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# VHF/UHF – An Expanding World

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David Smith VK3HZ

## Weak Signal

David Smith - VK3HZ

It can sometimes be forgotten that, as Radio Amateurs, we are very privileged. Looking at all the discussions, manoeuvrings and talks of mega-dollar auctions that are going on with regard to the slabs of RF spectrum that will be freed up as the Analogue TV system is closed down, we should remind ourselves that we have use of a very valuable resource in the form of the frequency allocations set aside for Amateur Radio. Commercial pressures on the ACMA for access to these frequency bands must be enormous.

In recent times, we have been generously granted even greater spectrum portions in LF, MF and HF regions. We should treat them and all of our other allocations as precious objects.

### Loss of 420-430

Unfortunately there are also some losses. For several years, use of the 420 to 430 MHz segment of the 70 cm amateur band has been restricted to Advanced licensees and further restricted by various exclusion zones in NSW, the ACT, Sydney, Perth and Melbourne. Recently, the ACMA has advised the WIA that this segment will be withdrawn from general amateur use from 1st January 2013. There are a number of repeater links within this segment that are affected. The WIA is currently negotiating with the appropriate parties as to whether the links may continue to operate within this segment or whether the licensees affected – mainly clubs - will be required to relocate them into the 430 to 450 MHz region.

In addition, as part of the re-organization of the land mobile service, the ACMA has indicated that the segment 440 to 450 MHz may be used on a temporary basis by displaced land mobile services until they are relocated during a transition phase. We should be active and vigilant in ensuring that this segment does not also go the way of the lowest 10 MHz of the 70 cm band.

### Threat to 10 GHz

One of the most popular microwave bands would have to be 10 GHz. We are privileged with 500 MHz of spectrum from 10.0 to 10.5 GHz with Amateur Radio as a Secondary Service. Most weak signal operation occurs around 10.368 MHz, being an exact multiple of 144 MHz.

On this band, homebrewing of equipment is still practical without the need for exotic test equipment. As well, there is a lot of ex-commercial microwave link equipment originally operating on 10.5 GHz and 14 GHz that can be easily modified to work in our area of the spectrum – Mitec, Qualcomm and the Whitebox being just a few.

At the recent WRC conference, one of the activities undertaken was the setting of the agenda for the next conference in 2015. Of particular note is the following item:

*Agenda item 1.12 to consider an extension of the current worldwide allocation to the Earth exploration-satellite (active) service in the frequency band 9 300-9 900 MHz by up to 600 MHz within the frequency bands 8 700-9 300 MHz and/or 9 900-10 500 MHz, in accordance with Resolution 651 (WRC-12)*

Active remote sensing satellites gather topographical data of the Earth's surface using synthetic aperture radars (SARs). The frequencies around 9 GHz are ideal for such applications. While there was no action taken with respect to the existing allocation of the 9.3 to 9.9 GHz band to the Earth exploration-satellite service, the Conference agreed to Agenda item 1.12 for WRC-15 which will consider the possible expansion of the existing X-band allocation by up to 600 MHz.

Given that there appear to be several options, if we can make our voice heard and demonstrate our need for this band, then the hope is that any decision will favour leaving our segment alone.

### **Threat to 76 GHz**

The Amateur Service has 5 GHz of spectrum allocation from 76 to 81 GHz, with the portion from 77.5 to 78 GHz as a Primary Allocation (the remainder as Secondary). While some may say that the 76 GHz band is getting into the realms of the esoteric, the same thing was thought of 10 GHz not so many years ago. At the recent GippsTech conference, Alan VK3XPD and Michael VK3KH showed that operation on the 76 GHz band was possible with relatively simple equipment.

At the recent WRC conference, another Agenda item for the WRC-15 conference is of concern:

*Agenda item 1.18 to consider a primary allocation to the radiolocation service for automotive applications in the 77.5-78.0 GHz frequency band in accordance with Resolution 654 (WRC-12)*

- *An allocation of spectrum that is compatible worldwide would be beneficial in terms of efficient use of spectrum and economies of scale*
- *The 77-81 GHz frequency band is considered to be a possible suitable band for automotive radars*
- *ITU-R will conduct the appropriate technical, operational and regulatory studies to consider a primary allocation to the radiolocation service in the 77.5-78 GHz frequency band*

Our primary allocation in the 76 GHz band is under threat for use by vehicle active cruise control radars. One could imagine the chaos as the Mercedes, on full autopilot, pulls into the mountaintop carpark where you are operating. A burst of CW on 78 GHz causes the Merc to lunge into the rear of the Volvo that arrived during the last over, causing massive interference to your reception.

Even though this re-allocation is probably already a done deal given that vehicles are already being made with these radars, we should not just roll over, but negotiate something in exchange for our loss of privilege.

Ironically, the advent of 76 GHz radar systems in the consumer segment (albeit high-end) may result longer-term in a source of surplus equipment for conversion to Amateur use. Keep an eye out for a late-model Merc in the wreckers yard.

### **Publicising Activity**

All this demonstrates that we should be active about protecting our frequency allocations. By active, I mean that we should get out and use the bands and publicise the activity. It's important that all those stations active on any microwave bands, and particularly 10 GHz, should post Spots on the VK Logger and write about their activities on the Logger forum, and VK-VHF and VK-Microwave mail lists.

As well, I welcome any submissions on your activities, even if they are just benchtop developments. There is much going on in the Amateur microwave regions and we urgently need to tell everyone about it.

### **VK3 Microwave Tune Up Day**

Discussions have recently started about having a Microwave Tune Up Day in the Melbourne area late in the year. The idea is that people can set up their systems and check the sensitivity, output power, dish efficiency, frequency accuracy and stability. Date and Venue have yet to be determined, but take this as an early warning so that you can have your system ready in time.

### **Vale Steve Powlishen K1FO**

It was sad to hear recently that Steve K1FO passed away at the young age of 60 years. Anyone who has dabbled in the VHF/UHF area will have heard of K1FO. His yagi antenna designs were the standard in ARRL publications for many years. He produced many VHF/UHF RF power amplifier designs that were built by Amateurs around the world. He was also an avid EME operator himself using, of course, yagis and amplifiers of his own design. His presence and expertise will be greatly missed.

### **Winter VHF/UHF Field Day Results**

Congratulations must go to those hardy soles who participated in the recent Winter VHF/UHF Field Day. For the first time, VK2 stations have won three sections - and also for the first time, VK3 stations won nothing.

Congratulations to the section winners:

- Matt VK2DAG – Single Operator, 24 Hours
- Steven VK2XDE – Single Operator, 8 Hours
- Sunshine Coast Amateur Radio Club VK4WIS – Multi Operator, 24 Hours
- Redcliffe and Districts Radio Club VK4IZ - Multi Operator, 8 Hours
- Keith VK5AKM – Home Station, 24 Hours
- Justin VK2CU – Rover Station, 24 Hours

The next VHF/UHF Field Day is the Spring event on the weekend of 24-25 November.

Please send any Weak Signal reports to David VK3HZ

## **Digital DX Modes**

Rex Moncur – VK7MO

### **Tropo-Scatter on 24 GHz**

To date most contacts on 24 GHz in VK have been over line of sight paths or due to occasional ducting. Rex VK7MO and Dave VK3HZ have been exploring the use of tropo-scatter on 24GHz to complete grid squares where a line of sight path is not available. The equipment used is 1.5 and 3 watts and 40 cm dishes. With SSB, tropo-scatter paths of up to 170 km have been completed when absorption is low but the additional sensitivity of JT65c has allowed tropo-scatter contacts of up to 268 km. A key issue on 24 GHz is absorption due to water vapour and it has been found that forecasts of Precipitable Water (PW) give a good indication of this loss. PW is defined as the amount of water that would be found if all the water vapour and any

liquid water in a column from the surface to the top of the atmosphere were condensed. In Australia PW is typically in the range 5 to 50 mm resulting in losses of 15 to 150 dB on a 250 km tropo-scatter path. As a rough guide it is found that absorption losses on tropo-scatter paths can be approximated by:

$$\text{Absorption Loss (dB)} = 0.012 * \text{PW (mm)} * \text{distance (km)}$$

Thus for PW of 10 mm over a 250 km path the absorption loss will be around 30 dB reducing to 15 dB on the few occasions each year that PW is down as low as 5 mm.

Forecasts of Precipitable water up to six days in advance are available at:

<http://wxmaps.org/pix/aus.pw.html>

Table 1 below shows the JT65c signal levels that have been achieved (and failures) over various tropo-scatter paths with generally close to zero take-off angles. All QSOs or attempts listed were back to Mt Macedon in QF22.

Grid Locator	Distance (km)	Average PW (mm)	Signal to Noise (dB) on WSJT scale
QF15	268	6	-29
QF01	244	9	-30
QF03	242	18	Nil
QF03	242	14	Nil
QF03	242	10	-27
QF02*	233	9	-30
QF34	220	9	-17
QF24	197	9	-18

\* Take-off angle of +0.7 degrees costing around 7 dB

The use of a single 1270 Hz tone on JT65 is a useful way to find a very weak signal on the waterfall display and gives around 4 dB improvement. 1270 Hz is chosen to coincide with the normal sync tone frequency of JT65 so that when one moves to send messages one knows exactly where to look on the water fall. To transmit a 1270 Hz tone, insert "@1270" in any message box. On very weak signals it is also useful to use single tone messages to transmit RRR and 73 and take advantage of the 4 dB improvement. RRR is transmitted with the single tone "@1595" and 73 with "@1700".

Please send any Digital DX Modes reports to Rex VK7MO

## The Magic Band – 6 m DX

Brian Cleland – VK5BC

July was another quiet month on 6m with only a few winter 'E' openings and some evening TEP openings in northern VK late in the month.

3rd of July saw many reports of contacts down the east coast from VK4 to VK2, 3 and 7 with Phil VK4FIL reporting contacts with VK1KW, VK2ZQ, VK2ZM, VK3BBB, VK3DUT, VK3AJN and VK7DX. The band also opened from southern VK2 and VK3 to northern VK4 with Leigh VK2KRR reporting Lloyd VK4FP in Townsville at +9 on WSPR.

8th July band opened from VK2 to ZL and VK2 to northern VK4. Mark ZL2WHO worked several VK2's including John VK2BHO, Mike VK2ZQ, Brett VK2FZR as well as Frank VK7DX.

Bob ZL1RS worked several VK2 and 4's from Sydney to Townsville on the 10th July

and the band again opened from ZL to VK2 and 3 on 13th July with ZL3ADT, ZL2TPY, and ZL2WHO and ZL3NW also in the action.

Good opening on the 18th July from VK5 to VK2 and 4 with Col VK5DK in Mt Gambier completing several contacts including VK4AQF, AFL and AMG. Brian VK5BC/p Corny Point also completed with VK2BXT, VK2TS, VK4EK, and VK4AMG and VK4WTN.

27th July produced the best opening for the winter with the band opening over most of VK including NW VK6. The VK6RSX beacon in Dampier was audible in VK3, 5 and 7 for 2-3 hours with Michael VK6BHY in Karratha working Steve VK3ZAZ, Norm VK3DUT and Frank VK7DX. In VK5 Stations could be heard from VK2, 3, 4, 6 and throughout the afternoon with several short skip contacts into VK3 completed. Brian VK5BC worked Kevin VK3AKC, Norm VK3DUT, David VK3ANP and Oly VK3XDX. Frank VK7DX worked VK5KAA, Jeff VK5GF and Brian VK5BC as well as Trevor VK4AFL and Ross VK4QM.

The band again opened from VK5 to VK6 on the 28th July. Both the Perth VK6RPH and Bunbury VK6RBU beacons were audible for over 2 hours but only 2 VK6 stations were heard and worked. Peter VK6KXW worked Peter VK5PJ in 3 modes, SSB, CW and RTTY and VK5BC in SSB. Wayne VK6JR near Bunbury worked Garry VK5ZK and Brian VK5BC.

29th July Frank VK7DX had a good opening to ZL3 working ZL3ADT 58/58, ZL3NW 59/59 and ZL3AAU 59/59.

Gary VK8AW in Darwin reports hearing JA beacons in the evening of the 23rd July and Hiro JR2HCN reported hearing both the Darwin VK8VF and Townsville VK4RTL beacons in evening of 31st July.

Meanwhile in Exmouth NW VK6, Rex VK6ARW has been busy building a Loop Fed Array yagi for 6m and hopes to have it in the air shortly.



**Rex VK6ARW with his new LFA yagi**

If you are interested in trying to figure out the vagaries of 6 m propagation, an interesting paper can be found at this site;

[http://www.ham-radio.com/n6ca/50MHz/K6MIO\\_50MHz\\_F2Prop.pdf](http://www.ham-radio.com/n6ca/50MHz/K6MIO_50MHz_F2Prop.pdf)

Please send any 6 m information to Brian VK5BC