VHF/UHF – An Expanding World

David Smith VK3HZ

Weak Signal

David Smith - VK3HZ

The weather gurus have been making dire predictions for the coming summer season. It looks like we're in for a long, hot, dry period and indications are that it has already started, with one of the hottest and driest Septembers on record. However, for VHF/UHF enthusiasts, there is a positive aspect to all this. We could be in for a very good DX season with lots of slow-moving high pressures cells and associated ducting. Keep an eye on the Hepburn Tropo Ducting Forecast site:

www.dxinfocentre.com/tropo_aus.html

And, almost on cue, the first VHF opening across the pond to New Zealand occurred on September 24th. At about 0700Z, Nick ZL1IU worked Ross VK2DVZ (5/5) in Taree and Steve VK2ZT (5/5) near Newcastle, both on 2 m.

On the morning of October 4th, conditions were generally good from the Adelaide region across Victorian and up into northern NSW. Mark VK2EMA and Leigh VK2KRR both reported hearing the VK5VF 2 m beacon at S5. Leigh worked Brian VK5UBC (5/6) on 2 m, and Phil VK5AKK on 2 m (5/9+), 70 cm (5/9) and they could hear each other's carriers on 23 cm, but no contact was made. Brian VK5UBC reports working VK2KRR, VK3WN, VK2EMA, VK3HZ, VK3VG, VK3ANP, VK3RW and VK3II on 2 m and VK3VG and VK3YLV on 70 cm.

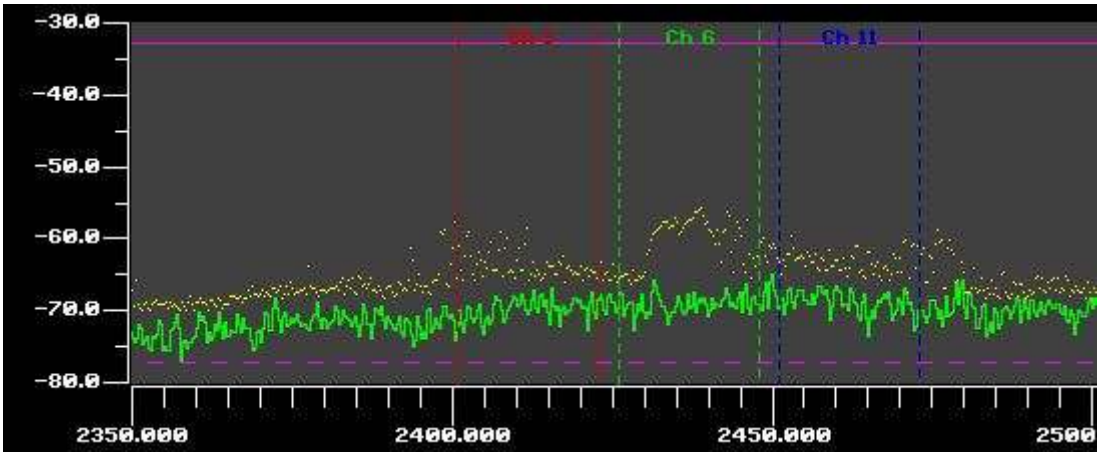
Spring VHF-UHF Field Day

A short reminder again that the Spring VHF-UHF Field Day is on the weekend of November 11th and 12th. Even if you do not intend to go out portable, please take the time to provide contacts for those who do.

13 cm Band

Anyone who is active on the 13 cm band (2.4 GHz) would be well aware that it is becoming less useable day by day. The interference resulting from the insidious spread of WiFi, cordless phones, AV senders, microwave ovens … and on the list goes … is gradually filling the weak signal end of the band with spurii and noise. I even have a problem at the home QTH with 2.4 GHz consumer items interfering with each other – the WiFi gets into the AV sender, and don't microwave anything while trying to make a call on the cordless phone!

One of our American brethren hooked his spectrum analyser up to an antenna and recorded the spectrum in the picture below.



The “grass” is probably WiFi, cordless phones and the like, while the broadband interference is probably an AV sender. It clearly shows that the area in which we operate for weak signal operation – 2403 MHz – is being swamped with interference.

Going back a few years, our allocation covered the range 2300 to 2450 MHz. The advent of microwave Pay TV systems like Galaxy and Austar in that frequency band saw our portion drastically reduced to 2400 to 2450 GHz. However, one little-known fact is that we still retain a small allocation from 2300 to 2302 MHz. The Pay TV systems now seem to have largely self-destructed, so the bottom end of our old allocation may be relatively free of interference. Perhaps it would be more logical for us to operate in the 2.3 GHz area, well away from the chaos at 2.4 GHz. I’d be interested to hear from anyone who has any knowledge of the state of the 2300 to 2302 MHz portion of the band.

Aircraft Enhanced Propagation

Barry VK3BJM near Kyneton in central Victoria writes about some interesting AEP efforts:

A few notes on contacts from Saturday morning (26/11/05). The normal AEP shindig was nearly finished, when Peter VK5ZLX asked me (via the VK Logger) if I wanted to have another go with the AEP "window" we'd observed back on the 28th of October. I agreed, and checked the on-line arrivals schedule for Melbourne Airport. The Virgin flight 536 (from Adelaide to Melbourne) was due to land at 2300z (1000EDST), so assuming that it would start to be in position 30-35 minutes before landing, I started calling at 2222z. We had a weak troppo path to start with (51 each way) but after about 2 minutes flutter became apparent on the signals before they became more solid as they built to the 56 report I gave Peter, and the 58 he gave me. That strength of signal stayed until about 2234, when it dropped sharply to the normal troppo level at 2235.

By chance, I called CQ again at 2239z, and Peter came back at 55, giving me another 58! We had another aircraft in the path, so I went back to the Melbourne Airport website to find which one it could be. I checked the domestic flights, neither QANTAS or Virgin (or anyone else) had anything due that would be travelling that route. I then checked the international arrivals board, and found a Singapore Airlines flight (SQ237 from Hong Kong) due to land about 10 minutes after the Virgin flight.

I went back to the domestic arrivals and noted that QANTAS had a flight from Adelaide due in Melbourne at 2350z. I suggested via the Logger that maybe we should try 70cm. We got established on 2m at 2309z (55/58 again) before QSY'ing to 70cm - unfortunately nothing was heard at either end. Signals on 2m held up until 2317z.

Seems like the Adelaide - Melbourne flight path can provide regular and predictable 10-minute AEP windows between Kyneton and the Barossa. My next intention is to see if the path will provide enhancement further south from Peter's QTH (to Brian VK5UBC in Gawler, for instance), and if so what the difference in the time calculation is.

Peter and I also need to have a few more goes at AE on 70cm.

The path won't provide enhancement into Adelaide proper, as the only place the path will intersect with my beam heading to Adelaide is somewhere near the northern end of the Adelaide Airport runway...

My apologies to Barry that this item was waylaid for so long. Perhaps the next section on ADS-B could be of interest to him for prediction of AEP events.

ADS-B

In the June issue, I spoke about the ADS-B system where aircraft regularly transmit data packets containing such items as their position and identification, on 1090 MHz. A UK company – Kinetics – makes a decoder box with software to turn your PC into a pretend air traffic control display.

Now a Sydney-based enthusiast has set up a web site to merge data from decoder boxes around the world and present the result on a Google Earth display:

www.openatc.com

In Australia, there are currently semi-permanent data feeds from Sydney, Melbourne and Brisbane with a temporary one (sometimes offline) around Hobart. There are more to come. The range seems to be up to about 400 km, so coverage between Hobart, Melbourne and Sydney is almost continuous.

ADS-B-enabled aircraft are still low in number - mostly the big internationals and those less than about 3 years old. So there can be times when not a lot of aircraft can be seen. This will only improve as ADS-B becomes mandated on all aircraft in 2009.

So next time there's a huge Aircraft-enhanced signal, go check Google Earth to see if it's due to an aircraft with ADS-B.

VK-ZL Propagation Logger

Finally, another plug for what I consider one of the most valuable Internet resources for the VK VHF/UHF enthusiast – the VK-ZL Propagation Logger:

www.vklogger.com

The logger provides valuable real-time information about the state of the bands, as well as a wealth of useful background information on beacons, events, VHF operator information etc.

Adam VK4CP is the creator, administrator and general dogsbody behind the site, and somehow also finds time to operate his radios. Adam also funds the site, which resides on a commercial server in order to provide the reliability, bandwidth and rapid response time expected of such a resource. Although he doesn't publicise the fact, contributions to the running costs of the site are very welcome. If you find the site useful, consider helping Adam out with the costs. There is a Donate button on the main page that provides more information.

Please send any Weak Signal reports to David VK3HZ

Digital DX Modes

Rex Moncur – VK7MO

The EME echo mode on the older versions of WSJT (Version 4) can be a useful indicator of system performance but there are some issues relating to EME one must take into account to achieve best results.

1. Faraday rotation
2. Amplitude variations due to libration
3. Frequency spreading due to libration

The way the echo mode works is that it transmits a signal for 2 seconds, waits for 0.5 second when the signal is about to return from the moon, receives and records this signal for 2 seconds, averages the signal for as many periods as desired, reports the results and keeps repeating this process. The program also provides a spectrum that

shows the spread of the signal which might for example be due to libration frequency spreading. Through the use of the averaging process and the spectrum display one can detect average echoes at low as -38 dB on the WSJT scale. It is possible to reset the average manually after each echo if one is interested in studying the variation of the signal amplitude and frequency spreading of individual echoes. All these separate echoes are recorded in the decode.cum file and can be copied into a spreadsheet for more detailed processing.

Version 4.9.8 of WSJT, which includes the echo mode, can be downloaded at:

http://pulsar.princeton.edu/~joe/K1JT/Download.htm

The echo mode has not yet been included in the later versions of WSJT, although this is intended.

On the lower EME bands such as 50, 144 and 432 MHz, most stations use linear polarization and the strength of the returned echoes vary depending on whether the polarization of the returned signal is the same as your antenna. This variation cannot readily be predicted and can take from a few minutes on 50 MHz, to half an hour or more at 432 MHz to go through a peak. Variations due to this effect can be up to 20 dB. The best one can do is wait for the echoes to peak and take that as the measurement on which to base system performance. At 1296 MHz most stations use circular polarization and this avoids the problems of Faraday rotation.

Libration amplitude variations affect returned signals on a shorter times scale of seconds at 50 MHz, about a second at 144 down to one tenth of a second at 1296 MHz. These amplitude variations can be up to 10 dB or more between successive echoes at 1296 MHz and are still significant on the lower EME bands. The best one can do to overcome the libration amplitude variations is to average the amplitude over a number of echoes, but this does of course make it more difficult to find the peak if Faraday rotation is also involved. WSJT provides one with the ability to average the echoes for any period and typically at 1296 MHz an average of 50 readings gives results that are consistent to within plus or minus 1 dB.

WSJT measures echoes in bins of about 0.66 Hz bandwidth, but the signal can be spread due to libration over one or two bins at 144 MHz and up to ten bins at 1296 MHz. As WSJT reports the echo level in the peak bin, this can dramatically underestimate the echo energy if it is spread over many bins – by as much as 10 dB at 1296 MHz. To help overcome this problem, WSJT provides a “W” reading which represents the approximate width of the signal in Hz and thus gives an indication of the number of bins over which it is spread. For example, if the W is 6.6 Hz, then most of the signal is spread over ten 0.66 Hz bins. If all the energy was equally spread between these bins, the reported power would be one tenth of the actual and thus down by 10 dB. Now in practice the energy is not spread equally but more in a bell curve shape with more energy inside the closer bins but still some energy in the bins outside the reported W reading. However tests show that the W does give a reasonable indication of the average spread of the signal and thus can be used to calculate the actual average echo level. The following table gives the correction one should add in dB to the reported signal level for various values of reported W.

Width "W"	Correction
Hz	dB
0.7	0.0
1.3	3.0
2.0	4.8
2.7	6.0
3.3	7.0
4.0	7.8
4.7	8.5

5.3	9.0
6.0	9.5
6.7	10.0
7.3	10.4
8.0	10.8
8.7	11.1
9.3	11.5
10.0	11.8

A typical example at 1296 might be:

Average echoes over 50 samples = -30 dB
W = 4.7 Hz, correction 8.5 dB
Corrected echo = -21.5 dB

Now, having measured a corrected echo, one needs a means of comparing this with the expected system performance. The WSJT program provides a calculator that can be used to estimate the expected echo for any particular equipment set up. The calculator gives the estimated echoes with reference to the noise in both a 2.5 KHz and 50 Hz bandwidth. It should be noted that the echoes are measured on the WSJT scale which applies to a nominal SSB passband of 2.5 KHz, so this is the reference that should be used.

Doug VK3UM has produced a calculator (EMECalc3) that provides for a wider range of station parameters. If you use Doug's program you need to set the bandwidth to 2.5 KHz to achieve comparable results. Doug's program was recently updated and is available at:

www.sm2cew.com/download.htm

Tests show that both calculators give similar results and at 1296 are within 2 or 3 dB of the measured results. This is not too far off and the difference might reflect the fact that W does not fully measure the spread of reflected energy at 1296 MHz.

There is a question as to the optimum number of samples to use in the average when running linear polarization. This is a compromise between making the number too small and not having enough samples to get a good average due to libration amplitude variation, or making it too large and not finding the peak as Faraday varies. Fortunately, the variation of libration amplitude tends to drop with lower frequency while the speed of Faraday increases and there is the opportunity for reasonable compromises. While I don't have enough data to determine the best compromise I think a reasonable starting point would be as follows when using linear polarisation:

50 MHz	10 samples
144 MHz	25 samples
432 MHz	50 samples
1296 MHz	50 samples

When using linear polarisation the approach would be to measure the echo over the desired number of samples and then reset the average on the WSJT program and make repeat measurements until one finds the best average which should result from the peaking of Faraday.

Please send any Digital DX Modes reports to Rex VK7MO

The Magic Band – 6 m DX

Brian Cleland – VK5UBC/BC

There haven't been any reports of openings during September.

On the morning of the 6th October tropo conditions on 2 m & 70 cm were very good from my QTH to central Victoria so 6 m was tried and, although signals were only S1, contacts were completed with Trevor VK3VG at Cobram (600 kms) and David VK3ANP at Wangaratta (700 kms) on 6 m tropo.

Further to the beacon listings in last months notes, it is pleasing to note that the Darwin beacon VK8VF is now back on air on 50.310 CW. Look forward to hearing the beacon and hope that there is some activity from Darwin during the coming summer.

In the Barossa Valley Peter VK5ZLX has finished erecting his antennas with the last one to go up being a 9-element 40 foot long-boom 6 m yagi (M2 antenna). Pictured are Peter's very impressive antennas, at the top a 32-element 70 cm yagi, in the middle an 18-element 2 m yagi with the 6 m yagi at the bottom.

Hopefully in November we will start to see the beginning of the summer DX season. Although it is the bottom of the sunspot cycle we should still experience a good sporadic-E season with many openings around Australia and to our near Pacific neighbours. It is hoped all 6 m operators support and take part in the local DX and not wait for the sunspot cycle to increase and the international DX to appear.

Please remember to send any 6 m information to Brian VK5UBC/BC