
VHF/UHF – An Expanding World

David Smith VK3HZ

Weak Signal

David Smith - VK3HZ

On the morning of October 24th, the bands opened to ZL from VK4 and VK2. Ross VK2DVZ was one of the first in, working Bob ZL3TY on 2 m at 2218Z. Bob enjoyed a number of other contacts into VK2 with signals peaking to 5x9. The opening continued that evening, again from Bob to VK2 stations.

The following morning, the band opening had strengthened and Stephen ZL1TPH was now out portable in northern NZ. He reports:

Portable on Moirs Hill, I worked the following stations:

144 MHz: VK2DVZ, VK2AMS, VK2BCC, VK2AWD, VK2AH, ZL2ARA, VK2ZT, VK2EI, VK2FRL, VK4JMC, VK4OX, VK4IBR

432 MHz: VK2DVZ, VK2AMS, VK2AH, VK2BCC, VK2ZT

1296 MHz: VK2DVZ, VK2AMS

The highlight today was the 432 MHz contact up to VK4OX at 2317 km. This is the first time I have worked this band to VK4. The contact did not come easy and we both persevered for over half an hour waiting for a peak. We finally found that peak and it resulted in an easy SSB contact with chat included.

Equipment used:

144 MHz: 200 W SSPA, TS700a driver, ZL1RS two 5 element stack

432 MHz 100 W Tono amp, FT817ND driver, 14 element Yagi

1296 MHz 150 W SSPA, 1296 MMT and ICOM 202 driver, 1.1 m dish



ZL1TPH/p 2 m and 23 cm Portable Setup

On the following day – October 26th – activity across the water continued. Kevin VK4UH reports:

During a recent visit to the VK4UH QTH in Samford by the VK5 Mt Gambier “team” (Colin VK5DK, Trevor VK5NC and Tom VK5EE), a short but intense Tropo opening to ZL1 occurred at around 0730Z on 26th October.

Although the Hepburn had been looking promising from SE VK4 up the coast and

across the Tasman, no beacons or stations had been heard all afternoon. As the sun was setting Brian ZL1AVS in RF73fd, operating from the shack of Steve ZL1AVZ in Auckland (2286 km), appeared out of the noise on 2 m SSB and was eventually worked at 5x1 / 5x5. Steve also came on the air and was worked by me and all the VK5 visitors. As conditions improved Steve and Brian were also worked on SSB on 70 cm peaking at 5x2 / 5x5. These were the first contacts to ZL for me from this new QTH on either band.

I estimate the opening lasted no more than 45 mins from this QTH and no beacons from ZL were audible at any time. Hopefully a sign of things to come later in this season.

On the morning of October 27th, the VK6 beacons made a brief appearance in VK3. At 2207Z, Jim VK3II reported hearing VK6REP near Esperance. A short time later, at 2225Z, Ian VK3AXH reported hearing VK6RST near Albany. No VK6 stations were heard.

VK3 Microwave Test Day

After not-so-good weather forecasts, Sunday November 6th turned on ideal weather for the Test Day. The venue was the Eastern and Mountain District Radio Club rooms and the grass area at the rear was converted to a test range for the day, with a signal generator and remote-reading field strength meter about 54 m away. Eight people arrived with 10 GHz systems, three of them also with 24 GHz systems. As well, about 20 onlookers checked out the systems and also brought along other bits and pieces for show.



Systems ready for testing

On the whole, most systems seemed to be working OK but some improvements were identified. Ian VK3AXH was one of the stand-outs, taking top spot in the normalised performance stakes (i.e. adjusted for dish size and output power) with his 10 GHz system that he had only completed days before and had not yet tested!

Jack VK3WWW was about with his video camera and filmed a short piece on the day. You can find it at: <http://www.youtube.com/watch?v=b9u01vPMmCU>

Thanks to the EMDRC for providing the venue and lunchtime BBQ.



**(R-L) Rhett VK3GHZ, Rex VK7MO and Bryon VK3YFL
behind Rex's new 50W 10 GHz system**



Peter VK3APW with his 24 GHz and 10 GHz setups

VK4 Microwave Activity Day

Following their very successful Test Day, the VK4 microwave community held an Activity Day on October 28th. Unfortunately, the weather was a little inclement in some areas but, nevertheless, about 12 stations participated including Colin VK5DK/p. Adam VK4GHZ has again put together an excellent video of the day, which can be found at: <http://www.youtube.com/watch?v=0DgF6Fun-qU>

VHF/UHF Field Day Scoring

The responses to the survey on the Field Day scoring have been collated and a report produced by Andrew VK1DA.

In summary, a majority of respondents support the proposal, with 79 in favour, 24 partly in favour and 13 against. In addition there was widespread approval for the concept of a separate category for the 6m / 2m / 70cm bands. This category could be further expanded to include the 23 cm band, but still providing for a 6/2/70 subcategory. This would effectively split the event into the bottom 4 bands and the microwave bands.

A number of other changes are proposed. The full 55-page report can be found at http://vk1da.net/VHF_report_final.pdf

Please send any Weak Signal reports to David VK3HZ

Digital DX Modes

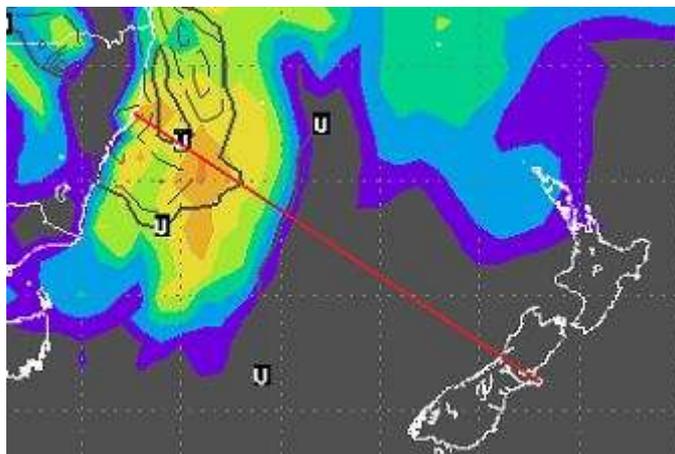
Rex Moncur – VK7MO

More Tropo-extension of Meteor Scatter

On 20 October Starr ZL3CU reported his first even Meteor scatter ping from the Australian mainland from Ross VK2DVZ over 2179 km as follows:

185430 6.5 160 2 26 30 , US*L3TY/73 VK2DVZ !L

Starr was beaming at VK7 at the time so this ping from Ross was off the side of his beam. Starr is at Christchurch on the South Island and beams of over New Zealand's Southern Alps, which would normally cut off long distance and thus low elevation meteor scatter signals. At the same time Simon ZL4PLM near Christchurch and Ross VK2DVZ reported seeing pings from each other which they have rarely seen before. The Hepburn chart (Fig 2) shows the possibility of a tropo-extension out a few hundred km from VK2DVZ , which effectively shortens the meteor scatter path and increase the elevation to get over the Alps.

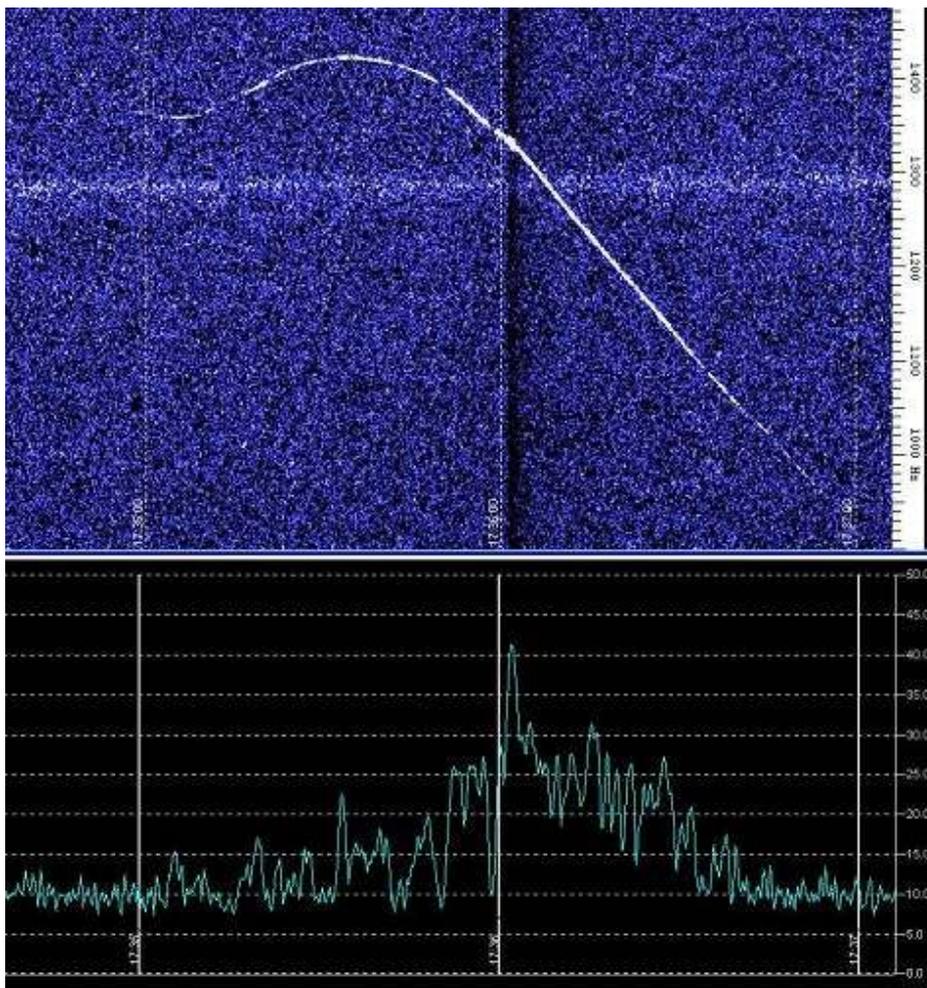


Path between VK2DVZ and ZL3CU

Aircraft Scatter on 10 GHz

Rhett VK3GHZ near Bairnsdale Victoria has just completed his 10 GHz station using a 10 Watt DB6NT amp and a 64 cm offset dish. It turns out that he has a reasonable take-off towards Rex VK7MO in Hobart Tasmania (561 km path) when Rhett operates from his carport and Rex can beam between trees towards Rhett and operate with his portable station from his lounge room. This has the advantage that both stations can remain set up out of the weather. It is found that there are a few

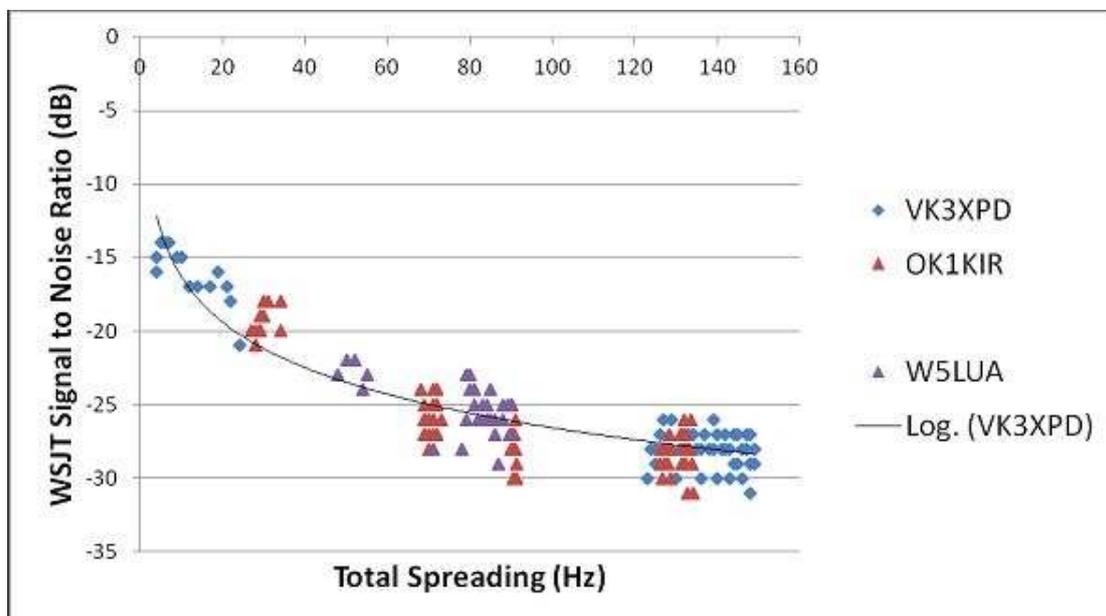
aircraft flights each day that cross the path and also that weak tropo-scatter can often be seen as well over this 561 km path across the mountains of Tasmania. Initial aircraft scatter tests using JT65c produced decodes but the signals did not last long enough for a QSO. Accordingly ISCAT-A was used in 15 second periods and two QSO's completed – each on a single aircraft. Tests were also conducted using a tone from VK7MO with VK3GHZ recording the result on a wave file on Spectrum Lab. Fig 3 shows both the waterfall display as well as the amplitude display showing signal to noise in a 1.6 Hz bandwidth. The waterfall display shows the frequency with Doppler shift due to the aircraft movement and also a weak and spread tropo-scatter signal at about 1300 Hz. It is seen that at about the time the aircraft scatter signal crosses the tropo-scatter, indicating zero Doppler and the crossing of the path of propagation, there is a very strong peak in the signal such that the noise background drops due to AGC action. The amplitude graph shows the signal to noise ratio peaked at over 40 dB at this time – but only for a second of so. There are, however, a number of peaks over 20 dB in 1.6 Hz bandwidth which is equivalent to over -13 dB on the WSJT scale and sufficient for ISCAT-A. One might ask why the peak signal did not occur exactly at the time the Doppler was zero – we think the explanation may be that the Doppler has not only a horizontal component due to the aircraft crossing the path but also a small vertical component and this off-set is a result of the vertical component.



**Aircraft scatter signal between VK7MO and VK3GHZ
(the vertical white lines represent one minute)**

10 GHz EME with 80 cm dish and JT65c

In DUBUS Volume 3/2012 it was reported that Rex VK7MO had worked Alan VK3XPD using his portable station comprising a 64 cm off-set dish and 8 Watts. This was achieved at a time of low libration spreading, down to 4 Hz, by using automatic Doppler correction and Deep Search averaging with Alan decoding Rex's signal at around -30 dB on the WSJT scale. Since then Rex has upgraded his portable station to a 77 cm dish and a 45 Watt DB6NT PA, the result has been a dramatic improvement with Alan decoding Rex at -14 dB at a time of 4 Hz spreading. This is an improvement of around 16 dB of which 8 dB can be explained by the increase in power and 2 dB by the increase in dish size – but there is still an unexplained improvement of around 6 dB. With this new set up tests showed that Rex could now work Alan with libration spreading of up to 150 Hz, opening up many more opportunities for portable EME on 10 GHz. Tests were conducted with OK1KIR at a time of 30 Hz spreading and with W5LUA at a time of 50 Hz spreading with good results. Rex then went portable to grid locator QE38 with Joe VK7JG and both completed QSOs with OK1KIR at a time of 70 Hz spreading. Further tests we conducted with OK1KIR and W5LUA to build up a picture of JT65c reported signal levels with spreading as shown in Fig 4. In general Deep Search decoding works effectively down to -30 and often -31 and -32 dB on the WSJT scale with libration spreading of up to 150 Hz – with VK3XPD's 3 metre dish and 75 watts to the feed. Test have still to be done with wider spreading, but Fig 4 suggests that the performance may only drop off marginally with spreading up to over 200 Hz as often occurs on 10 GHz. A question still to be resolved is whether the JT4G modes which are designed to cope with wide spreading will be better than JT65c. At this time there is a problem with the Doppler numbers on WSJT when using the JT4 modes but when this is resolved comparative tests will be undertaken.



10 GHz Rain Scatter?

On 23 October Rex VK7MO and Joe VK7JG set up Rex's 8 watt 64 cm, and 45 watt 80 cm stations on Joe's lawn with the aim of doing comparison tests with Dave VK3HZ over a 440 km path. While no rain was evident at either end, or on the Bureau of Meteorology radar, signals to and from VK3HZ were quite distorted, but

nevertheless JT65c and SSB contacts were completed. During these tests Rhett VK3GHZ called on SSB and was up to 5/4 even though he was 25 degrees away from the dish heading. When beaming direct to VK3GHZ signals were no stronger and still distorted. QSO's were also completed with Rod VK3BQJ on JT65c and SSB. Rod reported that the VK7 144 MHz and 432 MHz beacons were up over S9 and surmised that the propagation was due to a pre-frontal duct. However, the nature of the signals suggests that the propagation might be due to rain scatter from rain that is too light to be reported on the Bureau of Meteorology radar.

10 GHz Tests between VK7JG and VK7MO

Over the period 24 to 27 October Joe VK7JG at Launceston conducted tests with Rex VK7MO in Hobart. This 200 km path is over mountains in central Tasmania and Joe cannot beam towards Rex because of rising ground and trees. Instead Joe beamed at the TV towers on Mt Barrow some 30 km from his QTH and Rex also beamed at Mt Barrow which is 180 km away and beyond line of site. Weak JT65c signals were evident to Joe on most days but a JT65 QSO was only completed on one day, suggesting that there is a variable involved – perhaps the degree of radio refraction on the path from VK7MO to Mt Barrow. On 25 October heavy rain was present across Tasmania and Joe found he could pick up strong signals from Rex by beaming North in the opposite direction to Rex and using backscatter from rain clouds. QSO's were completed on both JT65c and JT4G but decoding was problematic. A single tone test shows that in fact the rain scattered signal was breaking up into several separate signals spaced across a few hundred Hz – presumably due to reflections from separate rain cells with different geometries or speeds. Thus multi-tone modes such as JT65c and JT4G had difficulty in decoding. Such a situation has not been evident in other rain scatter tests such as those conducted by VK3WRE, VK3ZYC, VK5DK and VK3ZQB and thus this splitting might be a more frequent issue with back scatter rain scatter. On the following day the single tone mode Hellschreiber was used and produced very good results via rain scatter and is likely to be the preferred mode for back-scatter rain-scatter.

Please send any Digital DX Modes reports to Rex VK7MO

The Magic Band – 6 m DX

Brian Cleland – VK5BC

The sunspot cycle hasn't progressed as 6 m DXers would have liked and as a consequence October was disappointing. Most activity was in the northern areas of VK with almost daily openings to Japan and China areas with some openings to Hawaii. Highlight for the month was a contact by Norm VK7AC into the USA.

Norm reports that he was listening around 0245 UTC on the 15th October when he starting hearing CW. Norm put out a CQ with several stations replying which he soon read as USA stations. The strongest in the pile up was Terry N8RGQ in Virginia USA and a contact was completed over a distance of approx 15,982 km., see EQSL below:

N8RGQ/QRP

Terry L. Quinn
 Box 211
 Haysi, VA 24256-0211
 USA

Authenticity Guaranteed
 eQSL.cc

Rigs Icom IC 7800 , 756 PRO3 , IC 7000
 PW-1 , NATA member , OMIS #6496
 Ant's Par OA50 8 stacked , Royal Septor
 X7 , 6BTV 4 Square , KLM 14 Element 6m

TU:8 CQ:5
 Gnd EM97
 Dunson County

To: VK7AC Confirming 2-way CW QSO, Band: 6m
 Date: October 15 2012 Time: 02:50Z RST : 599

Norm was running 400 w into a 5/8 vertical; his large 6 m yagi is presently down due to Norm's activity on 10 m and has been replaced with a wide spaced 10 m 6-element yagi. Terry's stations operates on Solar/Wind power and he was only running 20 w into a very large antenna. Unfortunately no other stateside contacts were completed but a little later Norm worked 15 x JA stations in all JA call areas. Interesting bystander to this activity was John VK7XX who although hearing some of the stations on his 4-el quad did not manage to complete a contact. 6 m in its usual way produces the unexpected and again lives up to its Magic Band title, well done Norm.

Most days during the month there was normally some activity to the north from the northern areas of VK and on a few occasions the propagation extended south. One of these days was the afternoon of the 10th October when conditions from Japan and China areas extend south to VK3 and 5. Many JA's including call areas JA1, 2, 3, 4, 6 and 7 along with Li BA4SI were worked by several stations including VK3's OER, OT, XDX and FI, VK5's GF, BC, DK and PO.

On the 15th October JA opening again extended further south with Norm VK3DUT and Col VK5DK working several JA's and Bill VK5ACY heard his 1st DX for the season, JA2IGY beacon.

The 24th October was also interesting with an E's opening from VK4 to VK5 in the morning with Brian VK5BC and Phil VK5RM working Brian VK4EK in Sapphire, Ray VK4BLK in Yeppoon and Kevin VK4BKP in Mackay. In the afternoon the band opened from JA into VK4 with this opening extending down to VK3 and VK7 with some signals being heard in VK5. Frank VK7DX and Steve VK7CW worked several JA stations. The opening continued into the evening with Norm VK3DUT working Li BA4SI and several JA's.

During the month whilst holidaying in Mildura I had a chance to visit and meet Noel VK3FI. Noel has a well-presented shack and is pictured below in his operating position:



Noel has been a stalwart of the Mildura club for some time and following a hectic year with the running of the WIA AGM is now taking a back seat and renewing his interest in 6 m. As reported above Noel managed to work JA on 10th October. Noel's 6 m setup includes an 8 element ATN yagi.

Back on the 27th July I received a report from IW9HII who claimed to have heard me. Roger VK2ZRH has analysed the possibility of this report being creditable as follows:

VK5BC 50 MHz to Sicily, an analysis

On 27 July 2012, Brian VK5BC enjoyed a fine winter afternoon on 6 m when the band opened over most of VK. Late in the day, Brian was surprised to receive an email from Davide IW9HII, in Sicily, who reported hearing his SSB signal at 0706 UTC, at 3/1 with QSB. Brian confirmed that he was calling CQ at the time, beaming northwest to VK6 as he had earlier copied the VK6RSX beacon at Dampier, at RST 559.

Brian posted a report to the VK Logger Forums (search "Any Thoughts"), sparking some discussion. He remarked that the day "... was probably the best winter opening in VK5 this season with the band open to VK2, 3, 4, 6 and 7 over a couple hour period."

Intrigued by the report, which, on the face of it I thought was credible, I embarked on an analysis of the probable propagation mode/s.

IW9HII is located in Marsala, right on the western tip of Sicily, at 37.810 N, 12.460 E (JM67FT). The path distance between VK5BC and IW9HII is 15,250 km, for which the 50 MHz free space path loss is 150.1 dB [1].

Given that the northern hemisphere summer sporadic E season was in full swing, and the southern hemisphere minor winter sporadic E season was providing widespread 50 MHz DX on the day, it was obvious that Es was most likely to be involved at each end of the path. It's the bit in between passing over the Indian Ocean, the Middle East and the Mediterranean that has to be figured out.

Figure 1 shows an azimuth-equidistant map of the VK5BC-IW9HII path, together with my analysis of the likely propagation modes. Local time across the map is shown by the arrows across the equatorial line. The heavy broken line running east-west is the geomagnetic dip equator, while the two light broken lines near the path centre

indicate the limits of the daily equatorial sporadic E region. I have shown the locations of ionosondes at Learmonth, Cocos Island, Gibilmanna (on Sicily) and Guangzhou (China). I used data from these 'sondes to deduce characteristics of the likely propagation modes.

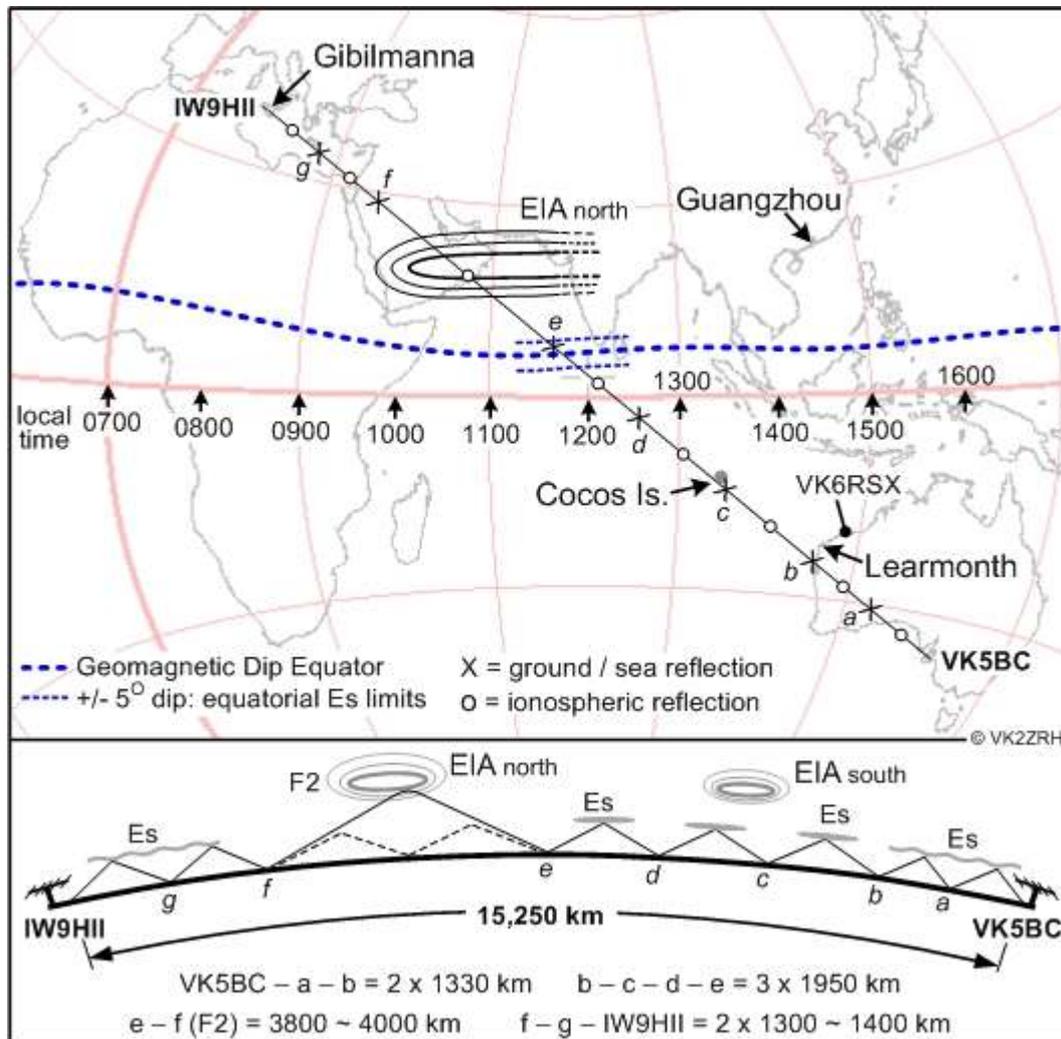


Figure 1: Map of the VK5BC-IW9HII path and, below, the vertical plane projection of the likely propagation modes (not to scale). The path may be designated as nEs-F-nEs. The equatorial ionospheric anomaly zones are indicated by EIA north and EIA south.

As it was most likely involved in this unusual event, the equatorial ionospheric anomaly (EIA) requires a quick explanation. Solar radiation causes plasma (ions and electrons) in the E and F regions over the geomagnetic equator to move up across the Earth's magnetic field lines, which are horizontal here. This sets up a complex process called the 'Fountain Effect', such that the plasma flows north and south along the magnetic field lines, accumulating into enormous 'bulges' in the F2 region that generally extend from about 100 to 300 geomagnetic latitude to the north and south of the geomagnetic equator. The anomaly zones enlarge and become denser as the day progresses and they move westward, following the Sun. The EIA dissipates after the Sun sets on the ionosphere. Around the equinoxes, the EIA bulges are pretty symmetrical, while around the solstices, they're not. In the northern summer, the northern EIA is large and dense, while the southern one is small and less dense; vice-versa in the southern summer.

The two EIA zones support daytime 6m chordal-hop transequatorial propagation

(TEP), most often around the equinoxes, but also outside those seasons at times, depending on favourable solar and ionospheric conditions [2].

In Figure 1, I have sketched-in the 'leading edge' of the northern EIA. It would have passed over the Guangzho 'sonde some 3-4 hours earlier, so I looked at the data published online. Sure enough, over 0700-0800 UT, the F2 critical frequencies rose above 12.5 MHz, enough to support a skip of 3800-4000 km at 50 MHz [3] after 1030 LT when the path opened. So this sector of the path is highly likely to have been an F2 skip. However, 2-hop Es can't be entirely ruled out, as the northern hemisphere summer Es season was in full swing.

Between VK5BC and the equator, the Learmonth and Cocos Island 'sondes both had spread-Es present, suggesting 'petit chordal hop' propagation [4]. Reception of the VK6RSX beacon 2660 km away indicated 2-hop Es of 1330 km per hop. From b to e, I deduced that Es of around 1950 km/hop (perhaps uneven hops) supported the path.

From landfall in the Middle East at f, it would have needed two Es hops of 1300-1400 km each. Interrogating the DXmaps 50 MHz database [5] over 0630-0910 UT showed that the propagation moved northwesterly, with skip distances ranging from 900-2300 km. If the Es was drifting northwest at speeds of 50-200 metres/sec, the ionograms would show Es with suitable characteristics would have moved between point g and Sicily some 2-3 hours earlier. Indeed it did, with Es drift speeds estimated at 110-125 m/s.

I did a rough estimate of VK5BC's signal strength at Sicily, using the method I have outlined on the VK Logger Forum [6], extending it for this exercise. Total path loss is roughly 178-180 dB, so VK5BC's antenna gain and power output would yield a signal strength around -118 to -120 dBm, which is S1 in anybody's book.

Six metres is always full of surprises.

Roger Harrison VK2ZRH

References

[1] www.siversima.com/rf-calculator/free-space-path-loss-calculator/

[2] <http://home.iprimus.com.au/toddemslie/aTEP-Harrison.htm>

[3] Appleton, E. and W. J. G. Beynon 1947, "The application of ionospheric data to radio-communication problems: part II", *Proceedings of the Physical Society*, Vol. 59, No. 1, January 1947, p. 66. Fig. 6 (Transmission curves). doi: 10.1088/0959-5309/59/1/311

[4] Harrison, R. L. VK2ZRH 2012, "On sporadic E VHF propagation and solving a mystery about maximum usable frequencies – Parts 1 and 2", *Amateur Radio magazine*, April and May.

[5] www.dxmaps.com/spots/map.php

[6] Harrison, R. 2012, "Signal Strengths of VHF Sporadic E Propagation", at www.vklogger.com/forum/viewtopic.php?f=43&andt=10336.

Thanks Roger, let's hope November produces some surprises and improved conditions.

Please send any 6 m information to Brian VK5BC.