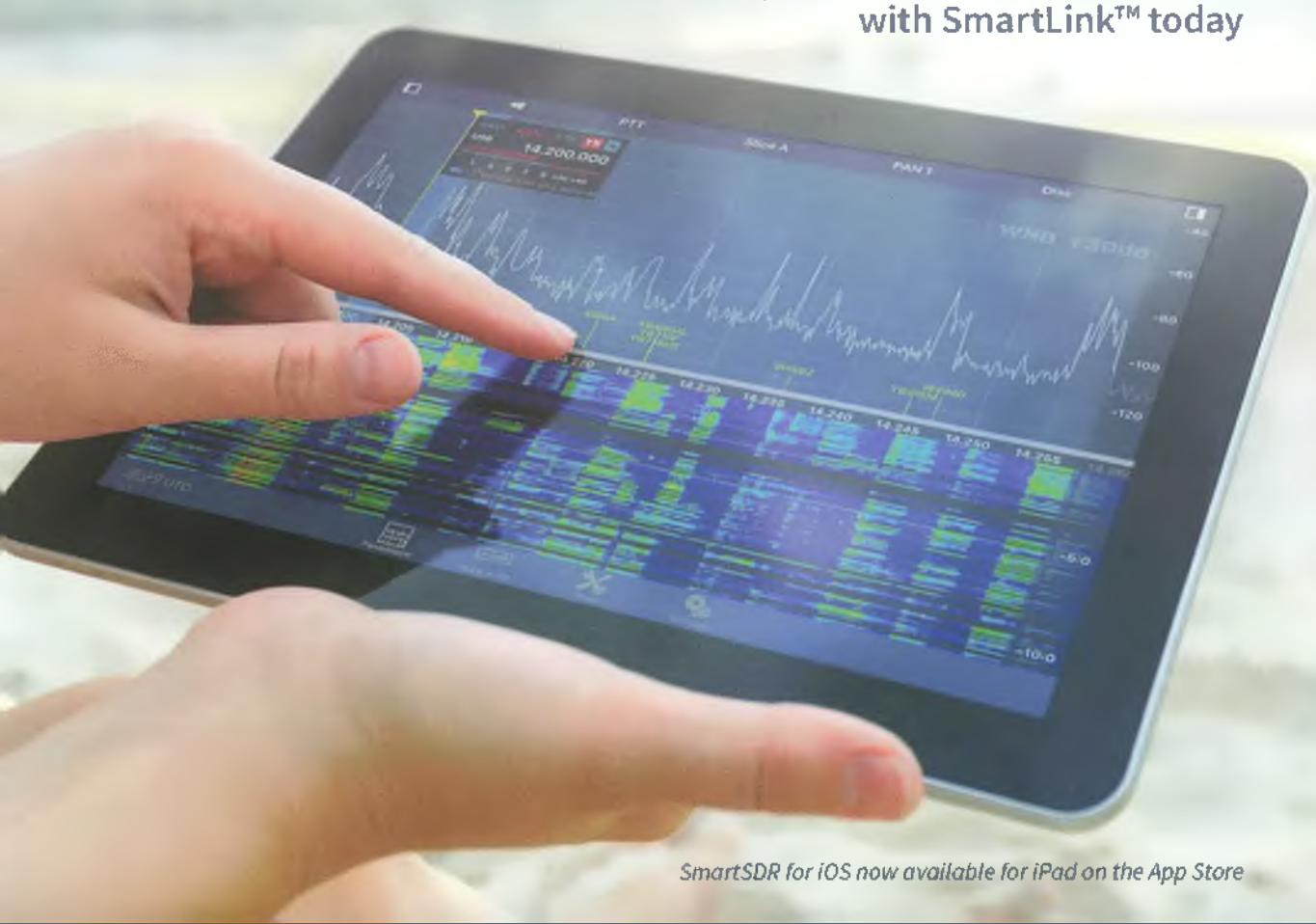

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* The antenna and antenna connector in the photo are after-market products.

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